

HANDLING OF AGRICULTURAL WASTES IN APMCs

RESEARCH REPORT 2011-12



**NATIONAL INSTITUTE OF
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JAIPUR, RAJASTHAN

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CHAPTER 1

INTRODUCTION

India with its varied agro climatic zones is amenable to grow a wide variety of food crops and horticultural products. These crops form a significant part of the total agricultural produce in the country comprising of cereals, pulses, cotton, fruits, vegetables, root and tuber crops, flowers, ornamental plants, medicinal and aromatic plants, spices, condiments, plantation crops and mushroom. After attaining independence in 1947, major emphasis was laid on achieving self sufficiency in food production. Development of high yielding wheat varieties and high production technologies and their adoption in areas of assured irrigation paved the way towards food security ushering in green revolution in the sixties. It, however, gradually became clear that horticultural crops for which the Indian topography and agro climates are well suited are an ideal option of achieving sustainability of small holdings, increasing employment, improving environment, providing an enormous export potential and above all achieving nutritional security. As a result, emphasis on diversification to horticultural crops was given since last one decade or so.

The agriculture sector in India contributes about 17 percent of country's GDP and provides employment to approximately two third of the population. However, its potential has not been tapped due to underdevelopment of the food sector in India. The single most important challenge facing the country is providing remunerative prices to farmers for their products without incurring the additional burden of subsidy through minimum support prices or other such measures. The challenge could be addressed if cereals, fruits, vegetables, milk, fish, meat and poultry etc. are processed for consumption in the domestic and international markets. There are various issues to be dealt with in utilizing the opportunities for agribusiness industry. In post WTO scenario, Indian produce has to face competition in domestic as well as export markets. With the phasing out of quantitative restrictions, developed countries are imposing strict qualitative restrictions and are imposing barriers to trade. The Indian commodities are facing tough competition in the international market when it comes to quality, pesticide residues, varieties with more shelf life, packaging etc. This implies that Indian produce need to be more competitive to face the international competition which again demands the maintenance of quality standards

throughout the value chain including good agricultural practices. Whereas it has been found that 30 – 40 percent of fruits and vegetables are wasted due to post harvest losses. There is lack of basic as well as specialized infrastructure such as cold storages, refer vans, cool chains, ripening chambers etc. Also there is a missing link between production and research system and international consumers. The system lacks in capacity building market information, research and intelligence.

Some interesting facts

- India is short by 10 million tonnes of cold storage capacity due to which over 30 percent of agricultural produce goes waste every year,
- More than 20% of produce from fields is lost to poor post-harvesting facilities and lack of cold chain infrastructure.
- Also 10% of food grain that India produces annually is eaten by rodents.
- Only 7% of food in India is processed. The United Kingdom process +65% of its food. Even a developing country like the Philippines processes as much as 45% of its food.
- India, the world's second largest fruit and vegetable producer encounters a waste of close to 25% worth of produce.

The post-harvest technologies for perishable horticulture produce serve as an effective tool for getting better return to the produce and also help in avoiding wastage both at production site and distribution centers, which will help in regulating the market infrastructure. Recycling of fruit and agricultural waste is one of the most important means of utilizing it in a number of innovative ways yielding new products and meeting the requirements of essential products required in human, animal and plant nutrition as well as in the pharmaceutical industry. Microbial technology is available for recycling and processing of fruit and vegetables waste and following products can be made out of the different processes. In the light of the above, the present study is an attempt to study the existing infrastructure for waste management and to suggest measures to utilize the bio-waste in appropriate manner.

Thus, waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials. Concern over environment is being

seen a massive increase in recycling globally which has grown to be an important part of modern civilization. The consumption habits of modern consumerist lifestyles are causing a huge global waste problem. Industrialization and economic growth has produced more amounts of waste, including hazardous and toxic wastes. There is a growing realization of the negative impacts that wastes have had on the local environment (air, water, land, human health etc.).

Objectives of the Study:

- a) To consolidate the information on the existing system of waste management
- b) To detail the action plan for waste management in conformity with the state policy on waste management.
- c) To provide a document which would be used for immediate procurement of equipment and services for implementation of the waste management system and
- d) Provide a baseline for all future plans for waste management for the market
- e) To provide detailed plans for the waste management in selected markets

Limitations of the Study:

- Very less data and information available on waste management in APMCs in India
- There is no specific state policy for Agricultural Waste Management in APMC
- There are data gaps in information received from the APMCs
- Withdrawal of the Collaborative SAU from middle of the Study
- This led to confining of the Study based on the data gathered by the collaborative Institute.

CHAPTER 2

RESEARCH METHODOLOGY

Study Area:

Due to fragmented supply chain and lack of storage, grading and proper packaging, lot of wastes of agricommodities is generated in the mandis. As the title of the Research Study indicates, the Study has been conducted in the major APMCs of the Country.

Since the Study has been conducted at all India level, different States were selected based on their geographical distribution i.e. East, West, North, South and North-East zones. Eleven major APMCs of different states have been selected for the study where the maximum arrival of fruits and vegetables is reported. This includes Azadpur Mandi of Delhi which is a market of National Importance. It is the biggest Fruits and Vegetable Market in Asia.

The Sample Markets where the Study has been carried out are as follows:

Sr. No.	Zone	State	APMC Market
1.	East	West Bengal, Bihar	Kolkata, Patna
2.	West	Maharashtra, Gujarat	Mumbai, Pune, Ahmedabad
3.	North	Delhi, Punjab, Uttar Pradesh	Delhi, Jalandhar, Kanpur
4.	South	Karnataka, Tamil Nadu	Bangalore, Chennai
5.	North East	Assam	Guwahati

Thus a total of 11 APMCs representing 10 States were sampled.

