Commodity Profile on

ONION



Prepared by

Raka Saxena and Rohit Kumar

And

Consultancy Project Co-ordinated: Dr Shiv Kumar

ICAR-National Institute of Agricultural Economics and Policy Research
New Delhi

Format of Report

1. INTRODUCTION

1.1 Origin

The Onion (*Allium cepa*) which is also called a bulb onion, common onion and garden onion is the most widely cultivated species of the genus Allium. Many archaeologists, botanists, and food historians believe onions originated in central Asia. Other research suggests onions were first grown in Iran and West Pakistan.

It is presumed our predecessors discovered and started eating wild onions very early – long before farming or even writing was invented. Very likely, this humble vegetable was a staple in the prehistoric diet.

Most researchers agree the onion has been cultivated for 5000 years or more. Since onions grew wild in various regions, they were probably consumed for thousands of years and domesticated simultaneously all over the world. Onions may be one of the earliest cultivated crops because they were less perishable than other foods of the time, were transportable, were easy to grow, and could be grown in a variety of soils and climates. In addition, the onion was useful for sustaining human life. Onions prevented thirst and could be dried and preserved for later consumption when food might be scarce. While the place and time of the onion's origin is still a mystery, many documents from very early times describe its importance as a food and its use in art, medicine, and mummification.

1.2 Importance

This is evident from the growth experienced in the horticultural and livestock products in the recent years. Among various high value products, onion has emerged among the fastest growing crops in recent years. Onion is a vegetable that is the most extensively cultivated species of the genus Allium. It also contains many other varieties. Onions are cultivated and used for cooking purposes throughout the world. They are usually served cooked, as a vegetable or as a part of a prepared pungent dish, but in several cases it can also be eaten raw. Historically onions have been described by different researchers to have been originated in Iran, western Indian subcontinent and Central Asia (Source: Alium Cepa)

Onion (Allium cepa L.) is an important vegetable traditionally used as a food ingredient in the Mediterranean diet that has a high production, domestic, and foreign trade worldwide. It is consumed raw, cooked or processed into different onion products in the daily diet. Onion added into different foods makes these products rich in bioactive compounds with potential beneficial health effects. Among them, its effect on cardiovascular disease, including hypocholesterolemic, hypolipidemic, anti-hypertensive, antithrombotic, and hypoglycaemic activities, is one of the most extensively studied benefits. Onion consumption has also been reported to have antiproliferative effects in many cancer cell lines, to be involved in the bone metabolism and in the behaviour as a possible antidepressant agent, and to stimulate the growth of specific microorganisms in the colon (Bifidobacteria and Lactobacilli) with a general positive health effect.

2. PRODUCTION

1.2 Major Producing Countries in the World

China is the largest onion producer followed by India and grew 24.34 million tonnes of onions during 2017 (Table 1).

Table 1: Major Onion producing countries in the world

Country	Area			Production		
	2018	2019	2020	2018	2019	2020
India	1.29	1.22	1.43	23.26	22.82	26.74
China	1.09	1.08	1.08	23.60	23.68	23.66
USA	0.05	0.05	0.05	3.28	3.55	3.82
Egypt	0.09	0.09	0.09	3.07	3.08	3.16
Türkiye	0.06	0.07	0.07	1.93	2.20	2.28
Pakistan	0.15	0.15	0.15	2.12	2.08	2.12
Iran	0.04	0.05	0.05	1.52	1.81	2.06
Bangladesh	0.18	0.17	0.19	1.74	1.80	1.95
Sudan	0.10	0.10	0.11	1.72	1.92	1.95
Indonesia	0.16	0.16	0.19	1.50	1.58	1.82
World	5.15	5.15	5.48	96.88	99.52	104.55

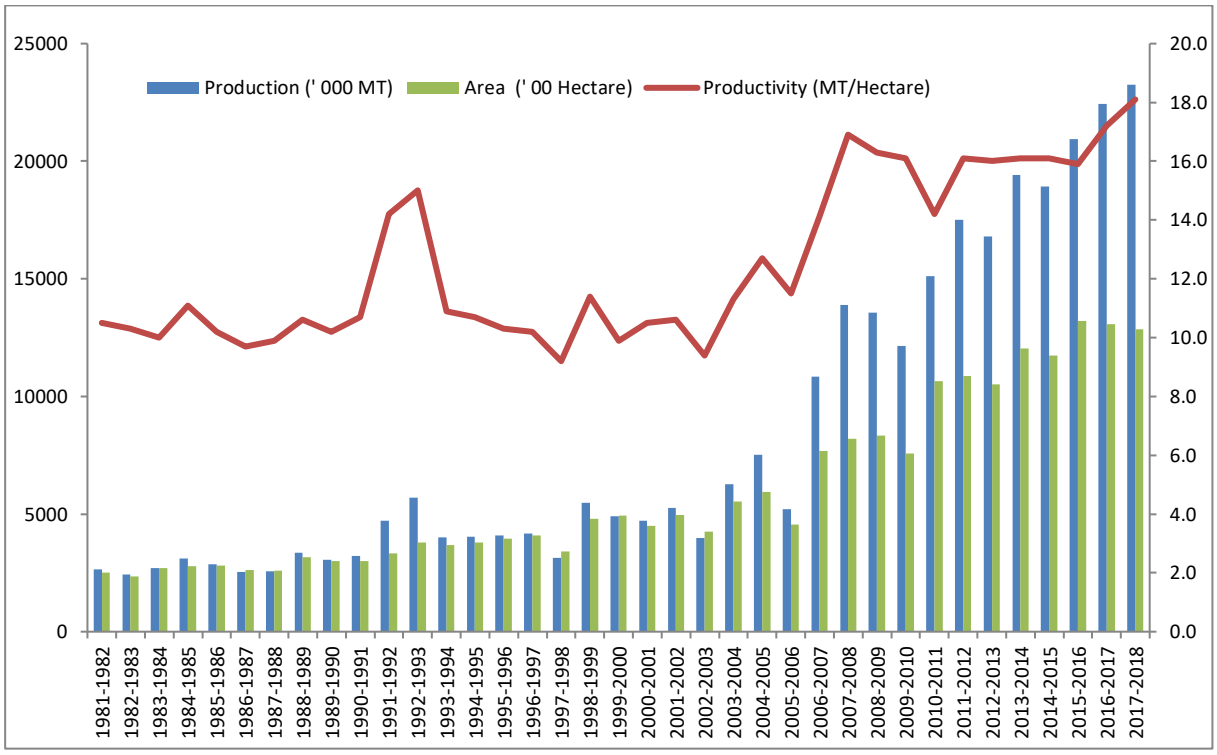
Source: FAO statistical database

1.3 Area and Production

Onion production in India can be broadly categorised into two phases – a) phase I with low growth and low volatility in onion production continued till 2002-03, b) phase II is characterized by high growth and high volatility in production which started with a turnaround in onion production after 2002-03 and continues till date.

The trends in area, production and productivity of onion since 1981-82 are presented in Figure 1; the first phase from 1981-82 to 2001-02 witnessed gradual increase in production driven largely by area expansion. In this period, area under onion cultivation doubled from 0.25 million hectares to 0.49 million hectares and production also doubled (refer to 2003-04). However, the yield levels remained stagnant at 100 quintals per hectare (10 MT/Hectare). After 2002-03, all three dimensions of production witnessed exponential growth. In ten years following 2002-03, onion productivity increased by about 60 per cent which attracted area shift in favour of onion. The increase in area turned out to be much higher (more than double) in 10 years period. As a result, onion production tripled in less than 10 years since 2002-03. Netting out for population growth, India's onion production increased from 4.6 kg/person/year during biennium 2000-01 and 2001-02 to 15.2 kg/ person/year in years 2013-14 and 2014-15.

Figure 1: Area, production and productivity of onion in India (1981-2017)

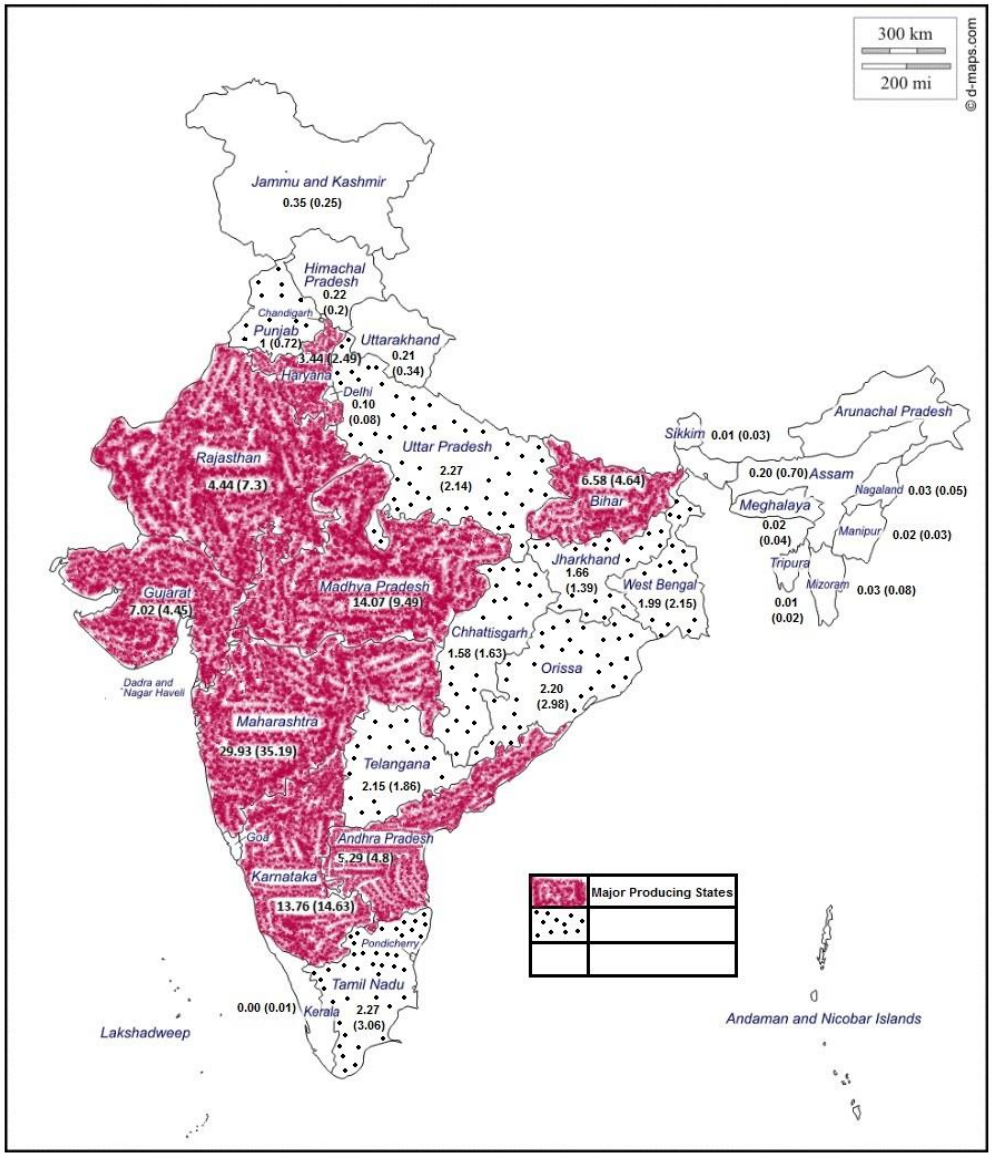


Source: NHRDF

2.3 Major Producing States in India

The major onion producing states in India are Maharashtra, Karnataka, Madhya Pradesh, Gujarat, Bihar, Andhra Pradesh, Rajasthan, Haryana and Telangana. At national level, close to 50-60 per cent of the onions are produced in *rabi* season and remaining 40-50 per cent are produced in kharif and late kharif. Onions are usually grown in winter (*rabi*) season in the northern part of the country, however, it is grown in both rabi and kharif seasons in the southern and western states of India like Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra and Gujarat. Onion area witnessed tremendous growth from TE 2006-07 to TE 2015-16 in Bihar, Madhya Pradesh and Maharashtra, which resulted in sharp increase in onion production during the above period.

Map 1. Distribution of onion production across states (%) (TE 2015-16)



Note: Figures in parentheses indicate onion area share in the country.

2.4 Major Commercial Varieties

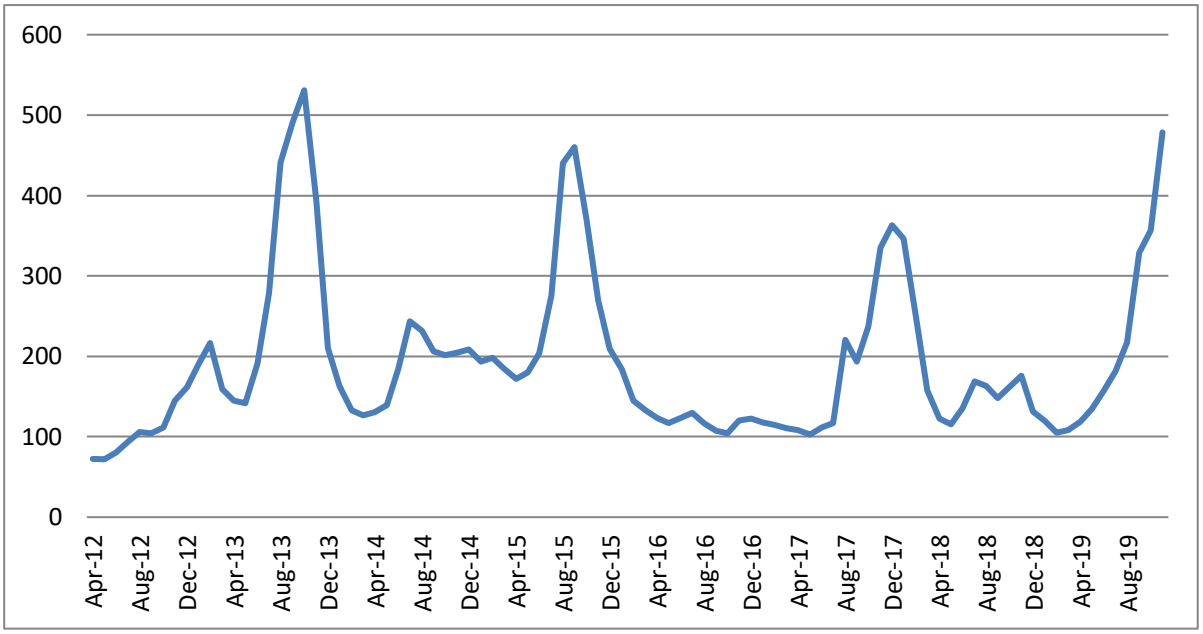
Major onion varieties include Agrifound Dark Red, Agrifound Light Red, NHRDF Red, Agrifound White, Agrifound Rose and Agrifound Red, Pusa Ratnar, Pusa Red, Pusa White Round. Other onion varieties suitable for export in European countries are Tana F1, Arad-H, Suprex, Granex 55, HA 60 and Granex 429 (APEDA).

2.5 National and International Price Trends

The onion price behaviour at aggregate level can be depicted from the WPI (Wholesale Price Index) published by the Office of Economic Advisor, Ministry of Industry, GoI. Figure 2

depicts the peak points in WPI during April, 2012 to November, 2019. However, higher price inflation was observed during October, 2013 in domestic market.

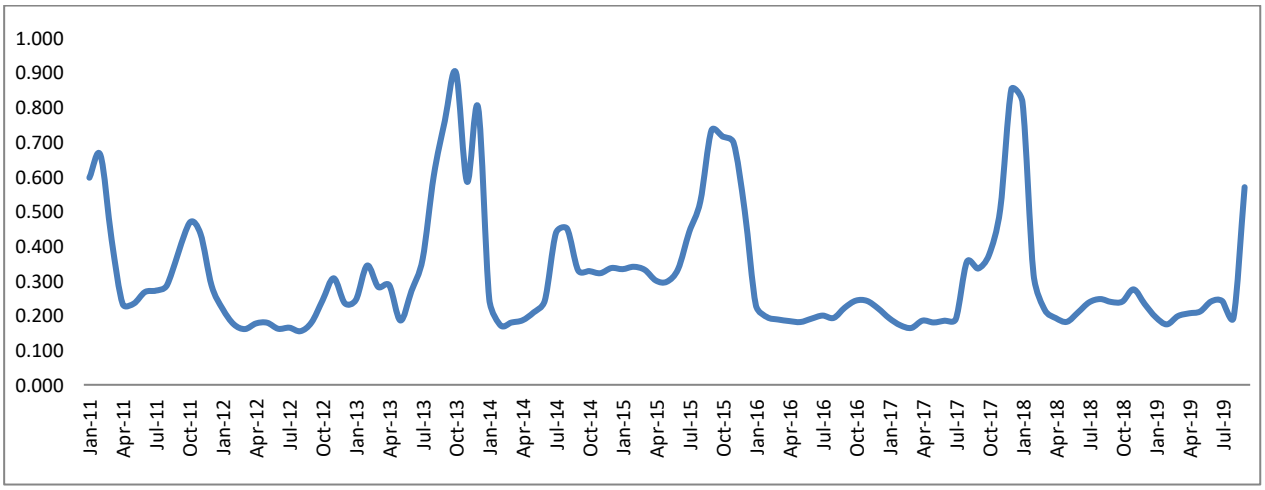
Figure 2: Wholesale price index of onion (WPI at 2011-12 bases)



Source: Office of Economic Advisor

Figure 3 provides the unit value realized (UVR) from exports of onions to various destinations. It can be observed that the UVR varied a lot during January-2011 to September-2019. In international markets, onion was stable during January-2018 to August-2019, however, increased drastically from 0.19$/Kg to 0.57$/Kg in September-2019. Higher price rise was observed during 2013 in international (0.9$/Kg) and domestic market (530 WPI) both.

Figure 3: Unit value realized from exports of Indian onion ($/Kg)



Source: comtrade.un.org

3.**POST HARVEST MANAGEMENT**

3.1 Post-Harvest Losses

Central Institute of Post Harvest Engineering & Technology (CIPHET, Ludhiana) estimated losses in onion based on data collected from six agro-climate zones across the country. The total losses in onion varied from 5.49 per cent in Gujarat to 12.72 per cent in western plateau and hill region (including the main onion production region of Maharashtra). There were wide variations in onion losses across regions. The storage losses were mainly reported at wholesale and retail levels.

3.2 Harvesting care

Curing is the major post-harvest operation, which is prerequisite for long storage of bulb onions. It is a drying process for dehydration of necks and external scale leaves of the bulbs to stop the loss of moisture. This may also prevent the attack by decay during storage. Curing requires heat and good air circulation with low humidity. Onions can also be gathered in platter, then stacked in a warm, covered area with decent ventilation. Onions can also be treated through tying the tops of the bulbs in bunches and hanging them on a horizontal pole in well-ventilated shades. Curing in shadow enhances the bulb colour and decreases losses significantly during storage. (Source: National Horticulture Board)

3.3 Grading

Onions after processing are graded manually before they are stored or marketed. Sorting and grading after storage is done to yield better price. In this, the outer dry scales are removed for better appearance. Proper grading and sorting before storage may also reduce losses. Onions are categorised based on their size for local marketing, usually the large onions have excessive demand and fetch good price.

Extra large onion (>6 cm dia.)
Medium (4-6 cm dia.)
Small (2-4 cm dia.)
(Source: National Horticulture Board)

3.4 Grade Specification

AGMARK standards for onions are classified into following classes:

Table 2: Showing AGMARK Standards and grade designation of Onions

Grade Designation	Grade Requirements	Grade Tolerances
Extra class	Onion shall be of superior quality. They shall be characteristic of the variety and/or commercial type. The bulbs shall be: - firm and compact; - unsprouted (free from externally visible shoots); - properly cleaned; - free from swelling caused by abnormal development; - free of root tufts, however, onions harvested before complete maturity, root tufts are allowed. They shall be free of defects, with the exception of very slight superficial blemishes, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.	5% by number or weight of onion not satisfying the requirements of the grade, but meeting those of class I grade or, exceptionally, coming within the tolerances ofthat grade.
Class I	Onion shall be of good quality. They shall be characteristics of the variety and/or commercial type. The bulbs shall be: - firm and compact; - unsprouted(free from externally visible shoots); - properly cleaned; - free from swelling caused by abnormal development; - free of root tufts, however, onions harvested before complete maturity, root tufts are allowed. The following slight defects, however, may be allowed, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package. - a slight defect in shape. - a slight defect in colouring; - light staining which does not affect the last dried skin protecting the flesh, provided it does not cover more than one-fifth of the bulb's surface. - Superficial cracks in and absence of part of the outer skins, provided the flesh is protected.	10% by number or weight of onion not satisfying the requirements of the grade, but meeting those of class II grade or, exceptionally, coming within the tolerances of that grade.
Class II	Onions which do not qualify for inclusion in higher grade but satisfy the minimum requirements. They shall be reasonably firm. The following defects, however, may be allowed, provided the onion retain their essential characteristics as regard the quality, the keeping quality and presentation. - defects in shape; - defects in colouring; - early signs of shoot growth visible from outside(not more than 10% by number or weight per unit of presentation); - traces of rubbing; - slight marking caused by parasites or disease; - small healed cracks; - slight bruising, healed, unlikely to impair keeping qualities; - root tufts; - stains which do not affect the last dried skin protecting the flesh provided they do not cover more than half the bulb's surface; - Cracks in the outer skins and the absence of a part of the outer skins from not more than one-third of the bulb's surface, provided the flesh is not damaged.	10% by number or weight of onion not satisfying the requirements of the grade but meeting the minimum requirements.

Source: APEDA

3.5 Provision concerning Size (APEDA)

Grading

Size is determined by the maximum diameter of the equatorial section, in accordance with the following table 3:

Table 3: Provision Concerning Size

Size Code	Diameter (in mm.)	Difference between the diameter of the smallest and the largest onion in the same package (in mm.)
A	10-20	5
B	21-40	15
C	41-70	20

Source: APEDA

Designations and definitions of quality for export of onions:

1. Errors in sizing should not be more than 5 per cent by weight of the bulbs in any lot. It may be count as a next lower grade than the minimum diameter recommended onions.

2. Onion bulbs internally or externally damaged, diseased affecting the quality. The decayed onions should not exceed 2 per cent in any lot.

3.6 Packaging

Usually limited size packing is done to ensure easy handling of the product during transit. However, it may vary according to demand. Onions are usually stuffed in jute bags for shipping to market yard. For safe usage, 40 kg open mesh jute bags should be used in domestic market. Usually for export, common big onions are filled in 5-25 kg size open mesh jute bags. (Source: National Horticulture Board)

It needs to be ensured that bulbs for storage are free from any cuts. Also the bulbs must not be released on to non-resilient surface from more than 6 feet height. If onions are to be arranged after packing in a store or truck, the prescribed height is 2-2.5 metres. (Source: National Horticulture Board)

3.7 Transport

Onions are usually transported in bullock carts, tractor trolleys and trucks. Railway wagons are used for long distance transport within the country. For export purpose, onions are carried in ventilated ships as well as sailing vessels / motorboats. (Source: National Horticulture Board)

3.8 Storage

Onions should be dried effectively either in the field or through artificial means before storing it. Appropriate storage of bulbs is essential both for seed production and consumption purposes. Temperature between 10-25°C increases sprouting. Sprouting can be controlled through maintaining temperature. Also, the rooting can be altered by relative humidity (RH), usually more the relative humidity, more the rooting. The Periodical spinning of bulbs and removal of rotten, smashed and sprouted bulbs should also be done. Well-ventilated enhanced storage structures and required for proper storage. (Source: National Horticulture Board)

NHRDF accumulates the data regarding the onion storage based on the information provided by different states. Generally, in Maharashtra, Gujarat, Haryana and Western Uttar Pradesh, large-scale storing of onions is done primarily in conventionally-designed structures (Gummagolmath, 2013). Maharashtra state stores around 30 per cent of its production during the rabi season production since during this season onions have better storage quality. Due to continuous government involvement and support to the states, onion storage in states like, Madhya Pradesh and Bihar has enhanced significantly during 2017. Though, Karnataka trails Maharashtra in onion production, the storage-to-production is only 4-5 per cent as the state produces large quantity of *kharif* onions. Precisely Maharashtra's position in production and storage is quite strategic and will play an important role in handling the onion price volatility in the country.

Table 4: State-wise onion storage during 2010-17 (Quantity in Lakh MT)

States	2010-11	2011-12	2012-13	2017
Maharashtra	14.50	15.50	15.00	18.00
Gujarat	2.00	1.80	0.85	1.25
Bihar & Jharkhand	1.50	1.50	1.65	3.75
Haryana	0.75	0.75	0.85	1.75
Karnataka	1.25	1.25	0.85	0.40
M.P. & Chhattisgarh	1.75	1.85	1.25	13.50
U.P. & Uttarakhand	1.85	1.80	1.75	3.50
Odisha	0.50	0.50	0.50	0.35
Rajasthan	1.75	1.75	1.85	1.00
Punjab	0.75	0.75	0.75	1.25
Tamil Nadu	1.00	1.00	1.00	0.18
Andhra Pradesh	0.30	0.45	0.45	–
Others	0.50	0.60	0.75	3.80
Total	28.40	29.50	27.50	48.73

Source: National Horticulture Mission and DAC&FW.

3.9 Major Storage Pest and their Control

Extended periods of wet conditions in the four to six weeks prior to harvest will promote the storage rots caused by Aspergillus and Penicillium spp., especially in hot areas.

Table 5: Major storage pest and their control

Major Pest	Chemical used	Dosage	Mode of Action	Other Remedies
Black Mold	Bayleton WP,bavistin WP (carbenbazim) 0.1%	1gm/ltr	Systemic	Cultural control-proper handling, storage at 33-55 degree F.
Smudge	Vitavax	1gm/ltr	Systemic	Cure & dry onions properly Quick drying after harvest. Store under cool, dry conditions.
	Raxil (tebaconazole)	1gm/ltr		
Gray Mold	Bayleton WP,bavistin WP (carbenbazim) 0.1%	1gm/ltr	Systemic	Cultural control-proper curing & careful handling.

Source: http://agropedia.iitk.ac.in/content/major-pests-diseases-onion

3.10 Storage Structures

Conventional structures

Onion stored in the traditional ventilated storage structures by majority of farmers in India. It is natural ventilated without any control of temperature and relative humidity.

Bamboo based structure

As it is clear from its name, this storage is constructed with bamboo framework having the roof made up with sugarcane leaves. This type of storage structure is low cost and easy to construct, but leads up to 42% losses of onion during four months of storage. This type of structure has a provision of ventilation from bottom and sides still results in increasing the losses up to 46% in four months storage.

Cold storage

Onions are stored at 0-5°C and 60-65 per cent relative humidity that leads to much lesser losses as comparative to ventilated storage structure. High energy is required to maintain the storage facility in the temperature range of 0-5°C lead to the high cost of construction and operations. However, the bulbs start sprouting immediately after they are removed from the cold storage.

ICAR-Directorate on Onion and Garlic Research, Pune developed a cold storage aiming at storing onion bulbs in controlled conditions with proper ventilation that enhances their storage life significantly by utilizing low energy while minimizing sprouting, rotting, and physiological weight loss. The storage structure maintain the temperature of 27 ± 2 °C and RH of 60 to 65% with air circulation system.

Improved storage structures help in

- Use of appropriate material for inner walls preventing from built up of high temperature inside.

- Elevated platforms during construction of storage godown help in reduction of moisture and dampness.
- Avoid formation of hot and humid spaces within the different onion layers.
- More height at the centre and more slope would increase air circulation and prevent humid microclimate inside godown.
- Avoid direct sunlight on onion bulbs to diminish sunscald, dwindling of colour and quality deterioration.

Table 6 Storage capacity and cost of storage in various types of onion storage structures designed and constructed.

Particulars	Traditional double row storage structure	Modified bottom ventilated double row storage structure	Top and bottom ventilated storage structure with mud plastered walls	Modified Bottom ventilated storage structure chain linked side walls	Traditional single row storage structure	Bottom Ventilated single row storage structure	Bottom ventilated single row low cost thatched roof storage structure
Cost of construction (million Rs)	0.225	0.19	0.149	0.125	0.035	0.040	0.005
Length (m)	9.60	9.9	9.9	9.9	5.0	5.0	4.9
Width (m)	7.5	6.0	4.75	3.6	1.2	1.2	1.2
Side height (m)	2.25	2.25	2.25	2.25	1.2	1.2	1.6
Central height (m)	3.50	4.5	4.0	4.0	2.2	2.2	1.9
Storage capacity (tones)	38	42	31	25	5	5	5
Expected life (years)	20	20	20	20	20	20	5
Cost of storage (Rs./Kg/year)	0.38	0.23	0.30	0.25	0.35	0.40	0.20
Construction material							
Roof	Asbestos	Asbestos with extended roof	Asbestos	Asbestos	Mangalore tiles	Mangalore tiles	Sugarcane leaves/thatch
Side wall	Wooden bantam	Wooden bantam	Split bamboo plastered with mud	Chain link	Split Bamboo	Split Bamboo	Split Bamboo
Floor	PCC	Wooden bantam with C channel support	Wooden bantam with C channel support	Wooden bantam with C channel support	PCC	Split bamboo bantam with C channel support	Split bamboo bantam supported on brick block
Foundation	PCC	RCC	RCC	RCC	PCC	Grouted C channel	Brick support

Source: Tripathi & Lawande (2016)

3.11 Storage Facilities

Maharashtra State Agricultural Marketing Board (MSAMB) has build up Rajgurunagar modified plan for onion storage (Kanda chawl) to support the growers for setting up of scientific onion storage systems. MSAMB has devised the subsidy scheme for scientific onion storage. Similarly, Department of Agriculture, Maharashtra State has also implemented the subsidy scheme for scientific onion storage with the support of NABARD and National Research Centre for Onion and Garlic. Farmers have to build onion storage structure according to proposed plan only to get assistance. The expenditure in construction of onion storeroom is assumed at Rs. 6000/- per MT for this scheme. The subsidy stands to the extent of Rs.1500/- per MT storage capacity. Storage structure of 5, 10, 15, 20, 25 & 50 MT capacity are eligible for this subsidy scheme.

4. MARKETING PRACTICES AND CONSTRAINTS

4.1 Trends on Prices and Arrivals

Table 8 highlights the onion arrivals across states and their geographical and seasonal distribution. On an average during TE 2017, around 13 million tonnes of onion reached the markets, which is roughly 65-70 per cent of total onion production in this period. However, this might include some overlapping market transactions as the produce moves from one market (primary) to other markets (secondary and terminal), remaining 35-40 per cent might have been retained/disposed of as family consumption, direct purchases, direct export and wastages. Though a large quantity of onion is being stored in states like Maharashtra, Madhya Pradesh & Chhattisgarh and Bihar & Jharkhand (Saxena & Chand, 2017), the same is assumed to be disposed of in the market at any point of the year. Maharashtra is a strategic state in the onion marketing as the state receives 50 per cent of the onion arrivals in the country. Most of the price shocks appear during July to October and are largely determined from shortages in *rabi* onion supply. Maharashtra coupled with Madhya Pradesh becomes much more strategic and crucial as the duo comprise of more than 60 per cent of arrivals of the country during April to September. Afterwards, the role of Karnataka and other kharif onion supplying states becomes crucial in generating price shocks.

MARKETING PRACTICES

Table 7: Concentrated pockets of Fresh Onions in Fresh Onions growing states

Sr. No.	State	Districts
1	Maharashtra	Nasik, Ahmednagar ,Pune, Sholapur
2	Karnataka	Dharwad ,Chitradurg, Gadag, Haveri, Bagalkot, Davengere
3	Andhra Pradesh	Kurnool, Medak, Rangareddy, Cuddapah, Mehboobnagar.
4	Uttar Pradesh	Varanasi, Patan, Kanpur ,Lucknow, Allahabad, Faizabad
5	Tamil Nadu	Coimbatore, Perambadur, Namakkal ,Dindigul Anna,Thirichirapalli, Periyar
6	Gujarat	Bhavnagar, Surendranagar
7	Punjab	Ropar and Ludhiana

Source: APEDA

4.2 Distribution of Produce from Primary to Terminal Market

The inter-market onion transaction data are not available as on date. The studies and observations indicate that major onion producing states in India like Maharashtra and Gujarat find major markets for their produce in Bhopal, Jaipur, Lucknow and Delhi from where it is distributed in Northern states like HP, Uttarakhand, J&K, Punjab and Haryana whereas onion produced in Southern states (like Karnataka, Andhra Pradesh etc) are largely consumed in Southern states and nearby markets.