Sample Size

Besides collecting information from the Market Committee of these APMCs(where information was made available), information was also collected from 222 traders from these APMCs.

The sample distribution is as follows:

S.No	Name of the APMC	No. of Traders Sampled
1.	Delhi	32
2.	Mumbai	15
3.	Pune	18
4.	Bangalore	32
5.	Ahmedabad	20
6.	Jalandhar	15
7.	Kolkata	16
8.	Chennai	31
9.	Guwahati	07
10.	Patna	09
11.	Kanpur	27
	Total	222

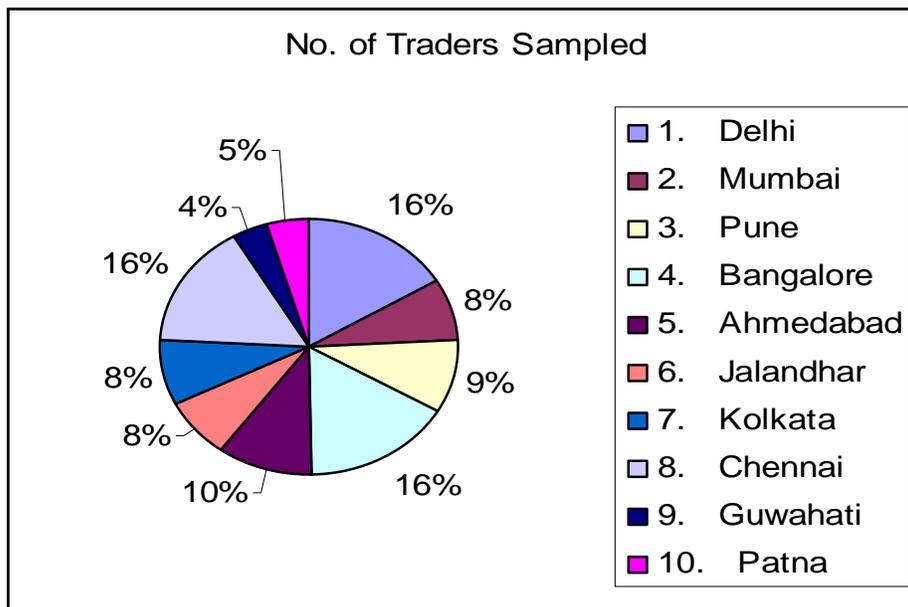


Fig: Distribution of the Sample used in the Study

Data Collection

The information was collected on the arrivals of fruits and vegetables and the existing system of waste management system. The study is based mainly on the primary data collected by conducting field survey of the APMCs in the Study areas. The

primary data was collected through structured questionnaires from Mandi Secretaries and Traders of the Sample APMCs. The study also utilizes the secondary data collected from Journals, books, reports and publications of various departments and websites of National and International organizations including Government Department.

Data Analysis:

The data collected was tabulated and analyzed for attainment of the study objectives. Descriptive statistical techniques like average, percentage, tabular and graphical was done to describe the information collected and draw inferences.

The results and conclusion were considered for making suitable recommendations.

Organization of the Report

- 1 Introduction
- 2 Research Methodology
- 3 Profile of the Major Sample Markets
- 4 Results and Discussion
- 5 Summary and Recommendations
- 6 Planning for Waste Management in APMCs

CHAPTER 3

PROFILE OF THE MAJOR SAMPLE MARKETS

1. APMC AZADPUR, DELHI - *Market of National Importance*

The 34 years have witnessed a memorable spell of all round progressive activities in the life of Delhi's World famous Fruit & Vegetable Market at Azadpur. The meaningful expansion with long awaited facilities, orderly management, fast pace of implementation, sustained efforts to enhance the credibility of the organization, and the participative administration to achieve desired objective have been possible by the commitment and team spirit of all concerned- the market committee, Officers, Officials, all traders and other market functionaries under the leadership and guidance of Delhi Agricultural Marketing Board.

Delhi Agricultural Produce marketing Regulation Act., 1976 was enacted and made effective in the Union Territory of Delhi from 5th of November 1976 for regulating the marketing of agricultural produce. Before the enactment of this Act the Fruit & Vegetable Market in Union Territory of Delhi was unregulated and it was mainly operating in the vicinity of Hindu Rao Hospital at Barafkhana near Ghantagarh . The first Marketing Committee under the Act was constituted vide notification dated 15.01.1977. Now repealed by new act namely Delhi Agricultural Marketing, Regulation Act, 1998

Azadpur Fruit & Vegetable Market i.e. Ch. Hira Singh Fruit & Vegetable Market, Azadpur has been declared as Market of National importance vide notification No.F-8/35/203/DAMB/MR/(i)83 dated the 7th January 2004. Section 27 of the Act previous Composition of the Marketing Committee for Market of National Importance.

Main Objectives of the Marketing Committee are Regulation of Marketing of Fruits & Vegetables. The purpose of regulation is to ensure orderly marketing to safe guard the interests of both producers/sellers & consumers by eliminating various mal-practices like under-weightment, short payment, delayed payments, unauthorized deductions and indulgence of too many intermediaries. The aim is to ensure economic, legal and infrastructural conditions conducive to competitive marketing.