Table 8: State-wise arrivals of onion in different seasons (TE 2017)

State	Arrivals (Th Tons)					Seasonal shares (%)					Share in the total arrival (%)				
	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total arrival
Maharashtra	1948	1691	1668	1329	6635	29	25	25	20	100	54	42	57	49	50
Madhya Pradesh	114	870	118	140	1241	9	70	9	11	100	3	22	4	5	9
Gujarat	551	333	118	185	1188	46	28	10	16	100	15	8	4	7	9
Uttar Pradesh	274	340	248	184	1046	26	33	24	18	100	8	8	9	7	8
Karnataka	218	230	200	342	990	22	23	20	35	100	6	6	7	13	7
NCT of Delhi	97	107	98	86	387	25	28	25	22	100	3	3	3	3	3
West Bengal	95	94	87	76	352	27	27	25	22	100	3	2	3	3	3
Telangana	62	76	82	70	290	21	26	28	24	100	2	2	3	3	2
Punjab	64	86	66	42	258	25	33	26	16	100	2	2	2	2	2
Rajasthan	46	41	53	84	224	20	18	24	38	100	1	1	2	3	2
Haryana	25	34	47	31	136	18	25	35	23	100	1	1	2	1	1
Orissa	24	21	23	26	94	25	22	24	28	100	1	1	1	1	1
Kerala	24	20	21	20	84	28	24	25	24	100	1	0	1	1	1
Andhra Pradesh	3	2	25	26	55	5	3	45	46	100	0	0	1	1	0
Others	51	66	61	58	237	22	28	26	24	100	1	2	2	2	2
INDIA	3595	4010	2915	2697	13217	27	30	22	20	100	100	100	100	100	100

Source: Based on data of NHRDF

Onion arrivals and prices

State	Sept 2018 to Aug 2019		Sept 2019 to Aug 2020		Sept 2020 to Aug 2021	
	Arrivals (Tonnes)	Weighted Avg. Modal Price (Rs./Qtl.)	Arrivals (Tonnes)	Weighted Avg. Modal Price (Rs./Qtl.)	Arrivals (Tonnes)	Weighted Avg. Modal Price (Rs./Qtl.)
Maharashtra	5650233	867	4783723	1952	5517442	1797
Telangana	1108830	838	928204	2433	1403970	2281
Gujarat	1314255	769	1032491	1847	1302080	1650
Madhya Pradesh	1503477	636	731365	1098	825326	1723
Karnataka	1266782	971	1117278	2544	778817	2196
Uttar Pradesh	1020165	1111	722294	2160	703918	2248
Rajasthan	393261	761	292174	1791	359690	2008
NCT of Delhi	401890	964	258120	1890	300519	2211
Punjab	275759	1061	165696	1706	227957	2114
West Bengal	285945	1400	182396	2753	203539	2962
Andhra Pradesh	89873	920	140927	2221	101310	1660
All India	13921421	897	10857959	2082	12111191	1963

Source: Data provided by DMI

4.3 Export

Interestingly, countries' shares in global trade do not follow specifically their production shares. For instance, Netherlands, a small country stands at the top in exports of onion (Table 9) because the country exports more than 90 per cent of its onion produce and captures

market share of more than 20 per cent. Though China's onion production is higher than India, its share in world export is quite less as compared to India in terms of quantity. India is the second biggest player in global onion market, the country exported around 1.45 million tonnes in 2020.

Table 9: Major exporter country and quantity exported (Tonnes)

Country	2018		2019		2020	
	Qty (MT)	Value (Th. US$)	Qty (MT)	Value (Th. US$)	Qty (MT)	Value (Th. US$)
Netherlands	1511379	656073	1596080	763569	1751363	797420
India	1688420	419572	1460547	367328	1448718	346640
China	910119	509517	983718	604387	881314	495414
Mexico	432618	428257	351952	360900	424408	419754
Egypt	236973	117967	487000	243895	369240	175100
USA	359717	231679	402437	287698	365406	249935
Spain	356252	176979	412311	213037	357507	155869
Pakistan	210609	48613	166264	67280	303989	124029
Peru	219169	74072	248722	87639	255669	94926
Türkiye	101296	16617	235205	53956	220719	51409
World	7590513	3297905	8485685	3875421	8452243	3607668

Source: FAO statistical database.

Major Export Destinations of Indian Onion (2021-22): There is a lot of demand of Indian Onion in the world, the country has exported 1.54 million tonnes of fresh onion to the world for the worth of Rs. 3432.14 crores (497.94 USD Millions) during the year 2021-22. Major export destinations of Indian onion are Bangladesh, Malaysia, Sri Lanka, Nepal and United Arab Emirates.

Table 10: Major Export Destinations of Indian Onion

	2019-20		**2020-21**		**2021-22**	
Country	Qty (MT)	Value (Rs. Lacs)	Qty (MT)	Value (Rs. Lacs)	Qty (MT)	Value (Rs. Lacs)
Bangladesh	2,59,370	55,014	5,52,363	75,548	6,58,722	1,30,125
Malaysia	1,90,694	43,429	1,98,109	46,147	1,70,554	49,091
Sri Lanka	1,25,757	29,324	1,44,713	31,322	1,62,918	41,155
Nepal	75,191	9,441	1,13,565	16,477	1,67,368	27,945
U A E	1,52,530	29,699	1,70,641	33,050	1,22,784	27,896
Indonesia	35,588	4,971	70,741	11,269	37,670	8,680
Qatar	42,302	8,103	45,354	9,336	33,321	7,809
Hong Kong	139	40	10,628	2,173	24,479	7,362
Kuwait	38,642	7,050	39,530	8,369	24,221	5,745
Vietnam	32,292	6,353	25,011	4,195	18,123	4,679

Source: APEDA

Onion Export Policy in India

The major policy instrument to regulate onion export and stabilise domestic market is minimum export price (MEP). A higher value of MEP is supposed to reduce the exports and vice versa. The other policy instrument is physical restriction on exports through banning the exports or canalising (routing) the exports through state trading enterprises. The motive behind such policies remains the stabilisation of domestic supply of onion and to keep check on domestic prices turning too high. In India, 47 price notifications regarding onion export policy have been issued by Directorate General of Foreign Trade during the last nine years. Surprisingly, mostly of these were issued in just one year i.e. 2011(19 notification) (Table 11). During the same year, onion exports were banned twice. Some varieties of onion like Bangalore rose onion and Krishnapuram onion having special attributes are treated differently in implementation of MEP policies. Bangalore rose onions are exclusively grown for the export markets in certain parts of Karnataka especially in Bengaluru rural, Kolar and Doddaballapur. The variety got the tag of Geographical Indicator in 2014-15 due to its specific attributes like shape, deep scarlet red colour, nutrient content (anthocyanin, phenols) and high pungency.

Time series data on onion prices indicate that 2013 price crises was the most severe with intense price shock in the recent year. Such a situation needed immediate attention of policy makers, consequent upon which the MEPs were kept at the historically highest levels. As the crises became intense, the government responded by repeatedly raising the MEP which went up to high level of $1150/MT. The situation eased only at the end of December. A similar price crises situation re-emerged in 2015 which appeared to be little less severe as compared to 2013 crises. An MEP level of $700/MT was notified in August 2015, which was 8 per cent higher as compared to August 2013 MEP. No further notifications were issued except in December 2015 when the price situation eased.

An examination of onion prices and policy in the recent years clearly brings out that domestic supply management needs to follow advance and well thought out plan in response to the signals given by relevant organizations and averting the price spike situations. An ideal approach demands proper market intelligence based on production and price forecast. Failing which the contingent management in terms of higher MEPs and export bans might affect export earnings of India as a less credible nation as compared to the competing countries like China and Pakistan. According to onion traders in Maharashtra, foreign buyers often prefer reliable suppliers who can maintain their commitments and if traders fail on reliability, they lose customers and their loyalty in international markets (Chengappa *et al.*, 2012). Indications are emerging that our import destinations in South East Asia are also trying to increase their levels of self-sufficiency in onion by cultivating similar varieties which we export to them. Thus, a long term orientation in onion export policy is the need of the hour.

Table 11: Onion export policy in recent years as seen from MEP and export bans

Year	Months	MEP (US$)	Date imposed	Export Policy relevant to	Nature of restriction

2011	February	-	10-Feb-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions) excluding cut, sliced or broken in powder form	Export ban
2011	February		11-Feb-11	Onion in (a) cut form (b) sliced form & (c) broken in powder form can be exported freely	Export free
2011	February		15-Feb-11	Bangalore rose onion and Krishnapuram onions excluding cut, sliced or broken in powder form	Export permitted under licence subject to MEP of US$ 1400 per metric ton
2011	February	600	18-Feb-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions) excluding cut, sliced or broken in powder form	Export permitted
2011	March	450	01-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 1400 continued for Bangalore Rose Onions and Krishnapuram onions
2011	March	350	08-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 1400 continued for Bangalore Rose Onions and Krishnapuram onions
2011	March	275	16-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 1400 continued for Bangalore Rose Onions and Krishnapuram onions
2011	March	225	23-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of Bangalore Rose Onions and Krishnapuram onions at US$ 600 per Metric Ton F.O.B.
2011	March	170	31-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 600 continued for Bangalore Rose Onions and Krishnapuram onions
2011	May	-	16-May-11	-	MEP of Bangalore Rose Onions and Krishnapuram onions at US$ 350 per Metric Ton F.O.B.
2011	June	200	08-Jun-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 350 continued for Bangalore Rose Onions and Krishnapuram onions
2011	July	230	15-Jul-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 350 continued for Bangalore Rose Onions and Krishnapuram onions
2011	August	275	12-Aug-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of Bangalore Rose Onions and Krishnapuram onions at US$ 400 per Metric Ton

					F.O.B.
2011	August	300	24-Aug-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 400 continued for Bangalore Rose Onions and Krishnapuram onions
2011	September	475	07-Sep-11	Onion all varieties including Bangalore rose onion and Krishnapuram onions	-
2011	September	-	09-Sep-11	Onions all varieties	Export prohibited
2011	September	475	20-Sep-11	Onions all varieties (except cut, sliced or powder form)	Prohibition withdrawn and exports allowed through STEs, Exports of cut, sliced or powder form made free
2011	November	350	18-Nov-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	For Bangalore Rose Onions and Krishnapuram Onions it will be US$ 400 per MT F.O.B
2011	November	250	28-Nov-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	For Bangalore Rose Onions and Krishnapuram Onions it will be US$ 300 per MT F.O.B
2012	January	150	11-Jan-12	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	For Bangalore Rose Onions and Krishnapuram Onions it will be US$ 250 per MT F.O.B
2012	February	125	15-Feb-12	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore Rose Onions and Krishnapuram onions
2012	May	-	08-May-12	The export of onion is allowed without any MEP upto 2nd July 2012.	-
2012	June	-	29-Jun-12	The export of onion is allowed without any MEP	Exports through STEs
2013	August	650	14-Aug-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore Rose Onions and Krishnapuram onions
2013	September	900	19-Sep-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore Rose Onions and Krishnapuram onions
2013	November	1150	01-Nov-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore Rose Onions and Krishnapuram onions
2013	December	800	16-Dec-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for

					Bangalore Rose Onions and Krishnapuram onions
2013	December	350	19-Dec-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore Rose Onions and Krishnapuram onions
2014	March	-	06-Mar-14	Onion all varieties	MEP removed till further orders
2014	March	-	12-Mar-14	Onion all varieties	Export of onion made free, not channelized through STEs
2014	June	300	17-Jun-14	Onion all varieties	-
2014	July	500	02-Jul-14	Onion all varieties	-
2014	August	300	21-Aug-14	Onion all varieties	-
2015	April	250	07-Apr-15	Onion all varieties	-
2015	June	425	26-Jun-15	Onion all varieties	-
2015	August	700	24-Aug-15	Onion all varieties	-
2015	December	400	11 Dec-15	Onion all varieties	-
2015	December	-	24-Dec-15	Onion all varieties	No MEP
2017	June		27-Jun-17		
2017	June		30-Jun-17		
2017	November	850	23-Nov-17		Imposition of (MEP). Only on LC subject to MEP of US$ 850 F.O.B. per metric ton till 31.12.2017
2017	December	850	29-Dec-17		Imposition of (MEP) extended till 20.01.18
2018	January	850	19-Jan-18		Imposition of (MEP) extended till 20.02.18
2018	February		02-Feb-18		Removal of Minimum Export Price (MEP)
2019	September	850	13-Sep-19		Imposition of (MEP) till further order.
2019	September	-	29-Sep-19		Export & import prohibited till further order
2019	October		28-Oct-19		Export of Bangalore Rose onion, upto quantity of 9000 MT, has been allowed for the period upto 30th November.

Source: Directorate General of Foreign Trade

4.4 Sanitary and Phyto-Sanitary requirements

Phytosanitary specifications for vegetables, fruits and citrus fruits Application:
The given specifications are applicable to vegetables and fruits, imported against following TN VED TS Codes.

Designation	TNVED TS Code
Large onion, alliums, garlic, leek and other bulbar vegetables, fresh or frozen	0703

Source: APEDA

The imported quarantined products must be free from the following types of quarantined harmful organisms in case of fruits and vegetables including onion.(Source: APEDA)

Packing specifications: During packing of certain fruits and vegetables, use of hay, straw, chaft, moss, leaves and other vegetable materials as packing material are prohibited due to quarantined harmful organisms. Wood-w001, saw-dust, paper and plastic must be used as packing material.

Restrictions on import: Availability of phytosanitary documents is essential (in compliance with the list for quarantined products*): Phytosanitary certificate, issued by the competent authority of the country-exporter is also required.

4.5 Export Procedure

The size of packing wholly depends on the requirement of importing country. Some of the netted poly bag sizes have been given below for different countries. Generally, there are 60 fills per 10kg bag of onion.