The fruit and vegetable market at Azadpur spread over an area of 43.65 Acres was constructed by Delhi Development Authority in the year 1975-76 and the Old Vegetable Market was shifted from Barafkhana old Delhi to New Subzi Mandi Azadpur in 1976-77. The plots for Shops to Traders were allotted by the D.D.A. Initially the market was maintained by

DDA itself. DDA withdrew its maintenance staff w.e.f. 01.12.1979 and the market was handed over to APMC, Azadpur for maintenance and regulation. Subsequently about 33 Acres of more land was acquired to make a New Fruit Market contiguous to the existing New Subzi Mandi at Azadpur. Shahdara sub-yard was made a separate APMC in 1992 and Keshopur sub-yard was made a separate APMC in 2001. Okhla fruit and vegetable market was developed by DDA and handed over to APMC Azadpur as its sub-yard in 1987. Azadpur Railway Station has also been declared as a subsidiary yard of the principal market of Azadpur for fruits like banana, orange and mango etc. coming from southern states. There are 118 commodities notified for transaction in the market yards of APMC, Azadpur (i.e. 50 fruits items and 68 vegetables).

The rechristened Ch. Hira Singh Wholesale Fruit And Vegetable Market, Azadpur today is the biggest Fruit and Vegetable Market in the continent of Asia and perhaps ranks first in the world also in terms of arrival. This is the market of national importance as it has assumed the character of a National Distribution Center for important fruits like Apple, Banana, Orange, Mango etc. and vegetables like Potato, Onion, Garlic, Ginger etc. The Limica Book of world record also declared the Azadpur Market as a biggest distributing Centre of Fruit & Veg. in the world.

To decongest the present Market, there is a proposal to develop a Fruit & Veg. Market with all infrastructural facilities at Tikri Khampur (GT Karnal Road) Delhi. An area of 71 Acre of land has already been acquired there.

After a period of 30 years of APMC establishment, the entire office of APMC, has been shifted to a newly constructed office complex with all infrastructural facilities at New Fruit Market Ph-II Azadpur. A Farmers Guest House having about 40 air conditioned rooms has also been constructed by APMC, Azadpur in NFM, Ph-II to provide best facilities to the farmers.

The newly constructed Office Complex of APMC and Kissan Bhawan were inaugurated by Hon'ble Chief Minister of Delhi on 2nd Dec.'2006.

APMC, AZADPUR – AN OVER VIEW

1.	Establishment Year	:	1977
2.	Objectives	:	Regulation of Marketing of Fruits & Vegetables. The purpose of regulation is to ensure orderly marketing to safe guard the interests of both producers / sellers & consumers
3.	Name of the Principal Market yard	:	Ch. Hira Singh Wholesale Fruit & Vegetable Market Azadpur
4.	Name of the Sub-yards	:	1. Okhla Fruit & Vegetable Market 2. Kela-Siding Azadpur.
5.	Area of Market Yard / sub-yard	:	About 160 Acres (including Tikri Khampur premises and the Okhla sub-yard)
6.	Market Area	:	The Whole of Union Territory of Delhi excluding the Area of East of Yamuna River forming Market Area of APMC, Shahdara and also excluding Area from junction point of Daya Basti and Sarai Rohilla, Railway Stations along Railway track going to Rohtak upto Delhi/Haryana Border at Tikri Kalan and from there upto Rewari line Railway track near Bijwasan and then again along Rewari Railway line upto junction point at Daya Basti and Sarai Rohilla Railway Stations forming market area of APMC Keshopur.
7.	Act & Rules	:	The Delhi Agricultural Produce Marketing (Regulation) Act, 1998 (Delhi Act No. 7 of 1999) The Delhi Agricultural Produce Marketing (Regulation) General Rules 2000.

BASIC STATISTICS /INFORMATION:

SNo.	Descriptions		Azadpur Yard	Okhla Sub-yard
A	Area of New Subzi Mandi , NSM		43.65 Acres	9.98 Acres
B	Area of Cement Godown		3.50 Acres	-
C	Area of New Fruit Market, Sarai Pipal Thala		29.18 Acres	-
D	New Acquired Land at Khampur		70.62 Acres	-
E	No. of Big Shops		438	50
F	No. of Small Shops		928	218
G	Size of Big Shops		12'x53'	12'x53'
H	Size of Small Shops		10'x18'	12'x12'
I	Covered Auction Sheds	No.	Area	3 Nos.
	A Block NSM	1		1536 Sqm
	C Block NSM	1	3272 Sqm	832 Sqm
	Potato & Onion Shed	1	3272 Sqm	832 Sqm

Commodity	2006-07	2007-08	2008-09	2009-10	2010-11
APPLE	572605.5	849736.6	756086.2	633893.4	823770.3

	Grower Shed	1	6000 Sqm	
	Cement Godown Area	3	2900 Sqm	
	NFM Phase-II	7	7766 Sqm	
	NFM Phase-I	8	19618 Sqm	
	Total	22	29214 Sqm	3200 Sqm
			72042 Sqm	
J	Rate of Commission		6%	6%
K	Rate of Market Fee		1%	1%
L	No. of Notified Commodities	Fruits	50	50
	(All Fruit & Vegetables)	Vegetables	68	68
M	No. of Licenses- Commission Agents "B"		1977	198
	(upto 31.03.11) Wholesale Traders		1390	146
	"A"			
	Farmers I-Cards		129	Nil
N.	No. of Banks		6	2
O	Total No. of Employees		573	75
P	No. of Cold Storage in Azadpur Mandi		7	-

1. Arrival of last 5 Years (In Tonnes) (Including sub-yards)

Year	Fruit	Vegetable	Total
2006-2007	2156145.4	2122959.3	4279104.7
2007-2008	2428091.8	2138698.0	4566789.8
2008-2009	2265244.5	2162844.6	4428089.1
2009-2010	2041758.3	2179323.8	4221082.1
2010-2011	2292619.6	2239825.8	4532445.4

2. Arrival of 6 Major Commodities (In Tonnes)_(Including sub-yards)

BANANA	243501.4	215392.5	219544.7	156144.4	155017.7
MANGO	262289.7	260432.9	192388.6	179882.8	224255.0
POTATO	527758.4	533499.5	592115.0	519096.7	545664.6
ONION	421010.2	412474.9	406037.6	427014.6	400548.9
TOMATO	194291.9	213243.2	211416.3	209404.2	198690.9

Income/Expenditure of last 5 Years (In Lacs)

Year	Market Fee	Other Income	Total	Expenditure	Surplus
2006-2007	3855.732	2863.628	6719.360	5730.780	988.580
2007-2008	4308.046	3018.580	7326.626	4835.230	2491.396
2008-2009	4606.135	3161.633	7767.768	4403.508	3364.260
2009-2010	5523.233	3235.638	8758.871	4465.824	4293.047
2010-2011 (Unaudited)	6056.187	2266.212	8322.399	4724.300	3598.099

4. Contribution Paid to Delhi Agricultural Marketing Board

Year	Amount (In Lacs)
2006-2007	783.357
2007-2008	900.900
2008-2009	937.911
2009-2010	1127.045
2010-11 (Unaudited)	1224.023

5. Average Daily Arrival of Vehicles

Type of Vehicles	Loaded	Empty	Grand Total
Trucks	416	234	650
Tempo	835	1858	2693
Rehra/Rickshaws	59	1941	2000
Total	1310	4033	5343

Highlights of Achievements & Future Plans

1. 16 Nos. of water hut with Chillar Plants have been provided in the market.
2. A centrally Air conditioned office building having an Auditorium has been constructed.
3. A Kissan Bhawan with full infrastructural facilities has been constructed in the market yard.
4. Covered space for trading at NFM/Kela Siding have provided by way of extension of sheds.

5. DDA has approved the change of land use of 70.62 acres of land at Tikri Khampur. Efforts for developing fruits and vegetable market at Khampur are being made.
6. Committee has achieved more than its target of market fee fixed by Board i.e. Target fixed as Rs. 46.20 Crore but achieved Rs. 55.29 Crore (approx.) by APMC in the year 2009-10.
7. Safe and Clean Drinking Water- Water Trolleys being replaced by ultra modern water booths with online state of the art Chiller Plants with cold drinking water in summers. A new scheme of supply of drinking water of app. three lakh gallons per day through borewells also functioning properly.
8. Well-illuminated Market Yards with Highmasts and provision for round the clock power supply through Generator Sets.
9. Hygiene in the Market yard : Scientific and Mechanised Disposal of Garbage maintains the sanitation condition at the market yard.
10. The market committee has already provided toilets blocks & urinals for public use in every block of the market yard and one toilet block maintain by M/s Rohtash District Sulabh Sauchalya.
11. Auction Space- 68000 Sqmtr. of covered auction space provided and is being continuously monitored to provide the required auction space to all the commodities in their respective seasons is a challenge, being successfully met with the help of trading community.
12. Traffic Regulation- By regular monitoring of gates and periodical shuffling of entry of commodities from different gates of market, strict vigilance, control and enforcement by staff inside the market for nearly 5000 vehicles and more than one lakh persons entering the market per day.
13. Market Information Service – To safeguard the interest of growers, traders, buyers and consumers, the daily arrival and prices of fruit & Vegetables are being uploaded on Website by MIS Branch. MIS also providing the information to the different departments, agencies as and when required and also to various visitors. Prices of Seasonal & non-

14. Seasonal Fruits & Vegetables are being published in various Newspapers and displaying on T.V. Channels from time to time for the awareness of people.
15. Computerization -The system of issue of gate passes has been fully computerised on all the gates of principal yard and sub-yards of APMC, Azadpur. During the apple season the computerized Gate Passes are being issued by APMC since 2007 from Tikri Khampur check post. It is under process that all the branches of APMC, Azadpur be computerised. This would help in smooth functioning and speedy disposal of various issues.
16. Other Facilities - A dispensary, a dormitory, Sulabh Sauchalyas, toilet blocks, and STD Booths in the Market Yard.
17. Celebration of Independence Day :_Since 2008 the Independence Day of our country is being celebrated every year with full enthusiasm in the Auditorium of MNI Complex, APMC,Azadpur. Only the officials of APMC,Azadpur are participated in various cultural programme on the occasion of Independence Day of India .
18. Buyer-Seller Meet :
 - a. Buyer-Seller meets were organised by APMC, Azadpur jointly with National Institute of Agricultural Marketing, in Delhi. Another meet was organized in Himachal Pradesh under the Chairmanship of Hon'ble Development Minister, Govt. of Delhi. There was a tremendous response as triennial was established which have the growers, commission agents and the authorities to discuss and thrash out the teething problems relating to Agricultural Marketing. On the same lines, APMC, Azadpur authorities went to organize programs at Bajora & Kullu both in Himachal Pradesh to educate farmers about the pre-harvest and post-harvest techniques for their benefits. Welcoming response was received from the Himachal Pradesh authorities
 - i. Farmers are also educated to make the packing consumer friendly as well as eco-friendly, which shall yield remunerative prices to the farmers.