Table 12: Packing specifications of some countries

S.No	Importing nation	Pack size
1	Malaysia and Indonesia	10 kg
2	Srilanka	25 Kg
3	Singapore	8 Kg
4	Philippines	20 Kg
5	Gulf countries	5 Kg, 10 Kg, 15 Kg and 20 Kg

Source: NIAM, Jaipur

Table 13: Size of Onion required by different countries

S. No.	Country	Size(mm)
1	Middle East and Gulf(Dubai, Sharjah, Doha, Muscat, Bahrain, Dammam, Saudi Arabia, Kuwait)	40 – 60
2	Malaysia, Singapore, Port Kelang & African Ports	25 – 30
3	Sri Lanka	25 – 30
4	Bangladesh, Pakistan & Nepal	25 – 30
5	Europe	60 – 70
6	Japan	60 – 70

Source: MSAMB, Pune

Table 14: Documents required for exports of Fresh Onions

Sr. No.	Documents related to goods	Documents related to shipment	Documents related to Payment	Documents related to quality of goods	Organic Certification	Documents related to Foreign Exchange Regulations	Other Documents
1	Invoice	Mate Receipt	Letter of Credit (L/C)	Phytosanitary Certificate	Certificate indicating material produce is based on organic farming.	GR Form: Documents required by RBI which assures to RBI that the exporter will realize the proceeds of goods within 180 days from the date of Shipment.	Bank Realization Certification (BRC): This is the advice given by Foreign Exchange Bank after the realization of money from Importer.
2	Packing List	Shipping Bill	Bill of Exchange	GLOBALGAP Certification			
3	Certificate of origin	Bill of handing		Health Certificate			
4		Airway Bill					

Source: NAFED

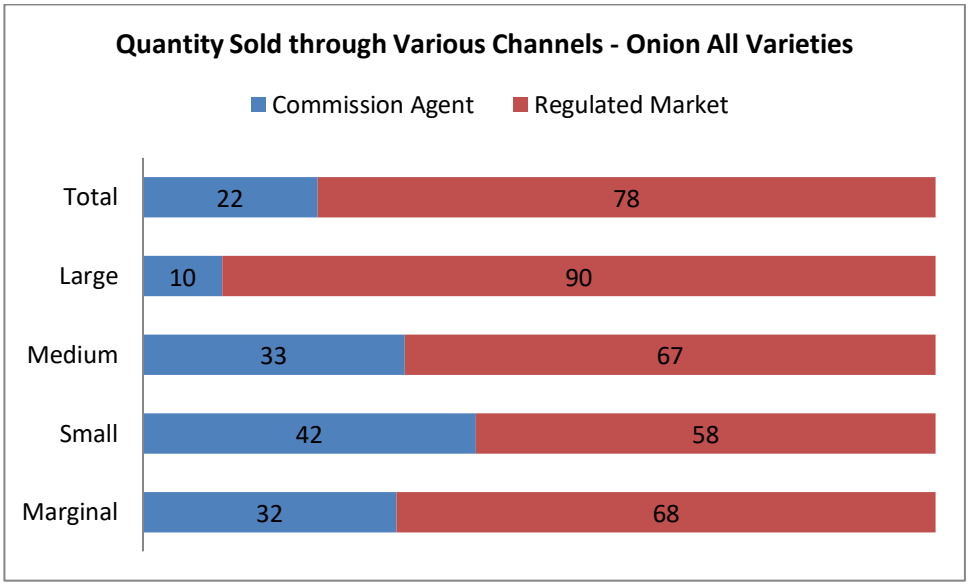
5. MARKETING CHANNELS, COSTS AND MARGINS

Marketing of onion largely takes place through the regulated markets/APMCs. The trade in regulated markets takes place through designated commission agents and wholesalers. Then, onions are transacted to retail and terminals markets.

5.1 Marketing Channels

The study conducted by Agricultural Development and Rural Transformation Centre, Institute for Social and Economic Change (ISEC) Bangalore evaluated the price differences in wholesale prices, retail Prices and price Realized by farmers for onion. The study also examined the marketing channels thorough which different varieties of onion were sold. Results of study are described below.

Figure 4: Percentage of onion sold through Various Channels



Onion Marketing in Maharashtra

Within Maharashtra, onion is largely produced in Nashik, Pune and Ahmednagar districts of the state. As reported, three crops of onions are marketed in Maharashtra with about 10-15 per cent during Kharif, 30-40 per cent as late Kharif and as much as 50-60 per cent rabi crop harvested during summer season. Like other agricultural commodities, marketing of onions in the country is also regulated through APMC Act of respective states. The Maharashtra State Agricultural Marketing Board (MSAMB), Pune was established in 1984, under section 39A of Maharashtra Agricultural Produce Marketing (Development & Regulation) Act, 1963. Maharashtra has made suitable amendments in its Maharashtra Agricultural Produce Marketing (Regulation) Act, 1963, the State amended the Act in June 2006, framed rules in June 2007 with development led objectives and the amended Act was entitled as

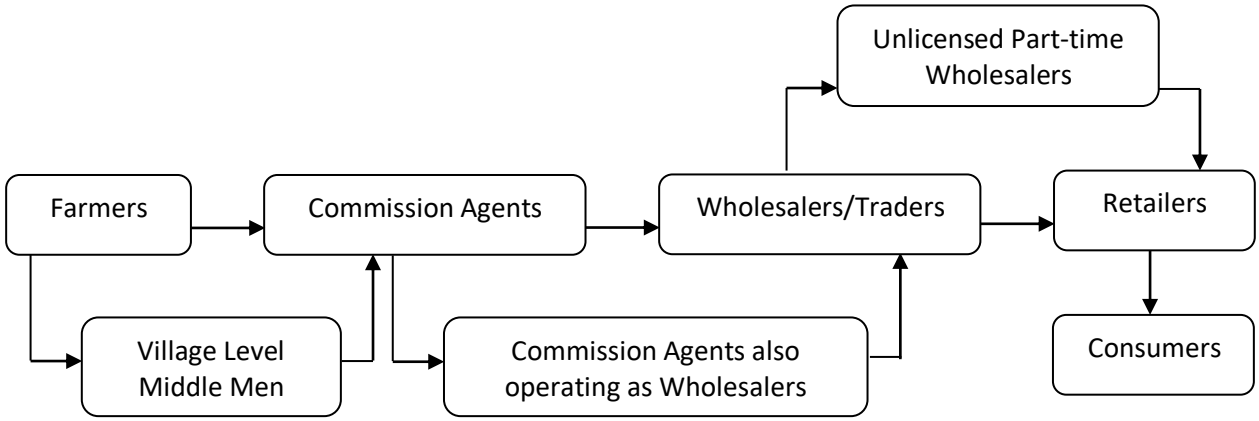
"Maharashtra Agricultural Produce Marketing (Development and Regulation) (Amendment) Act, 2006". The Act has been amended to promote the competitive marketing of agricultural commodities.

After the amendment, the State has issued 72 licenses under direct marketing, gave approval to 7 private markets, identified 33 locations for farmer consumer markets, facilitated contract farming covering 1 Lakh hectares, organized 20 festivals for promoting special commodity markets and given licenses to 9 private players under Single License System (Gummagolmath, 2013). State has also made some efforts to promote Public Private Partnership and has proposed to set up terminal market for fruits and vegetables at Mumbai, Nashik and Nagpur (Gummagolmath, 2013). To facilitate the electronic processes in marketing, the markets are being provided with requisite infrastructural facilities. Under AGMARKNET project, computerization of 291 APMCs and 54 submarkets is completed (Gummagolmath, 2013).

Lasalgaon mandi, in Nashik district of Maharashtra, is Asia's largest onion market. There are 550 licensed traders in Lasalgaon APMC which are categorised as A, B and C class traders with the license fee of 200, 100 and 20, respectively. There are 154 general commission agents and 9 godown holders. As reported in the Lasalgaon Market Profile at AGMARKNET, onion is traded through open auction system with a commission of 4 per cent charged from farmers by the registered commission agents in the Lasalgaon APMC. The onions from Lasalgaon are supplied to many places in India and also exported to many countries. The APMC has close linkages with many organizations like NHRDF and Bhabha Atomic Research Center (BARC) in improving the quality of onions produced and marketed locally. NHRDF produces and distributes quality seed of onion to the farmers. BARC processes onions to keep them fresh for a longer time.

As rabi onion has a better shelf life, it is stored by the farmers on-farm in bamboo based conventional storage structures. Since kharif and late kharif onions are not good for storage, these are sold by the farmers within 15 days to 1 month after harvest. The onion marketing chain in Maharashtra is presented in Figure 5 presenting linkages among various stakeholders. The Nashik division of Maharashtra receives the produce largely from the producers. The APMCs like Lasalgaon, Pimpalgaon, Yeola etc purely primary markets. As informed by the mandi officials, there are around 40-45 onion traders in Lasalgaon market and 16-17 traders in Yeola market. A commission of 4 per cent is charged from the onion sellers by the Commission Agents. The farmers bring onions in loose form in trucks/trolleys to sell these to onion traders. The onions are sold through open auction method.

Figure 5: Onion marketing system in Maharashtra



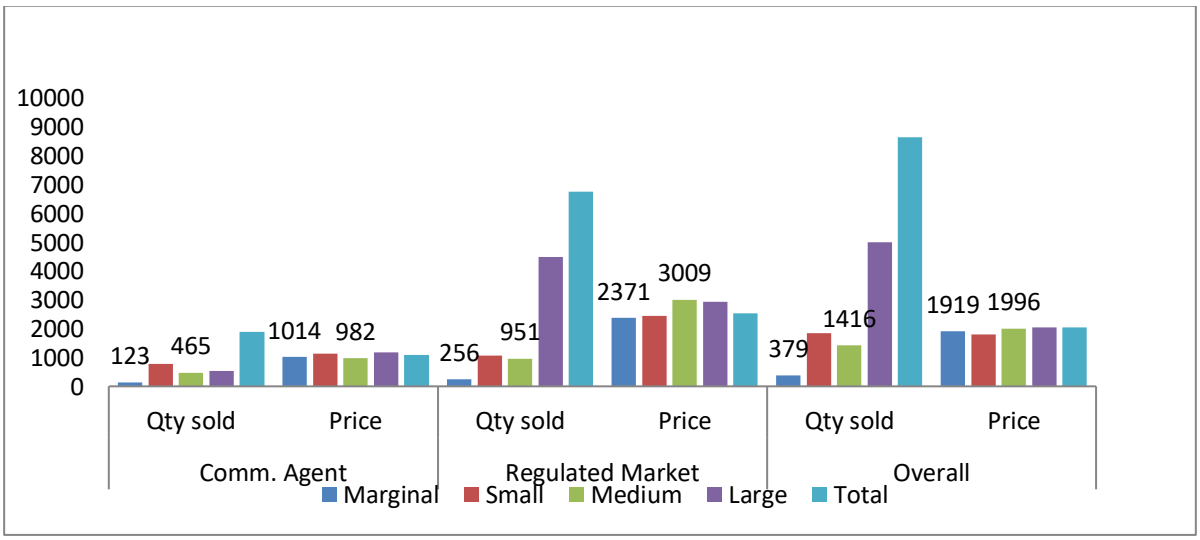
Source: Chengappa *et al.* (2012).

In Karnataka and Maharashtra, the agricultural marketing is more or less entirely in the hands of the intermediate market functionaries, both the states do not have strong network of postharvest services, infrastructural facilities & amenities and dynamic marketing system (Chengappa *et al*., 2012).

5.2 Marketing Costs and Margins

Study on onion different marketing channels in Karnataka (2016) across different farmers categories based on farm holding size revealed that direct sell in regulated market was major marketing channel for all farm size categories farmers. Onion price per quintal varied from Rs 982 to 1014 through commission agents. However, quantity sold was very less as compared to direct sell at regulated market.

Figure 6 : Quantity sold (Qtls.) and Price Received (Rs./Qtls.) under Various Channels - Onion All Varieties



6. MARKETING INFORMATION AND EXTENSION

6.1 Price Transmission across Markets

Onion production and market arrivals are concentrated in a few months and states but they are consumed throughout the country and throughout the year. State-wise market arrivals follow a more or less similar pattern as production, but a large part of onion is distributed through the Azadpur market in Delhi. Bengaluru and Solapur are the most important onion markets in terms of secondary arrivals; however, Lasalgaon has its own importance due to its strategic location and being a primary producer market. The major markets for onion in various states and their share in total market arrivals in the state are given in Table 15 As evident, the strategic position of the markets has been changing specially during the crisis years.

Table 15: Major markets across major producing states

State	Market	Market Share (%)							
		2006/07 - 2015/16	Rank	2010-11	Rank	2013-14	Rank	2015-16	Rank
Maharashtra	Solapur	9.08	I	9.19	I	14.6	I	9.5	I
	Pune	8.39	II	7.14	III	9.0	II	7.5	II
	Lasalgaon	7.48	III	5.94	IV	7.4	III	5.0	VI
	Yeola	6.39	IV	5.30	VI	6.0	IV	4.7	VII
	Mumbai	6.08	V	8.14	II	4.0	IX	7.4	III
Karnataka	Bengaluru	66.32	I	67.22	I	70.9	I	67.1	I
	Hubli	11.63	II	12.54	II	10.9	II	12.3	II
	Belgaum	7.04	III	4.12	III	6.1	III	7.2	III
	Hassan	2.90	IV	3.97	IV	3.4	IV	3.1	IV
	Mysore	2.69	V	2.58	VI	1.5	VII	1.6	VIII
Gujarat	Gondal	18.58	I	8.90	IV	32.4	I	8.1	V
	Mahuva	18.19	II	33.90	I	25.5	II	-	-
	Bhavnagar	14.81	III	17.33	II	12.4	III	13.3	II
	Ahmedabad	12.02	IV	14.94	III	11.3	IV	11.5	III
	Mahuva (Station Road)	11.51	V	-	-	1.0	XI	35.6	I
Madhya Pradesh	Indore (F&V)	34.99	I	40.01	I	27.6	II	33.3	I
	Shujalpur	23.47	II	2.47	IV	37.7	I	20.9	II
	Sagar	6.20	III	6.29	III	8.0	III	-	
	Indore	5.02	IV	-		-		-	
	Ujjain	4.07	V	8.60	II	5.2	IV	-	

Source: Computed based on Agmarknet data.

6.2 Price Movements of Onion Prices in major markets

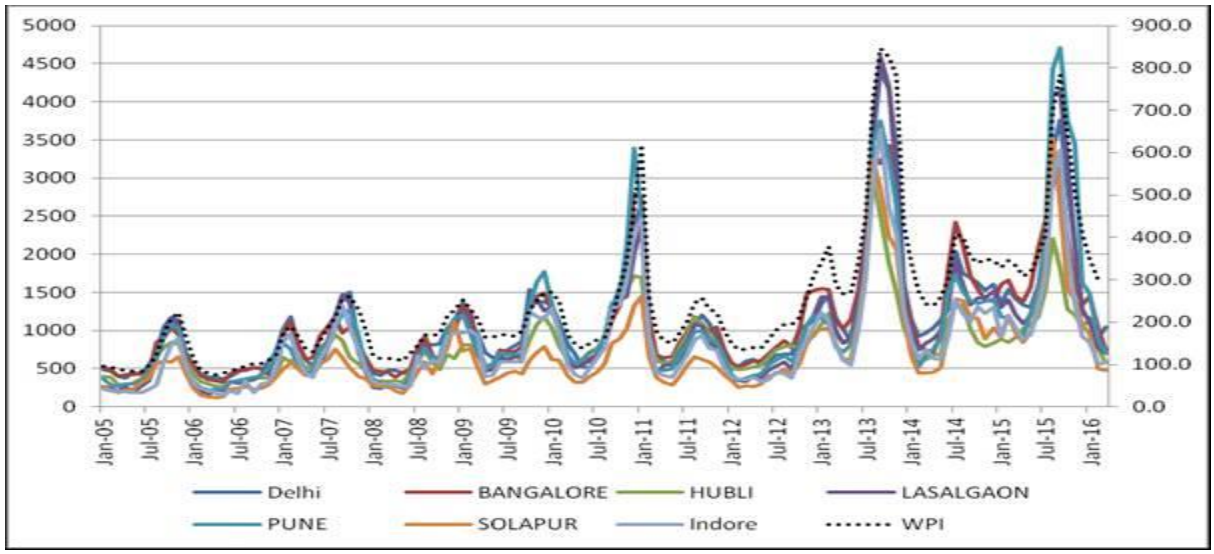
The onion price behaviour at aggregate level can be depicted from the wholesale price indices computed and published by the Office of Economic Advisor, Ministry of Industry, GoI. The volatility in onion prices has been much more pronounced after 2009 with price spikes becoming bigger and more frequent. India faced three recursive extreme price shocks

during last five years with crises occurring every alternate year followed by situation of price falls (extreme in 2016). Onion WPI touched the highest value of 619 in January 2011. In 2013, highest ever onion WPI was recorded in September 2013. Year 2015 also led the WPI to jump to an index of 758, which was, of course, lower than the previous shocks.