- b. Forward Linkage - The produce after its arrival at the level of commission agents/whole-sellers passes through various hands in the mechanical fashion in the form of re-packing etc. before it finally reaches the consumers. Since growers, commission agents/whole-sellers and consumers work in close coordination; it is always desired that consumer friendly packing should be done so that handling at various stages is avoided to increase shelf life and to maintain the quality of the product. Farmer will get employment opportunity in growing region and fetch more prices.

Other Major Works at Azadpur :-

1. The works of improvement of existing roads and re-habitation of RCC sheds in NSM, are in progress.
2. Remodeling of Dhallaao & Toilet block in Block C in NSM , Azadpur has been finalized and the work is in progress.
3. Computerization of APMC, Azadpur – is under process.

Electrical Wing :

1. 27 Nos, 20mtr high masts have been provided in Azadpur Market.
2. 6 Nos. of 13.5 mtr High Mast have been provided in Okhla Market also to illuminate the remaining portion of mandi additional 4 Nos. of High Mast is under process.
3. High Tension line and its distribution has been done at NFM Ph-I & II Azadpur also for POMA, Tomato and Gazar Shed Azadpur.
4. Provision of CC TV System is being under executing by the Central Govt. for NSM, Azadpur. They have also assured that such system shall be taken for NFM PH- I & II Azadpur in future. Therefore APMC, Azadpur has withdrawn their proposal.

Licence Branch
Category of Licences of Azadpur from 2001-06

Year 2001 to 2002:		
	AZADPUR	Sub-yard OKHLA
A. Cat.	1396	116
B.Cat.	1991	147
E. Cat.	1	Nil
D.Cat.	2	Nil
F.Cat.	1	Nil
G.Cat.	31	Nil
Year 2002 to 2003:		
A. Cat.	1491	141
B.Cat.	2197	183
E. Cat.	1	Nil
D.Cat.	2	Nil
F.Cat.	1	Nil
G.Cat.	31	Nil
Year 2003 to 2004:		
A. Cat.	1511	143
B.Cat.	2215	195
E. Cat.	1	Nil
D.Cat.	1	Nil
F.Cat.	1	Nil
G.Cat.	30	Nil
Year 2004 to 2005 :		
A. Cat.	1514	150
B.Cat.	2201	203
E. Cat.	1	Nil
D.Cat.	1	Nil
F.Cat.	1	Nil
G.Cat.	24	Nil
Year 2005 to 2006 :		
A. Cat.	1477	157
B.Cat.	2172	210
E. Cat.	Nil	Nil
F.Cat.	1	Nil
G.Cat.	23	Nil
Year 2006 to 2007 :		
A. Cat.	1550	153
B.Cat.	2132	205
I. Card.	125	Nil

E.Cat.	--	Nil
F.Cat.	--	Nil
G.Cat.	1	
Year 2007 to 2008 :		
A. Cat.	1468	145
B.Cat.	2121	201
I. Card.	125	Nil
E.Cat.	--	Nil
F.Cat.	--	Nil
G.Cat.	1	Nil
Year 2008 to 2009 :		
A. Cat.	1478	146
B.Cat.	2114	200
I. Card.	125	Nil
E.Cat.	--	Nil
F.Cat.	--	Nil
G.Cat.	1	Nil
Year 2009 to 2010 :		
A. Cat.	1479	145
B.Cat.	2065	200
I. Card.	129	Nil
E.Cat.	--	Nil
F.Cat.	--	Nil
G.Cat.	1	Nil
Year 2010 to 2011 :		
A. Cat.	1390	146
B.Cat.	1977	198
I. Card.	129	Nil
E.Cat.	--	Nil
F.Cat.	--	Nil
G.Cat.	1	Nil

MARKET CHARGES

Bye-laws No. 49 of Agricultural Produce Marketing Committee, Azadpur

Market Service Fee and Incidental Service Fee – 1 No functionary shall charge in any transaction an amount more than the maximum amount thereafter provided for his services actually rendered.

Part-I from Sellers:-

(1) Unloading Charges (Including Weighing Charges)

(a) Potato and Onion:	Rs.P.
Package up to 4 kg.	0.12

Package 15 to 30 kgs.	0.16
Package 31 to 65 kgs.	9.35
Package 66 kg onward	0.50

(b) Green Vegetable:

Package up to 14 kg.	0.12
Package 15 to 30 kgs.	0.20
Package 31 to 65 kg.	0.35
Package 66 kg onward	0.65

(c) Fruits:

	Package up to 14 kg.	0.12
	Package 15 to 20 kg.	0.16
	Package 21 kg.and above	0.25
II.	Full load from Rehra/Tonga	5.00
	Full load from Tempo	8.00
	Full load from 3 tonner Truck	15.00
	Full load from large Truck	60.00
	Full load from Wagon	70.00
	Full load from C.R.T.	80.00
	Full load from Box Wagon	140.00

(2). Charge pertaining to Postal/Telephone/Telegraphy/Actual Baradana/Sutli/Insutance/Godowns Rent/Packaging/Transport and Octroi etc.

(3). Commission on sale value of all varieties and kinds of fruit and Vegetables. 6.00%

The following rate of market incidentals and market service fee shall be charged from the purchasers of the produce. The market committee shall be competent to review these rates from time to time except the rates of market fees.

From Purchaser:		
(1) Market Fees		1% ad-valoras
(2) Loading charges(including weighing Charges)		
(a) Potato and Onion :		Rs.P.
Package up to 4 kg.		
Package 15 to 30 kgs.		0.12
Package 31 to 65 kgs.		0.16
Package 66 kg onward		0.35
		0.50
(b) Green Vegetables :		
Package up to 14 kg.		
Package 15 to 30 kgs.		0.12
Package 31 to 65 kg.		0.20
Package 66 kg onward		0.35
		0.65
(c) Fruits :		
Package up to 14 kg.		0.12
Package 15 to 20 kg.		0.16
Package 21 kg.and above		0.25
II.		
Full load from Rehra/Tonga		5.0
Full load from Tempo		8.00
Full load from 3 tonner Truck		15.00
Full load from large Truck		60.00
Full load from wagon		70.00
Full load from C.R.T.		80.00
Full load from Box Wagon		140.00

Transporting Charges: For movement

Rs.1.00 per 40 kg.of goods from

Market/Railway siding/Air Port to anywhere in

Delhi up to

a distance of 15 km.

Over 15 km.

Rs.1.50 Per 40 kg.

- (i) No functionary shall charge any other market incidentals market service fee/market charges except the ones mentioned above.
- (ii) Any functionary charging unauthorized market charges such as chungji, dami etc. shall be liable to be prosecuted in the court of law and suitable action will be taken by the market committee against him/them.
- (iii) In case no palledar is engaged by the grower/seller, no charge of unloading including weighing will be charged/will be deducted from the payable amount being given to a grower/seller by the commission agent.
- (iv) The following maximum rates of storage will be charged by the owners of cold storage-
 - (a) Stock of potato (i) Rs. 13.70 (including labour charges for full season from Oct to Jan.)
 - (b) Stock of Apple Rs. 1.00 per package of 8 kgs Rs. 1.60 per package of 16kg
 - (c) Stock of Orange Rs. 3.50 per month per pack

2. APMC MUMBAI

1. **Name of the market:** **Mumbai Agricultural Produce market Committee, Mumbai**
2. **Periodicity** (Daily/weekly / biweekly) : Daily
3. **No. of villages served** : Greater Mumbai, Thane Taluka and 30 Villages of Uran Taluka of Raigarh district
4. **Establishment year** : 1977
5. **Market Area** : 69.045 Hectares
6. **Composition of market authority:** Established under the provision of Maharashtra Agricultural Produce Marketing (Regulation) Act, 1963. It is a Body Corporate and Local Authority u/s 12 of the said Act. Main objective is to establish Market Yards, regulate marketing of agricultural commodities etc.
7. **Ownership of market:** Market Committee which consists of Elected Body comprising 26 no. of Members headed by Chairman.
8. **Operation & management** : Administration is headed by Additional Commissioner and Secretary on deputation from Government of Maharashtra.
9. **No. of markets functioning under Market authority** : 5 Market Yards on daily basis
10. **No. Of Market Functionaries:** 8725
- 11.. **No of Employees:** 785

15. Income & Expenditure for last 3 years (Rs. In Lakhs)

	2008-09	2009-10	2010-11
Annual Income	7131.78	7863.74	8430.10
Expenditure on admn/Establishment	2092.66	2609.25	3031.50
Expenditure on Waste disposal	302.88	389.33	265.55
Other expenditure	2191.93	2089.46	2722.45
Total Expenditure	4587.47	5088.04	6119.50

16. Shops, Amenities & Services available:

Name of the Market	Year of regulation	Year of shifting	Area in Hectares	No. of Galas	No. of Offices	Cost (in Crores)
Onion & Potato Market	1977	1981	7.92	243	Administrative Bldg.	4.06
Spices & condiments Market	1989	1991	19.26	660	272	28.32
Foodgrains & Pulses market	1989	1993	16.29	412	356	24.19
Fruit & Vegetables Market	1977	1996	17.19	1965	225	117.00
Additional Shop Cum Godown Complex	1989	1999	7.01	228	453	80.87
Additional Vegetables Market	1977	2009	1.37	285	-	22.00
Total:			69.045	3793	1306	276.44

City and Industrial Development Corporation of Maharashtra Ltd. has earmarked 122 hectares of land for development of market yards of agricultural commodities, from which CIDCO has handed over a land of about 69 hectares to Mumbai APMC on which 5 Wholesale Market Yards with 3788 shop cum godowns, 1591 office blocks, 4 Auction Halls, 2 Warehouses, 5 Central Facility Buildings, 2 Exporters Buildings etc. are developed by the Mumbai APMC.

17. **Amount spent on monthly/ weekly maintenance of the market** : Annually Rs.359.61 Lakhs

18 Infrastructure facilities available in the Market (enclose list with details)

Facilities: Central Facility Buildings, Guest House, Police Stations, Canteens, banks, Post Offices, Telex & Telephone Office, Dispensary, Electronic Telephone Exchange (EPABX), Farmers Rest House, Weighing Machines, Weighbridges, Sulabh Souchalaya, Ripening Chamber, Auction Halls, Common Warehouses, Cold Drinking Water Centres etc.

19. Total quantum of produce handled (in 2010-2011):

Rs. 39,61,668 M.T

20. Commodity wise Arrival for 3 years in Metric Tonnes

Commodities	2010-11	2009-10	2008-09
Fruits	492676	484824	522072
Vegetables	673864	674304	617441
Food Grains	1617798	1674652	1575408
Flowers	-	-	-
Others	1560269	1513757	1492587

Flower is not under regulation in Mumbai APMC

21. Hygiene in the Market yard

Mumbai APMC had outsourced day to day collection and disposal of garbage. Accordingly, market yards are cleaned and maintained on daily basis.