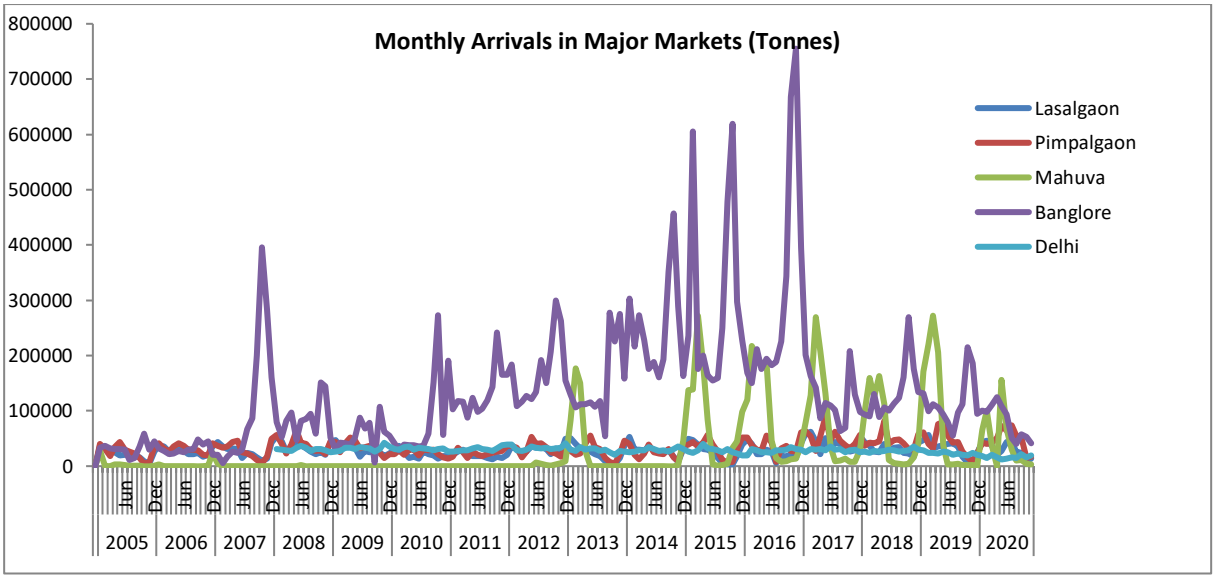
As indicated in the previous sections, Maharashtra, Madhya Pradesh, Karnataka and Delhi are major onion marketing states, the price signals are also likely to flow across these states and also to other states. Figure 7 provides the movement of prices in selected markets of Maharashtra, Karnataka and Madhya Pradesh along with the WPI onion as well as the export price of onion. It is observed that the prices move in a similar fashion exhibiting similar ups and down swings in prices. Major peaks in the prices are noticed in 2010, 2013 and 2015 which were the onion price crises years. Major pattern are observed as follows:

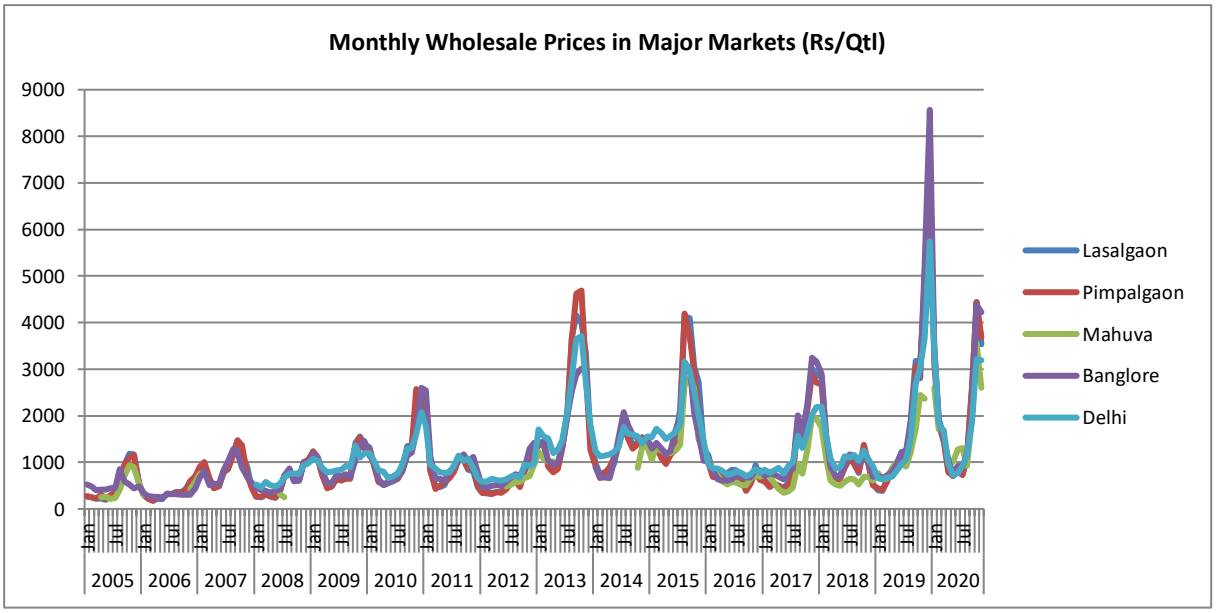
1. Prices in major onion markets including the WPI exhibit similar movements.
2. Onion prices in Bengaluru market remain at a higher level as compared to other markets probably due to trading of locally superior and export oriented varieties like Bangalore Rose onions.
3. The prices in Solapur market remain at a lower level as compared to the prices in other selected markets
4. As obvious, the export prices of onion remained higher than the prices prevailing in domestic markets
5. Export prices usually followed/attained their peaks with one month lag with peak in domestic prices indicating that price spikes originate in domestic market not in overseas market.

Figure 7: Movement of onion prices in selected markets



Source: Agmarknet and office of the Economic Advisor.





6.3 Cointegration and Causality in Onion Prices

Cointegration Analysis: As Lasalgaon is the largest onion market in the country, two-step Engle-Granger method was used to check the cointegration between Lasalgaon and other domestic markets, exports and WPI. The cointegration equation was estimated using OLS (ordinary least square) and the residuals from the estimation were examined. The variables are considered co-integrated if the residuals generated from the equations are found to be stationary. The following equations provide the estimates obtained from OLS equations.

$$\ln L = \underset{(0.000)}{-1.61} + \underset{(0.000)}{1.21 \ln D}$$

$$\ln D = \underset{(0.000)}{1.75} + \underset{(0.000)}{0.76 \ln L}$$

$$\ln L = \underset{(0.000)}{-1.58} + \underset{(0.000)}{1.20 \ln B}$$

$$\ln B = 1.84 + 0.748 \ln L$$
$$(0.000) \quad (0.000)$$
$$\ln L = -2.15 + 1.33 \ln H$$
$$(0.000) \quad (0.000)$$
$$\ln H = 2.21 + 0.65 \ln L$$
$$(0.000) \quad (0.000)$$
$$\ln L = -0.37 + 1.05 \ln P$$
$$(0.006) \quad (0.000)$$
$$\ln P = 0.63 + 0.90 \ln L$$
$$(0.000) \quad (0.000)$$
$$\ln L = 0.28 + 1.00 \ln S$$
$$(0.103) \quad (0.000)$$
$$\ln S = 0.29 + 0.90 \ln L$$
$$(0.081) \quad (0.000)$$

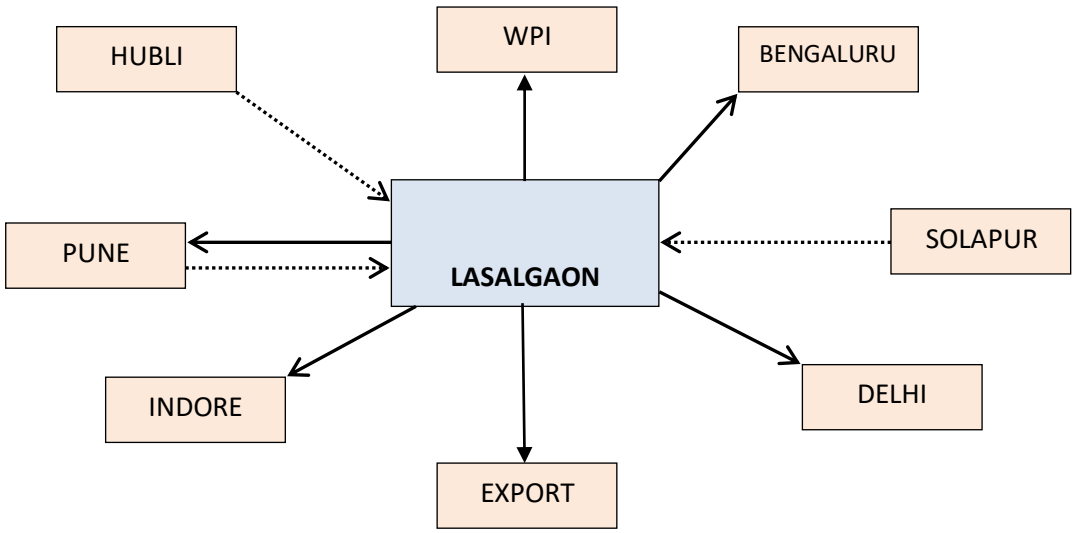
where, ln L = log value of Lasalgaon prices;
ln D = log value of Delhi prices;
ln B= log value of Bengaluru prices;
ln H= log value of Hubli prices;
ln P= log value of Pune prices
ln S= log value of Solapur prices
(Figures in parentheses indicate the probability value.)

The residuals from the above equations were checked for stationarity using ADF unit root test and these were found to be stationary at level. Thus, Lasalgaon and all other market prices were found to be cointegrated with each other.

Causality between the Export Prices and the Domestic Prices

Figure 8 presents the causal relation between prices in Lasalgaon and other markets. Lasalgaon prices granger cause prices in all the markets except Hubli and Solapur. In terms of arrival, Solapur receives larger arrival as compared to Lasalgaon, thus, Solapur market granger causes the prices in Lasalgaon, while the reverse is not found true. Also, prices in Hubli, Pune and Solapur granger cause Lasalgaon, while prices in Bengaluru and Delhi do not cause prices in Lasalgaon. Thus, Lasalgaon shares bidirectional causal relationship with Pune only. Lasalgaon granger causes WPI.

Figure 8: Transmission of price signals between the producing market (Lasalgaon) and other markets



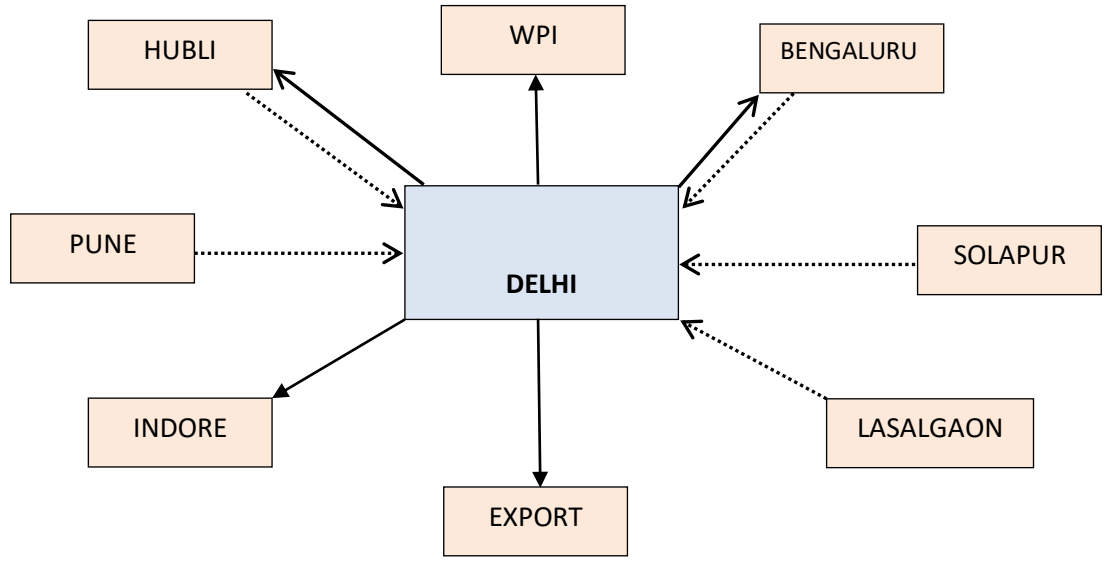
Null Hypothesis	F-Statistic	Prob.
Lasalgaon does not granger cause Bengaluru	3.813	0.025
Lasalgaon does not granger cause Delhi	10.748	0.000
Lasalgaon does not granger cause Hubli	2.206	0.115
Lasalgaon does not granger cause Pune	3.335	0.039
Lasalgaon does not granger cause Solapur	2.581	0.080
Lasalgaon does not granger cause WPI	8.878	0.000
Lasalgaon does not Granger Cause Indore	19.352	0.000
Lasalgaon does not Granger Cause Export price	38.920	0.000
Delhi does not granger cause Lasalgaon	2.969	0.055
Hubli does not granger cause Lasalgaon	6.447	0.002
Pune does not granger cause Lasalgaon	17.565	0.000
Solapur does not granger cause Lasalgaon	6.073	0.003
Export price does not Granger Cause Lasalgaon	0.231	0.794
Indore does not Granger Cause Lasalgaon	2.230	0.110
Bengaluru does not granger cause Lasalgaon	2.119	0.125

Drawn based on the probabilities level of less than 0.05

Source: Authors' computations.

Figure 9 shows the causal relationship between prices in Delhi and other markets. Delhi, being a consuming market, is affected by the price changes emanating from other markets. Prices in Delhi granger cause prices in Bengaluru, Hubli and WPI. It does not granger cause prices in Lasalgaon, Pune and Solapur. However, prices in all the other markets granger cause prices in Delhi. So, Delhi shares bidirectional causal relationship with Bengaluru and Hubli. Delhi granger causes WPI.

Figure 9: Transmission of price signals between the consuming market (Delhi) and other markets



Null Hypothesis	F-Statistic	Prob.
Delhi does not granger cause Bengaluru	4.713	0.011
Delhi does not granger cause Hubli	3.273	0.041
Delhi does not granger cause Lasalgaon	2.969	0.055
Delhi does not granger cause Pune	0.734	0.482
Delhi does not granger cause Solapur	1.581	0.210
Delhi does not granger cause WPI	6.894	0.002
Delhi does not granger cause Indore	7.552	0.000
Delhi does not granger cause Export price	30.332	0.000
Bengaluru does not granger cause Delhi	8.315	0.000
Hubli does not granger cause Delhi	17.538	0.000
Lasalgaon does not granger cause Delhi	10.748	0.000
Pune does not granger cause Delhi	15.742	0.000
Solapur does not granger cause Delhi	23.018	0.000
Indore does not granger cause Delhi	2.131	0.120
Export price does not granger cause Delhi	1.031	0.360

Drawn based on the probabilities level of below 0.05

Source: Authors' computations.

Indore is affected by the prices in all other markets; whereas, it does not affect the prices in other markets except Solapur. Export prices neither granger cause prices in any of the domestic markets nor WPI. However, prices in all the markets granger cause export prices. So, there is unidirectional causal relationship between export prices and domestic market prices wherein, causality runs from domestic market prices towards export prices but not vice-versa. This is quite logical that if domestic prices are high, the traders will export only when sufficiently large margins are available over the domestic prices. Further, the Government would announce a relatively higher MEP to discourage the exports, so if some quantity is exported to meet the commitments, that would obviously be the higher price.

6.4 Price Transmission between Lasalgaon and other Markets

The coefficient of error correction term denotes the speed of adjustment; the higher the speed of adjustment, the higher is the chance of correction of any disequilibrium caused due to change in any phenomenon. It is observed that when Lasalgaon is considered to be dependent on other markets, the speed of adjustment is very low in general in Lasalgaon. This is probably due to the reason that only one way transaction exists between the markets i.e. Lasalgaon only supplies the produce to the other markets. However, in some cases especially Solapur and Hubli, the speed of adjustment is found to be higher in Lasalgaon as compared to the other way. As Solapur is the nearby secondary market of onion, the stored quantity might be released due to which faster error correction mechanism takes place. The speed of adjustment is found to be highest (49 per cent) when the prices in Pune are affected by the prices in Lasalgaon. The speed of adjustment is very low (10 per cent), for prices in Lasalgaon to get adjusted to changes in prices in Delhi.