3. APMC PUNE

1. **Name of the market:** Pune Zilla Krishi Utpanna Bazaar Samiti, Pune
2. **Periodicity** (Daily/weekly / biweekly) : Daily
3. **No. of villages served** : 101
4. **Establishment year** : 1st May 1957
5. **Market Area** : 170 Acres
6. **Composition of market authority:** Local Body
7. **Ownership of market:** : Pune Zilla Krishi Utpanna Bazaar Samiti, Pune
8. **Operation & management** : According to the Maharashtra Agricultural Produce Marketing (Development and Regulation) Act 1963 and Rules 1967 and Byelaws of the Market Committee
9. **No. of markets functioning under Market authority** : 5 Market Yards on daily basis
10. **No. Of Market Functionaries:** 9920
- 11.. **No of Employees:** 297

15. Income & Expenditure for last 3 years (Rs. In Lakhs)

	2008-09	2009-10	2010-11
Annual Income	24,64,75,573	32,05,61,948	37,00,14,792
Expenditure on admn/Establishment	13,07,59,065	15,49,28,467	19,51,25,266
Expenditure on Waste disposal	59,79,387	67,26,840	86,60,334
Other expenditure	99,05,000	1,28,05,350	1,26,62,336
Total Expenditure	14,66,43,452	17,44,60,657	21,64,47,936

16. Shops, Amenities & Services available:

- 24 hours water supply, general security
- Allotment of Plots/Gala to trader on long lease
- Plots were allotted to warehouses, cold storages, urban banks, Nationalised Banks, Cooperative Institution etc
- There is a lodging facility available for the farmers by paying nominal charges Rs. 5/- per day (Shetkari Nivas)
- Two weigh bridges having capacity of 50 MT and 20 MT
- More than 1500 commission agents have been allotted shops and Galas on lease
- Separate Market for perishable commodities i.e. Banana market, fruits Market, Vegetable, Onions and Potato Market, Flower Market and Retail Market.

17. **Amount spent on monthly/ weekly maintenance of the market** : Monthly 18 Lakhs (approx)

18 Infrastructure facilities available in the Market (enclose list with details)

Water, Roads, electricity, Security

19. Total quantum of produce handled (in 2010-2011): Rs. 18071156 Quintals

20. Commodity wise Arrival for 3 years in Metric Tonnes

Commodities	2010-11	2009-10	2008-09
Fruits	106189.3	101758.4	81174.1
Vegetables	910589.5	727681.5	813612.5
Food Grains	421216	376876.1	377864.3
Flowers	28820.3	17311.2	14745.2

21. Hygiene in the Market yard: In house staff maintains daily cleaning and hygienic services.

4. APMC BANGALORE

Name of the Market	Agricultural Produce Market Committee, Bangalore
Year of establishment	1955
Population Served	76278
Geographical area served by Market (No. of Villages etc.)	728

Regulated/Unregulated	Regulated	
Year of Regulation	1955	
Name of the Market Legislation	KAPM (R& D) ACT 1966	
Whether Elected/Nominated/Superseded APMC	Elected	
If Unregulated, Name of Owner and Management		
Details of Staff:	Supervisory	Administrative
Permanent	30	51
Temporary	0	0
Market holidays	SUNDAY	
Market hours	9 to 6	

Market Area

(i)	Notified area of Market Committee	Bengaluru, North, South, East and Anekal
(ii)	Sub yard (If any) and It's exact location	K.R.Puram, Jigani, Chandrapura, Anekal,
(iii)	Number of Cold Storages available	2
(iv)	Capacity of Cold Storages available	1200 M.T & 2000 MT
(v)	Number of Commodities notified under regulation	112
(vi)	Average daily dispatches to outside markets during the season	70-85%
(viii)	Average daily dispatches to outside markets during the peak period	80-85%
(viii)	Names of traditional markets(important) to which produce is sent	Mysore, Poona, Gujarat, & Major Cities In Karnataka & Outside State.

Arrivals

Daily arrivals in Metric Tonnes throughout season of all commodities:

S.No	Name Of Commodity	Average Daily Arrivals	Maximum Daily Arrivals	Minimum Daily Arrivals
1.	Onion	2601	8109	1686
2.	Coconut(1000 Nos)	78	243	63
3.	Toordal	181	695	77
4.	Ragi	30	264	2
5.	Potato	823	2316	23
6.	Wheat	76	378	4
7.	Maize	41	156	7
8.	Garlic	129	427	3
9.	Rice	1346	5442	410
10.	Dry Chillies	18	114	5

Commodity wise Arrival for 3 years in Metric Tonnes

Commodities	2010-11	2009-10	2008-09
Onion	577537	539261	561687
Coconut(1000 Nos)	21103	28271	32126
Toordal	50757	38255	45859
Ragi	10229	9155	10164
Potato	255984	220128	272093
Wheat	22886	22351	25191
Maize	10314	6036	9070
Garlic	30876	38172	40551
Rice	577537	539261	561687
Dry Chillies	21103	28271	32126

Market Functionaries

Name	Number	License Fee	Number Of Years
Commission Agents	1406	2000	10
Exporters	1140	1000	10
Crushers	0	1000	10
Weighmen	0	10	1
Retail Traders	820	250	10
Traders	1689	2000	10
Processors	182	1000	10
Hamals	0	10	1
Stockist	192	1000	10
Importers	1291	1000	10