The following ECM equations measure the short-term relationship between Lasalgaon market and other markets

$$\Delta lnLasalgaon_t = -0.102\ ECT_{t-1} + 0.227 \sum \Delta lnDelhi_{t-1} + 0.279 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnDelhi_t = -0.607\ ECT_{t-1} + 0.056 \sum \Delta lnLasalgaon_{t-1} + 0.388 \sum \Delta lnDelhi_{t-1}$$

$$\Delta lnLasalgaon_t = -0.205\ ECT_{t-1} + 0.174 \sum \Delta lnBangalore_{t-1} + 0.319 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnBangalore_t = -0.414\ ECT_{t-1} + 0.026 \sum \Delta lnLasalgaon_{t-1} + 0.421 \sum \Delta lnBangalore_{t-1}$$

$$\Delta lnLasalgaon_t = -0.347\ ECT_{t-1} + 0.310 \sum \Delta lnHubli_{t-1} + 0.280 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnHubli_t = -0.111\ ECT_{t-1} + 0.119 \sum \Delta lnLasalgaon_{t-1} + 0.317 \sum \Delta lnHubli_{t-1}$$

$$\Delta lnLasalgaon_t = -0.124\ ECT_{t-1} + 0.919 \sum \Delta lnPune_{t-1} - 0.356 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnPune_t = -0.496\ ECT_{t-1} - 0.390 \sum \Delta lnLasalgaon_{t-1} + 0.965 \sum \Delta lnPune_{t-1}$$

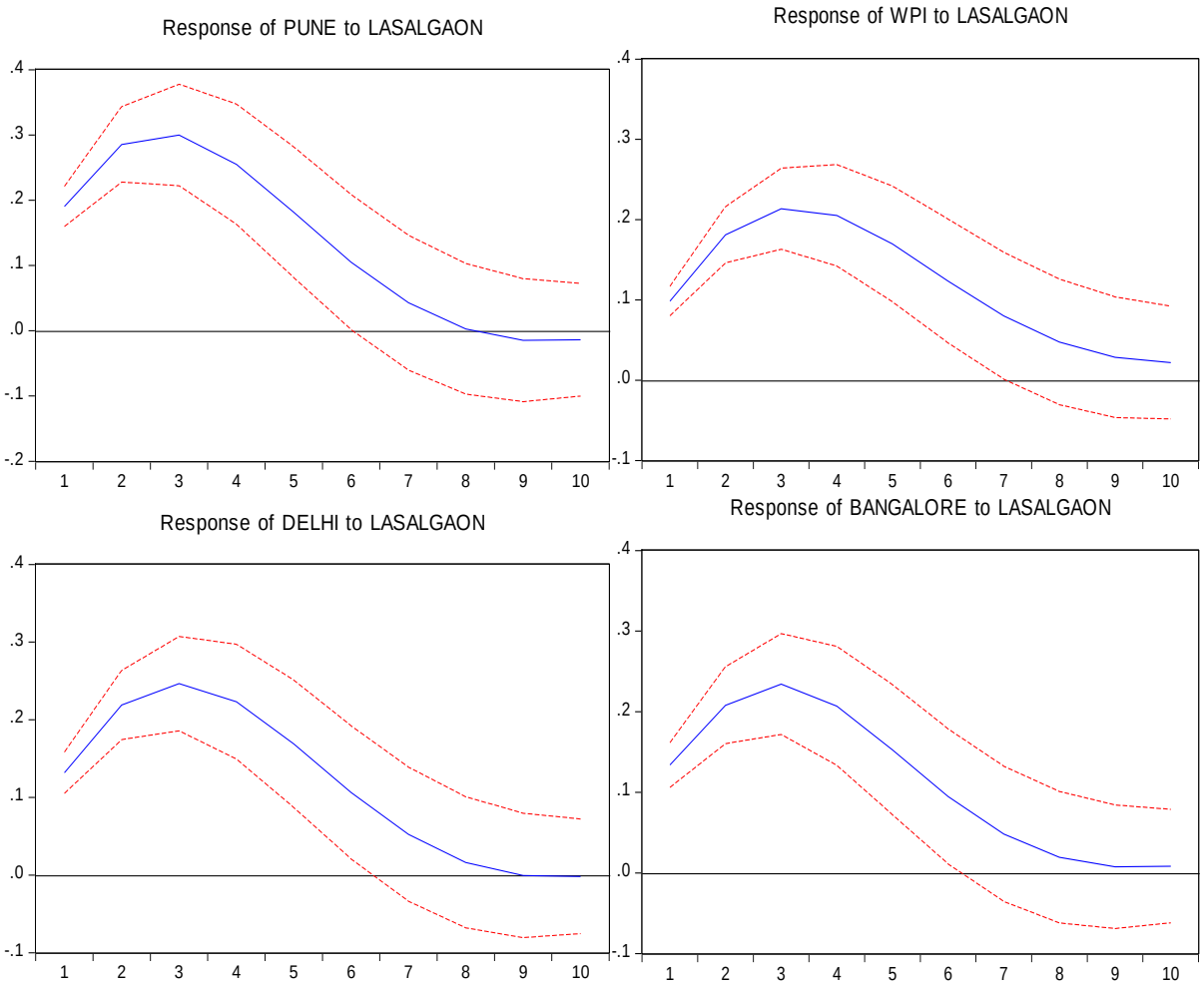
$$\Delta lnLasalgaon_t = -0.473\ ECT_{t-1} + 0.050 \sum \Delta lnSolapur_{t-1} + 0.419 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnSolapur_t = -0.127\ ECT_{t-1} + 0.211 \sum \Delta lnLasalgaon_{t-1} + 0.240 \sum \Delta lnSolapur_{t-1}$$

Impact of Price Shocks

Figure 10 shows the results of impulse response functions which describe how and to what extent a standard deviation shock in one of the onion market (Lasalgaon) affects the current as well as future prices in all the integrated markets over a period of ten months. It is observed that when a standard deviation shock is given to Lasalgaon market, an immediate and a high response was noticed in almost all markets between second and fourth month reaching a peak at third month. After fourth month, the response starts to decline and reaches negative in case of Bengaluru, Delhi and Pune. The increase and decline were steeper in case of Pune market.

Figure 10: Response of other markets to change in price in Lasalgaon market



Source: Authors' computations.

This shows that if a shock is arising in Lasalgaon market it is transmitted to all other markets with a higher response in the approaching months exhibiting a dominance of Lasalgaon market in onion price determination in the country. The response was found to be higher in case of Pune market.

6.5 Production-Price Linkages in Maharashtra

It is important to understand the production-arrival linkages along with price dynamics to understand the recurring price shocks in the country. As evident, the year-on-year (YOY) growth in onion production reveals that previous year's growth during the crisis preceding year plays a determining role. This becomes evident from close examination of the sequence of change in production, market arrival and prices during the crisis year and in the year preceding the price crisis. This is examined by using the evidence from the state of Maharashtra (Table 16), which is the largest onion producing state and market leader for onion.

A very strong and significant association is seen between the production in year T and market arrivals in the year T+1. The sequence of change is seen for the last 12 years. In these

ten years, production of onion witnessed decline in four years followed by the decline in market arrivals in the subsequent year in each case. The next change was seen in domestic prices. In year 2007-08, the production declined by about 4 per cent leading to decline in arrivals in 2008-09 by about 9 per cent. This sequence got repeated in the years 2009-10, 2012-13 and 2014-15, where production decline of about 20, 17 and 9 per cent led to 17, 16 and 12 per cent decline in arrivals, respectively. The discussion with traders and farmers revealed that production decline not only resulted in the decline in market arrivals but also the quality as the production shock resulted mainly due to untimely rains and thunderstorms. This further affected the storability of rabi onion and reduced the shelf life of the crop. Corresponding to this, prices increased exorbitantly by around 70 per cent in Maharashtra in 2013. Similarly, an aggregate price increase of 4 per cent at the state level was observed in 2015. However, the disaggregate impacts were much higher.

Nashik division is the major cluster producing rabi onion in Maharashtra. Nashik, Ahmednagar, Dhulia, Jalgaon and Nandurgaon are major producing districts in the Nashik division. This cluster is the most important rabi producing onion cluster in the country and the crisis is triggered from climate and production shocks in the region. Lasalgaon, Yeola and Pimpalgaon are the most important primary onion markets receiving arrival only from the onion producers. On the other hand, Solapur, Mumbai, Pune are the major secondary onion markets in the state. The contribution of the rabi crop in total onion produced in the cluster is gaining prominence and contributed about 70 per cent in the year 2013-14.

Table 16: Trends in production, arrival and prices of onion in Maharashtra

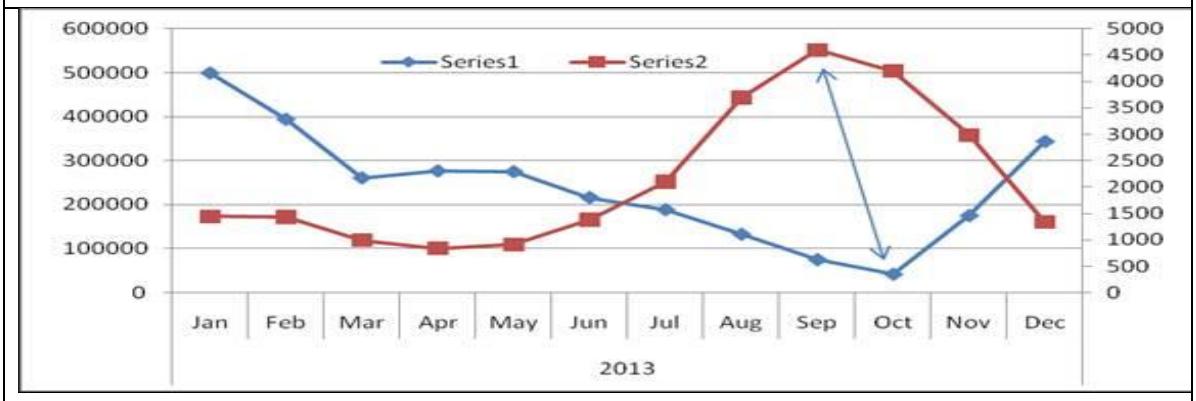
Year	Production (Th tons)	Arrival (Th tons)	Price (Rs/ton)	Change in Production (%)	Change in Arrival (%)	Change in Price (%)
2005-06	2469	2321	396			
2006-07	2812	2417	537	13.9	4.1	35.6
2007-08	2713	2985	564	-3.5	23.5	5.0
2008-09	3933	2719	734	44.9	-8.9	30.1
2009-10	3146	4113	860	-20.0	51.3	17.2
2010-11	4905	3405	1051	55.9	-17.2	22.2
2011-12	5638	3308	594	14.9	-2.8	-43.5
2012-13	4660	3702	878	-17.3	11.9	47.8
2013-14	5864	3108	1489	25.8	-16.1	69.6
2014-15	5362	3548	1333	-8.6	14.2	-10.5
2015-16	6529	3132	1382	21.8	-11.7	3.7
2016-17	-	5603	660	-	78.9	-52.2

Source: Authors'computations based on NHRDF and Agmarknet data.

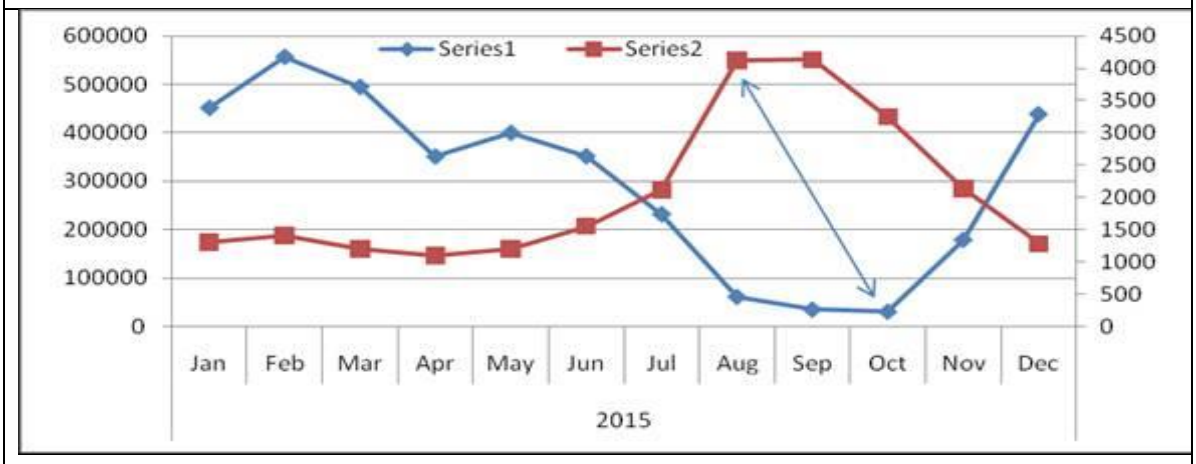
An extreme situation of price fall was observed in 2016-17, where prices declined by about 52 per cent creating disastrous situation for onion farmers of the region. The farmers lost on two counts: a) the loss in revenue resulted from extreme price fall b) the loss of revenue from the competitive crop as area was shifted from other seasonal crops.

Figure 11: Seasonality in prices and arrival of onion in Lasalgaon (2005-15)

Note: Figures are seasonal indices for onion arrivals and prices



Note: Series 1 presents the onion arrivals in quintals and series 2 presents the onion prices in Rs/quintal



Note: Series 1 presents the onion arrivals in quintals and series 2 presents the onion prices in Rs/quintal

Variance Decomposition in Onion Prices across Markets

As revealed that the shocks generate from the primary onion markets and spread throughout the markets in the country, the variance decomposition technique was applied for examining the price changes in other markets caused due to price changes in Lasalgaon

prices. As Delhi is a major consuming and distributing market, the time series onion wholesale price data were standardized by dividing with the Delhi wholesale price of onion (Table 17). After standardization, the series became stationary at the level. It can be observed that Lasalgaon is the major influencing market for all the selected markets. As markets are co-integrated, the price signals are transmitted slowly to other markets as well. In case of Lasalgaon market, Lasalgaon prices are influenced by the changes in its own price. This seems to be very logical as Lasalgaon is the biggest primary market of onion and does not receive produce from any other markets. Thus, only the changes on supply front in the surrounding producing clusters will bring the change in Lasalgaon.

Lasalgaon has been a major change agent in causing variation in other markets too, mainly in Pune, Solapur and Indore markets. Lasalgaon is located at the distance of 200-400 kms from these markets, so the physical movement of onion can easily take place between Lasalgaon and these markets. The long run impact of Lasalgaon in Indore has been quite significant. Hubli is the only market which seems to be least affected by its own price changes. Hubli dominates in terms of supply of kharif onions. Kharif onions comprise of more than 60 per cent of total long term annual arrivals of Hubli. Therefore, it has to maintain linkages with markets which can supply rabi onions and meet the consumption requirements throughout the year.

Table 17: Variance decomposition in onion prices for selected markets of India

Variance Decomposition	Markets	Periods											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Lasalgaon	S.E.	0.13	0.16	0.18	0.18	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20
	Lasalgaon	100.0	97.8	89.8	87.6	85.0	80.5	77.0	75.8	75.2	74.5	74.0	73.7
	Bengaluru	0.0	0.0	0.1	0.3	0.5	2.8	4.9	5.3	5.3	5.3	5.2	5.2
	Solapur	0.0	0.0	0.7	2.2	2.9	2.8	2.6	2.6	2.6	2.6	2.6	2.6
	Indore	0.0	0.7	5.2	5.1	5.0	4.8	4.7	4.6	4.6	4.6	4.5	4.5
	Pune	0.0	1.4	3.9	3.7	5.4	7.7	8.4	8.5	8.8	9.3	9.7	10.0
	Hubli	0.0	0.2	0.3	1.1	1.2	1.5	2.4	3.2	3.6	3.7	3.8	3.9
Bengaluru	S.E.	0.14	0.17	0.18	0.18	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.21
	Lasalgaon	24.4	18.7	17.4	19.2	18.7	17.2	16.7	16.8	16.9	16.9	16.9	17.0
	Bengaluru	75.6	80.4	76.2	73.4	67.5	61.5	60.3	60.1	59.9	59.8	59.7	59.6
	Solapur	0.0	0.1	0.4	0.6	2.0	4.0	4.3	4.3	4.3	4.2	4.2	4.2
	Indore	0.0	0.5	5.5	5.3	6.4	8.8	9.5	9.6	9.6	9.6	9.5	9.5
	Pune	0.0	0.0	0.2	0.5	4.1	7.4	8.0	8.0	8.1	8.1	8.1	8.1
	Hubli	0.0	0.3	0.3	1.0	1.3	1.2	1.2	1.2	1.3	1.4	1.5	1.5
Solapur	S.E.	0.11	0.14	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.17
	Lasalgaon	30.1	29.6	26.1	25.6	25.2	24.1	23.1	22.6	22.3	22.3	22.2	22.1
	Bengaluru	11.5	18.7	18.9	18.5	18.8	18.0	18.1	19.0	19.2	19.1	19.0	18.9
	Solapur	58.4	49.8	46.3	45.5	44.9	43.2	41.5	40.4	40.0	39.8	39.6	39.4
	Indore	0.0	1.4	6.8	7.1	7.1	7.1	6.9	6.7	6.8	6.8	6.9	6.8
	Pune	0.0	0.2	0.5	1.2	2.0	5.4	7.8	8.3	8.6	8.8	9.2	9.5
	Hubli	0.0	0.2	1.5	2.0	2.0	2.2	2.6	3.0	3.1	3.2	3.2	3.2
Indore	S.E.	0.11	0.13	0.14	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17
	Lasalgaon	33.4	43.4	47.7	47.9	48.8	48.9	48.7	48.6	48.5	48.5	48.4	48.3
	Bengaluru	0.6	2.7	3.0	3.3	3.8	3.7	4.4	5.1	5.2	5.2	5.2	5.2
	Solapur	0.0	1.3	1.1	2.5	2.7	2.6	2.5	2.5	2.6	2.6	2.6	2.6
	Indore	66.0	51.5	44.6	40.4	37.5	35.8	34.9	34.3	34.1	34.0	34.0	33.9
	Pune	0.0	0.8	3.1	3.6	3.4	4.9	5.5	5.5	5.6	5.7	5.9	6.0
	Hubli	0.0	0.2	0.5	2.3	3.7	4.1	4.0	4.0	3.9	3.9	3.9	4.0
Pune	S.E.	0.15	0.19	0.21	0.21	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23
	Lasalgaon	47.5	44.0	40.5	38.2	38.2	37.2	36.1	35.8	35.8	35.6	35.5	35.5
	Bengaluru	4.7	2.9	4.8	6.9	6.9	8.1	10.5	11.1	11.1	11.2	11.2	11.1
	Solapur	4.3	3.4	3.0	4.2	4.5	4.4	4.2	4.2	4.2	4.3	4.3	4.3
	Indore	0.0	1.3	3.4	3.5	3.8	4.4	4.4	4.5	4.5	4.6	4.7	4.8
	Pune	43.4	48.5	48.3	46.5	45.4	44.6	43.3	43.0	42.9	42.9	42.8	42.8
	Hubli	0.0	0.0	0.0	0.8	1.3	1.2	1.4	1.5	1.5	1.5	1.5	1.5
Hubli	S.E.	0.13	0.16	0.17	0.18	0.19	0.19	0.20	0.20	0.20	0.21	0.21	0.21
	Lasalgaon	27.1	21.9	18.7	18.4	18.1	17.6	17.2	16.9	16.6	16.6	16.8	17.2
	Bengaluru	27.7	27.9	26.0	23.8	22.7	21.7	21.2	20.9	21.0	21.1	21.1	20.9
	Solapur	4.0	2.8	3.1	3.7	4.5	5.4	5.8	5.7	5.6	5.4	5.3	5.3
	Indore	1.9	4.6	7.5	7.1	7.2	9.1	10.4	11.0	10.8	10.5	10.2	10.0
	Pune	0.2	0.1	0.2	0.3	0.7	1.0	1.0	2.1	3.9	5.3	6.1	6.5
	Hubli	39.0	42.7	44.5	46.7	46.8	45.2	44.3	43.3	42.2	41.1	40.4	40.0

7. ALTERNATIVE SYSTEMS OF MARKETING

NAFED provides marketing support to state level Marketing Federations, Primary Agricultural Cooperative Marketing societies and the National Cooperative Development Corporation.

7.1 Marketing Reforms Undertaken by the States

The APMC Model Act on introducing marketing reforms in agriculture was circulated to the states for its implementation. There are few states which have fully amended and notified APMC Act. Karnataka, Rajasthan Himachal Pradesh, Jharkhand, Gujarat and Goa are pioneering states, which have fully amended and notified the APMC Act. In states like Uttar Pradesh, West Bengal, J&K, Meghalaya, Puducherry, Delhi, Arunachal Pradesh and Assam, the implementation of marketing reforms are in nascent stage. States like Kerala, Manipur, A&N island, D&N Haweli, Daman & Diu and Lakshadweep don't have APMC.

Table 18: State wise market reform status

Developed and functioning	Developing stage	Laggard	Don't have APMC
Karnataka	Madhya Pradesh	Bihar	Kerala
Rajasthan	Sikkim	Uttar Pradesh	Manipur
Jharkhand	Uttrakhand	West Bengal	Andaman & Nikobar
Gujarat	Nagaland	Jammu & Kashmir	D & N Haweli
Goa	Mijoram	Meghalaya	Daman & Diu
Andhra Pradesh	Tripura	Puducherry	Lakshadweep
Telangana	Punjab	Delhi	
Maharashtra	Haryana	Arunachal Pradesh	
	Tamilnadu	Assam	
	Chandigarh		

Source: DMI

7.2 Reform-Induced Developments: E-Markets

Table 19: Details of mandis and traders registered on eNAM, in different States/UTs

State/ UT	*Mandies*	Traders	FPOs	Farmer	No. of Unified licenses issued by State
Andhra Pradesh	33	3483	177	1445806	3,483
Chandigarh	1	114	0	7106	0
Chhattisgarh	14	3126	22	135253	36
Gujarat	122	9444	110	869102	9,444
Haryana	81	14486	243	2725243	35
Himachal Pradesh	19	2015	56	124506	0
Jammu and Kashmir	2	237	4	957	0
Jharkhand	19	2315	120	247554	104
Karnataka	2	662	13	1455	662
Kerala	6	354	7	2792	35
Madhya Pradesh	80	22378	104	3007337	1,070
Maharashtra	118	21548	268	1217277	0
Odisha	41	7504	208	285380	7,504
Puducherry	2	181	2	13529	0
Punjab	37	2611	10	217427	1
Rajasthan	144	82924	189	1500993	82,924
Tamil Nadu	63	6375	108	312051	3,768
Telangana	57	5803	62	1823790	5,803
Uttar Pradesh	125	35157	271	3315390	90
Uttarakhand	16	4738	44	54329	4,738
West Bengal	18	3994	171	49819	33
Total	1000	229,449	2,189	17,357,096	1,19,730

Source: https://enam.gov.in/

7.3 Availability of Marketing Infrastructure

Table 20: Details of wholesale, Rural Primary and Regulated Markets in Different States/UTs (As on 31.03.2015)

	Number of Markets				Regulated Markets			
States/UTs	Wholesale	Rural primary	Total	Total market per lakh gross cropped area	Principal markets	Sub market yards	Total	Regulated markets per lakh gross cropped area
Andhra Pradesh	190	157	347	4.3	190	157	347	4.3
Bihar	325	1469	1794	23.7	-	-	-	-
Chhattisgarh	2	1132	1134	19.9	69	118	187	3.3
Goa	4	24	28	17.7	1	7	8	5.1
Gujarat	205	129	334	2.7	213	187	400	3.2
Haryana	281	195	476	7.4	107	174	281	4.3
Himachal Pradesh	42	35	77	8.2	10	44	54	5.7
Jammu & Kashmir	0	8	8	0.7	11	0	11	1.0
Jharkhand	201	602	803	48.0	28	173	201	12.0
Karnataka	315	730	1243	10.1	157	356	513	4.2
Kerala	348	1014	1362	52.1	-	-	-	-
Madhya Pradesh	0	0	0	0.0	254	284	538	2.2
Maharashtra	881	3500	4381	18.8	305	603	908	3.9
Odisha	398	1150	1548	30.0	54	382	436	8.4
Punjab	424	1390	1814	23.1	150	274	424	5.4
Rajashthan	446	312	758	2.9	134	312	446	1.7
Tamil Nadu	0	0	0	0.0	277	6	283	4.8
Telangana	150	110	260	4.1	150	110	260	4.1
Uttar Pradesh	584	3464	4048	15.6	250	365	615	2.4
Uttarakhand	36	30	66	6.0	26	32	58	5.3
West Bengal	279	3250	3529	36.7	20	464	484	5.0
N.E States								
Assam	405	735	1140	27.8	20	206	226	5.5
Arunachal Pradesh	5	66	71	24.0	0	0	0	0.0
Manipur	24	95	119	31.6	-	-	-	-
Meghalaya	35	85	120	35.0	2	0	2	0.6
Mizoram	7	218	225	197.6	-	-	-	-
Nagaland	19	174	193	38.7	18	0	18	3.6
Sikkim	7	12	19	12.9	-	-	-	-
Tripura	84	470	554	-	21	0	21	-
Union Territories								
A & N Islands	0	28	28	115.3	-	-	-	-
Chandigarh	1	0	1	51.2	1	0	1	51.2
D & N Haveli	0	0	0	0.0	-	-	-	-
Daman & Diu	0	0	0	0.0	-	-	-	-
Delhi	30	0	30	84.9	7	8	15	42.5
Lakshadweep	0	0	0	0.0	-	-	-	-
Pudducherry	4	5	9	35.6	4	5	9	35.6

Source: Doubling Farmers Income Report Volume III

Table 21: Number of Cold Storages and Capacity (in metric tons) in India

States/UTs	2014		2015		2016		2017	
	Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity
Andhra Pradesh & Telengana	404	1577828	413	1622320	426	1729286	432	1757785
Bihar	303	1406395	304	1411395	305	1416095	305	1416095
Chhattisgarh	89	427766	97	470546	98	484557	98	484557
Goa	29	7705	29	7705	29	7705	29	7705
Gujarat	560	2030873	625	2323175	692	2570973	753	2875713
Haryana	295	588649	307	638601	318	695795	336	741446
Himachal Pradesh	32	38557	34	53009	53	105726	63	119167
Jammu & Kashmir	28	64769	29	69769	33	100976	36	112206
Jharkhand	55	217280	56	221680	57	226680	58	236680
Karnataka	189	526752	192	536333	193	548001	194	553401
Kerala	197	78355	197	78355	196	78105	196	78105
Madhya Pradesh	260	1097168	275	1168321	294	1253715	294	253715
Maharashtra	540	706303	555	762798	575	881860	581	896730
Orissa	111	326639	120	366699	167	523139	170	538139
Punjab	606	2004778	617	2051377	655	2152003	655	2152003
Rajasthan	154	480032	157	490888	159	521387	161	527893
Tamil Nadu	163	295671	165	304771	168	316583	168	316583
Uttar Pradesh	2176	13633039	2209	13807762	2250	13978608	2285	14139098
Uttrakhand	28	84545	30	89689	44	148921	45	151421
West Bengal	502	5901925	506	5912237	511	5940511	511	5940511
N.E States								
Assam	34	119652	35	126179	35	152706	36	157906
Arunachal Pradesh	1	5000	1	5000	1	5000	1	5000
Manipur	1	2175	1	2175	1	3000	1	3000
Meghalaya	4	8200	4	8200	4	8200	4	8200
Mizoram	3	3931	3	3931	3	4471	3	4471
Nagaland	2	6150	2	6150	2	6150	2	6150
Sikkim	2	2000	3	2100	2	2100	2	2100
Tripura	13	39181	14	45477	14	45477	14	45477
Union Territories								
A. & N. Islands	2	210	2	210	2	210	2	210
Chandigarh	6	12216	7	12462	7	12462	7	12462
Delhi	97	129857	97	129857	97	129857	97	129857
Lakshadweep	1	15	1	15	1	15	1	15
Pudducherry	3	85	3	85	3	85	3	85
All India	6,891	31,823,701	7,091	32,729,271	7,395	34,050,359	7,543	34,673,886

Source: Doubling Farmers Income Report Volume III

The ground status of market reforms

The Government is trying to implement the electronic trading of agricultural commodities to bring transparency and efficiency in agricultural marketing. The efforts are being made to strengthen agri-logistics to build effective supply chains. However, the emphasis is required on addressing regional constraints and address issues hindering trade through e-NAM.

Table 22: State wise progress of market reforms

State/ UT	Limiting regulation within APMC Yard	Separation of Powers between Dir(Mktg.) & MD, Mandi Board	Single unified trading license	Single Point levy of Market fee	Private Wholesale market	Direct marketing (Outside mandi)	Declaring warehouse, silos / cold storages, as deemed market	e-trading	Deregulation of marketing of F&V
Andhra Pradesh	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Arunachal Pradesh	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Assam	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bihar	No APMC Act								
Chhattisgarh	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Goa	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gujarat	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Haryana	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
HP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Jharkhand	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Karnataka	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kerala	No APMC Act								
MP	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Mah.	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Manipur	No APMC Act								
Meghalaya	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mizoram	No	No	Yes	Yes	Yes	Yes	No	Yes	No
Nagaland	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Odisha	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Punjab	No	No	Yes	Yes	Yes	Yes	No	Yes	No
Rajasthan	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Sikkim	No	No	Yes	Yes	Yes	Yes	No	Yes	No
Tamil Nadu	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Telangana	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Tripura	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UP	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Uttarakhand	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
West Bengal	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes
Delhi	No	No	No	No	No	No	No	No	Yes
Chandigarh	No	No	Yes	Yes	Yes	Yes	No	Yes	No
Puducherry	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
J&K	No APMC Act								
Laddakh									
A&N Islands									
DNH									
Daman & Diu									
Lakshdeep									

Source: DMI (updated on 14.07.2020)

8. INSTITUTIONAL FACILITIES

8.1 Operation Green

To shield consumers from excessive price volatility in horticultural commodities like onion, potatoes and pulses the Government of India has set up the price stabilization fund (PSF) in 2014-15 under the aegis of Department of Agriculture, Cooperation & Famers Welfare (DAC&FW). Initially the fund was set up with a corpus of Rs. 500 crores, for the procurement of price sensitive horticultural commodities so as to ensure supply at reasonable prices. Moreover, Ministry of Food Processing Industries (MOFPI) for the integrated development of value chain of Tomato, Onion and Potato (TOP) launched Operation Greens scheme in 2018 with the intent to augment value realization for TOP growers, assuring significant reduction in post-harvest losses consequently ensuring price stabilization for producer and consumers. Over the time Organizations such as NAFED, Small Farmers Agribusiness Consortium (SFAC) have evolved so as to play a vital role in onion storage to ensure supply during the supply shortage crisis. NAFED is the nodal agency for implementation of short term price stabilization measures for execution of the scheme. Under the PSF, NAFED procured and managed a buffer stock of 56000 tonnes onions in 2018-19.

Centre has procured 2.50 lakh tons of onion for the buffer in 2022-23. The onion buffer size in current year is 0.50 lakh tons higher than the 2.0 lakh tons created during 2021-22. The onions were procured from current rabi harvest for the price stabilisation buffer. The stocks have been procured by National Agricultural Cooperative Marketing Federation of India (NAFED) from farmers through the Farmer Producer Organisations (FPOs) in rabi onion growing states of Maharashtra, Gujarat and Madhya Pradesh.

8.2 Institutional Credit Facilities

Over the time **National Bank for Agriculture and Rural Development (NABARD)** has ensured several initiatives so as to ensure hassle free loans to farmers for crop cultivation. Major initiatives include ensuring availability of agriculture credit at a reduced interest rate of 7% p.a. and interest subvention scheme for short term crop loans up to Rs. 3.00 lakh. In addition, credit available through Kisan Credit Card (KCC), ensures timely availability of various agricultural inputs to the farmers. The Government of India has sanctioned a capital investment subsidy scheme for construction/ modernization/ expansion of cold storages and storages for horticultural produce. NABARD provides refinancing to various eligible banks for financing onion storage structures under its normal refinance programme. They issue the guidelines from time to time in this regard.

Small Farmers Agribusiness Consortium (SFAC) encouraged the instigation of Farmer Producer Organizations/Farmer Producer Companies (FPCs), through offering various schemes like Equity Grant and Credit Guarantee Fund to ensure working capital and expansion of business activities of FPOs/FPCs. It also encourages agribusiness through its VCA Scheme for value added processing and marketing linkages.

Agricultural processed products and export development agency (**APEDA**) controls and regulates the service levels, charges, terms and conditions levied upon exporters of perishable agricultural produce by the nodal agencies, moreover it also provides advisory services to the exporters. Directorate of Marketing and Inspection (**DMI**) is providing certification of fruits and vegetables for exports through its approved laboratories stretched all over the country to attend to grading and certification.

9. PROCESSING AND UTILIZATION

9.1 Processing of Onion[1]

Onion can be processed into a wide range of products such as, ready to use or ready to cook fresh onions, onion paste, dehydrated onion flakes, onion powder, onion oil, onion vinegar, onion sauce, pickled onion, onion wine and beverage. Over the time the hectic lifestyles and changing consumption patterns have led to an increase in demand for these processed products. As per recent estimates, approximately 6.75% of the onion produced in the country is used for processing.

(1) ***Minimally processed onions***: These are peeled and/or cut onions for ready to use that retain its freshness, packed in suitable packaging material and stored at refrigerated conditions or frozen conditions.
(2) ***Onion paste***: Preparation of minimally processed onions and onion paste entails optimization of preservatives and packaging materials so as to increase their shelf life.
(3) ***Dehydrated onions***: Dehydration of onions reduces the bulk of transport simultaneously increasing the shelf life of onions significantly due to decreased amount of moisture, thus limiting the growth of microorganism. Dehydrated onion flakes can be processed into onion powder by proper grinding. Onion powder dissolves very easily and reconstitute quickly as compared to onion flakes. Onion powder can be used to ensure the flavour of onion in a variety of foods. Ensuring suitable packaging is most crucial to enhance the shelf life of dehydrated onion flakes and powder since they are very hygroscopic in nature.
(4) ***Pickles***: Pickling is an old age practice of increasing the shelf life of food products. Most widely used pickling for onions are vinegar based pickling and oil based pickling. While vinegar based pickling is widespread in the United States and Europe, oil based pickling is very popular in Asia and Africa.
(5) ***Oil***: Onion oil is usually extracted through different methods like distillation, solvent extraction, super critical fluid extraction etc. It is used as a flavouring substance extensively for different processed products, besides it is also used as a natural food preservative.
(6) ***Vinegar/Beverage/Sauce***: Since onions are rich in sugars and other nutrients they can be administered into onion vinegar and onion wine. Likewise, they can also be processed for onion beverage and onion sauce.

Onion waste processing

Significant amount of onion waste is produced as a result of consumption of onion both domestically and industrially. Onion waste includes onion skins, two outer fleshy scales and roots generated during industrial peeling and undersized malformed or damaged bulbs. Thus efforts are required to search for opportunities where this waste can be utilized judiciously.

(1) ***Source of fiber***: The skin of an onion bulb contains rich fibre. After harnessing the color from the dry skin by decoloration, the outcome product is converted into a fibrous material which can be utilized as a fiber supplement. The same fibrous material can be used as a thickening agent for the preparations of different soups.

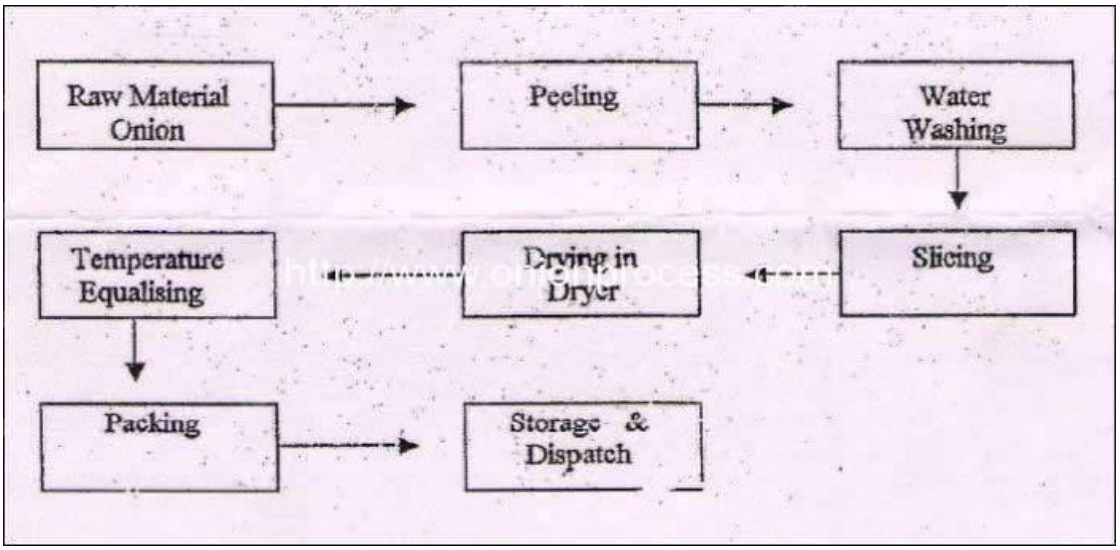
[1] Onion processing article by ICAR-Directorate of Onion & Garlic Research (DOGR), Pune. Retrieved from https://dogr.icar.gov.in/index.php?option=com_content&view=article&id=53&Itemid=210&lang=en

(2) ***Natural colour***: The dry skin of onion contains flavonoids. The color extracted from onion skin can be used as a natural dye. Onion essence which is utilized as a flavoring agent can also be extracted from the skin of an onion bulb.

(3) ***Bio-gas***: Other resultant materials like outer layers, roots and stalks can be anaerobically digested in a bio-digester to produce alternative energy sources like bio-gas.

9.2 Dehydrated Onions[2]

The main benefits of dehydrated onions are that they are easy to store, being lighter in weight and slighter in bulk than fresh or other processed onions. Furthermore, they are cheap to pack compared with canned goods. Also they do not require refrigerated storage. The newest dehydration process appears to be a variation on the air-drying process and is based on the principle of vapor pressure differentials, using air circulated around the onions at relatively low temperatures to `sweat' the water from the food. It is reported that this method of dehydration prevents a crust forming on the outside of the pieces of food and that the low temperatures have less effect on flavor, texture, color and vitamin contents of onion then, of the higher temperatures used in conventional hot air-drying methods.



Source: https://www.onionprocess.com/how-to-make-dehydrated-onion-flakes/

Red onions are not appropriate for dehydration due to low solid content, low pungency levels and large content in reduced sugars. White onions used for dehydration are grown on a commercial scale only in a few districts in the states of Maharashtra and Gujarat.

[2] NIIR Project Consultancy Services (NPCS) project report on dehydrated onion. Retrieved from https://www.niir.org/profile-project-reports/profile/2180/dehydrated-onions.html

9.3 Preparation of Onion Vadagam[3]

Ingredients	
Onion	1kg
Black gram dhal	200g
Garlic	100g
Cumin	20g
Mustard	20g
Chillies	100g
Salt	to taste

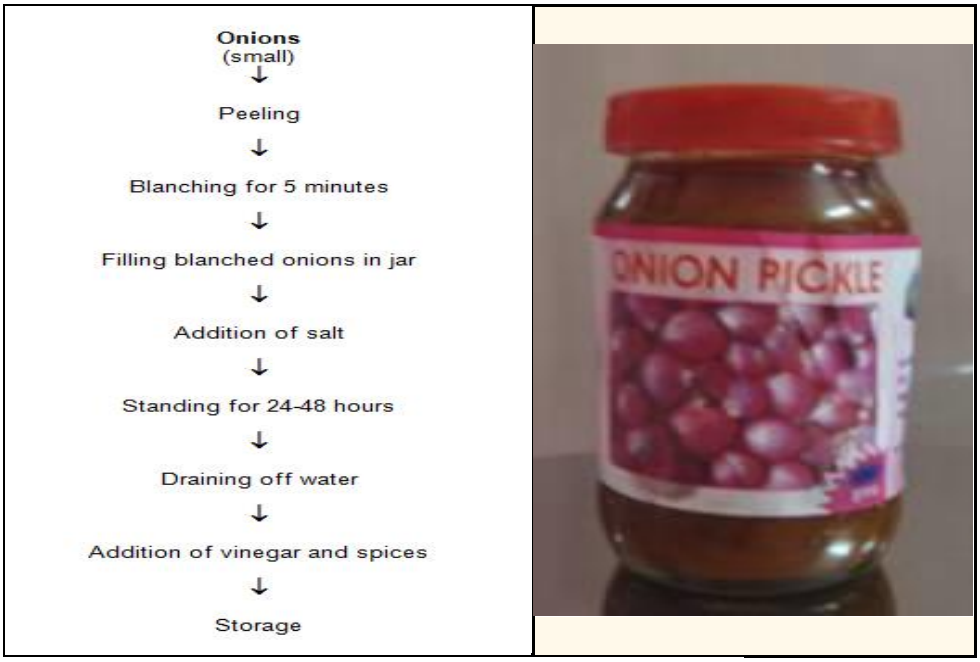
Method

1. Soak black gram dhal in water for 2 hrs and grind into paste.
2. Peel and wash onions, make a slit in the onions.
3. Make red chillies into powder.
4. Mix onion, mustard, salt, chillies and cumin. Make into small balls without pressure.
5. In a tray put the polythene covers and place the vadagam and sun dried for 2-3 day

Source: Home Science College and Research Institute, TNAU, Madurai

9.4 Preparation of Onion Pickle[4]

Items: Onions 1 kg, vinegar 1 litre, salt 250 g, red chilli powder 10 g, cardamom (large), black pepper, cumin (powdered) each 10 g, clove (headless) 5 numbers.



Source: Home Science College and Research Institute, TNAU, Madurai

[3] Web article on Post Harvest Technology : Vegetables, TNAU Agritech portal, Tamilnadu. Retrieved from https://agritech.tnau.ac.in/postharvest/pht_rootsandtubers.html

[4] Web article on Post Harvest Technology : Vegetables, TNAU Agritech portal, Tamilnadu. Retrieved from https://agritech.tnau.ac.in/postharvest/pht_rootsandtubers.html

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Appendices

State-wise Progress of AMI (Storage Infrastructure) including Erstwhile GBY

Since inception w.e.f. 01.04.2001& up to 31.03.2022

S. No.	State	No. of projects	Storage Capacity (in MT)	Subsidy Released (Rs. Lakh)
1	Andhra Pradesh	1444	5816670	29303.71
2	Arunachal Pradesh	1	945	6.30
3	Assam	346	1067157	6659.78
4	Bihar	1089	715539	3018.15
5	Chhattisgarh	600	1953611	7372.00
6	Goa	1	299	0.94
7	Gujarat	11970	4964855	27995.05
8	Haryana	2284	6818374	38871.69
9	Himachal Pradesh	88	30826	180.77
10	Jammu & Kashmir	15	88027	709.79
11	Jharkhand	37	183708	814.92
12	Karnataka	4674	3941516	19387.07
13	Kerala	209	105903	539.55
14	Madhya Pradesh	4617	13749757	71724.49
15	Maharashtra	3698	7035176	29225.43
16	Meghalaya	16	21012	186.75
17	Mizoram	1	302	2.52
18	Nagaland	36	32814	354.38
19	Odisha	695	1019830	4191.55
20	Punjab	1761	6814459	23516.33
21	Rajasthan	1594	3123742	10585.51
22	Tamilnadu	1202	1436730	5205.06
23	Telangana	857	5023442	25292.72
24	Tripura	5	28764	296.61
25	Uttar Pradesh	1182	5600154	18074.01
26	Uttarakhand	291	786272	3467.72
27	West Bengal	2565	1619834	5093.98
Total		**41278**	**71979718**	**332076.78**

State-wise Progress of AMI (Other than storage infrastructure) including Erstwhile AMIGS SchemeSince inception w.e.f. 20.10.2004 & upto 31.03.2022

S. No.	State	No. of projects	Subsidy Released (Rs. Lakh)
1.	Andhra Pradesh	379	7102.90
2.	Assam	13	573.52
3.	Chhattisgarh	339	6688.92
4.	Delhi	1	30.41
5.	Goa	1	50.00
6.	Gujarat	8815	22844.76
7.	Haryana	7	137.70
8.	Himachal Pradesh	62	1640.18
9.	Jharkhand	1	0.00
10.	Karnataka	835	8975.19
11.	Kerala	372	6254.84
12.	Madhya Pradesh	1264	33761.78
13.	Maharashtra	1568	43965.50
14.	Manipur	17	0.00
15.	Mizoram	1	2.52
16.	Nagaland	72	1422.33
17.	Odisha	20	852.13
18.	Punjab	2074	26920.31
19.	Rajasthan	557	9853.39
20.	Sikkim	1	15.52
21.	Tamil Nadu	1811	5361.95
22.	Telangana	711	11489.05
23.	Uttar Pradesh	3	872.00
24.	Uttarakhand	7	1002.26
Total		**18931**	**189817.16**

Export of Onions Dried from India

Country / Region	Values in Rs. Lacs		Quantity in tons	
	2020-2021	2021-2022	2020-2021	2021-2022
GERMANY	13,027.83	13,833.24	8,992.03	9,813.18
U S A	12,559.42	13,680.38	8,650.73	9,278.84
BRAZIL	11,082.00	9,346.24	8,194.83	7,338.34
INDONESIA	3,278.75	8,928.29	2,797.38	7,652.15
U K	7,598.58	8,637.66	5,324.16	6,082.12
BELGIUM	3,731.51	6,824.90	2,512.81	4,437.65
RUSSIA	6,801.63	6,355.83	4,880.78	4,824.59
SOUTH AFRICA	3,097.45	3,991.46	2,127.56	2,925.58
SLOVENIA	2,340.25	3,414.84	1,456.80	2,360.90
CANADA	2,983.95	3,077.86	1,869.05	1,869.05
NETHERLAND	2,186.11	3,044.12	1,495.15	2,267.82
POLAND	3,824.21	2,847.07	2,762.06	2,125.53
NIGERIA	2,096.29	2,798.80	1,364.47	1,834.85
COTE D' IVOIRE	1,526.42	2,739.22	874.1	1,563.50
SPAIN	3,026.86	1,938.18	2,108.09	1,392.49
TURKEY	1,553.13	1,812.82	1,160.68	1,402.83
MEXICO	1,245.31	1,633.69	930.75	1,186.38
ISRAEL	1,381.07	1,588.93	918.18	1,115.85
UKRAINE	1,588.26	1,409.35	1,038.38	953.3
Total	**106,325.41**	**118,126.02**	**74811.94**	**84961.24**

Source: Ministry of Commerce, GOI

Export of Onions Fresh or Chilled from India

Country / Region	Values in Rs. Lacs		Quantity in Tons	
	2020-2021	2021-2022	2020-2021	2021-2022
BANGLADESH PR	75,552.94	130,143.24	552,388.13	658,821.31
MALAYSIA	46,146.99	49,020.19	198,109.13	170,438.80
SRI LANKA DSR	31,322.23	41,121.15	144,713.34	162,870.66
NEPAL	16,837.61	28,077.06	114,548.77	168,475.02
U ARAB EMTS	33,050.16	27,885.12	170,641.23	122,761.34
INDONESIA	11,269.31	8,680.13	70,741.11	37,666.46
QATAR	9,335.93	7,814.89	45,354.15	33,326.29
HONG KONG	2,172.70	7,371.94	10,627.95	24,496.45
KUWAIT	8,369.06	5,745.42	39,529.51	24,219.65
VIETNAM SOC REP	4,194.59	4,679.17	25,010.94	18,093.87
PHILIPPINES	2,058.64	4,640.64	7,103.31	13,562.78
SINGAPORE	4,217.11	4,571.28	18,937.70	17,217.60
MALDIVES	3,912.50	3,747.71	11,473.06	11,490.59
BAHARAIN IS	3,410.22	3,405.54	17,153.26	14,386.80
SAUDI ARAB	10,025.78	3,381.13	57,363.62	15,154.60
OMAN	8,123.81	3,212.11	42,545.37	14,586.93
MAURITIUS	1,962.24	1,990.56	7,308.00	6,917.00
U K	1,454.18	1,684.96	5,454.15	4,879.62
Total	**283,018.91**	**343,304.98**	**1579025.56**	**1538612.49**

Source: Ministry of Commerce, GOI