Time at which sale begins in the market	9 AM
Peak trading hours	9 AM TO 6 PM
Time at which sale ends in the market	6 PM
Whether produce is cleaned/graded before sale	Yes
Accepted grade in the market	GENERAL
Farmer level grading in practice	Yes
Are there quality disputes?	No
How are quality disputes settled?	Mutual Understanding OR Through APMC

Transactional Methods

System of sale(if different for commodities please clarify)	Open Auction: Onion & Potato/ Garlic By Mutual Negotiation Rest of Commodities by Sale
System of weighment	Electronic Machine
System of payment	Cash
Degree of transparency on method of Sale, Weighment and Payment	100%
Transactional Disputes and Redressal Mechanism	APMCs Arbitrators dispute committee

Transportation

(i) Modes of transport generally adopted for the market	Lorries & Auto
(ii) Modes of transport for despatches to various stations	AUTO, LORRIES
(iii) Modal Mix% Mode Wise	50-50

Storage

(i) Storage facilities available in the market with trade as well as APMC	Yes
(ii) Availability of Ripening Chambers if available	Nil

Facilities and Services

Information Notice Board/Electric Display Board, Public Address System, Canteen, Toilets, Internal Roads, Parking, Post Office, Input/Sundry Shops, Fire Extinguishers Bank, Fencing, Rest house for farmers, Drinking Water, Electricity, Auction Platform, Grading and Analysing Laboratory, Mechanical Graders, Sieves, Garbage Disposal System, Sweeping Facilities, Information Unit, Extension Unit, Audio Visual side, Market office building, Welfare scheme for producers.

Market Charges	
-Commission	2%
-Market Fee	1.5% /Onion and potato 1%
-Weighment	Rs.3.70/Quntal /Each 50 Kgs Rs. 2.30
-Brokerage	0
-Charity	0
-Trade Allowance	0
-Octroi	0
-Sales Tax	As applicable
-Other Taxes/Levies	0
-Other Charges	Nil

Financial Position	
Annual Income	285190371
Annual Expenditure	136393693
Surplus/Deficit	148796678
Total Reserves with APMC on 31st March	148796678
Total Liabilities(loan etc.)with APMC on 31st March	181975878

APMC Ahmedabad

City	AHMEDABAD		
Full Postal Address	Sardar patel market o/s.Jamalpur Gate, Jamalpur, Ahmedabad.		
Year of establishment	1948		
Geographical area served by Market (No. of Villages etc.)	97		
Regulation	Regulated		
Year of Regulation	1948		
Name of the Market Legislation	GUJARAT AGRICULTURAL PRODUCE MARKETS ACT, 1963		
Whether Elected/Nominated/Superseded APMC	Nominated		
Details of Staff:	Supervisory	Administrative	
Permanent	9	15	
Temporary	0	0	
Market holidays	Sunday and Govt. holidays		
Market hours	12		

Market Area

Notified area of Market Committee	City with corp.limit and Dascroi taluka
Subyard (If any) and It's exact location	Vasna, Naroda, Jamalpur, Jetalpur
Commodity Wise Processing Units in the Market area	not applicable
Number of Cold Storages available	0
Capacity of Cold Storages available	N.A.
Number of Commodities notified under regulation	110
Average daily dispatches to outside markets during the season	14000
Average daily dispatches to outside markets during the peak period	8000
Names of traditional markets(important) to which produce is sent	Baroda, Mumbai, Delhi, Jaipur, Surat, Rajkot, Bhavnagar,

Arrivals

Daily arrivals in Metric Tonnes throughout season of all commodities:

S.No	Name Of Commodity	Average Daily Arrivals	Maximum Daily Arrivals	Minimum Daily Arrivals
1.	POTATO	430	500	150
2.	ONION	420	550	150
3.	CABBAGE	112	179	58
4.	PEAS GREEN	54	188	2
5.	CHILLIES GREEN	141	140	94
6.	TOMETO RED	360	422	290
7.	BRINJAL	28	29	8
8.	CAULIFLOWER	120	159	20
9.	MANGO	188	977	105
10.	APPLE	87	285	10

Year	Total Arrival of commodities in tons
2010-11	753624.6 tons
2009-10	768512 tons

Market Functionaries

Name	Number	License Fee	Number Of Years
General Commission Agent	373	200	1
A- Class Traders	247	125	1

Time at which sale begins in the market	6.00 am
Peak trading hours	8
Time at which sale ends in the market	2.00 pm
Whether produce is cleaned/graded before sale	No
Farmer level grading in practice	Yes
Are there quality disputes?	No

Transactional Methods

System of sale(if different for commodities please clarify)	Open Auction
System of weightment	metric
System of payment	cash
Degree of transparency on method of Sale,Weightment and Payment	
Transactional Disputes and Redressal Mechanism	

Transportation

Modes of transport generally adopted for the market	Motor Vehicles
Modes of transport for despatches to various stations	Motor Vehicles

Storage

Storage facilities available in the market with trade as well as APMC	Nil
Availability of Ripening Chambers if available	Nil

Facilities and Services

Information Notice Board/Electric Display Board, Canteen, Toilets, Internal Roads, Parking, Input/Sundry Shops, Fire Extinguishers Bank, Fencing, Rest house for farmers, Drinking Water, Electricity, Auction Platform, Garbage Disposal System, Sweeping Facilities, Information Unit, Extension Unit, Market office building, Welfare scheme for producers.

Market Charges

Commission	6 %
Market Fee	0.50 paise per Rs.100
Weighment	Re.1.00 to 2.50
Brokerage	
Charity	
Trade Allowance	
Octroi	
Sales Tax	
Other Taxes/Levies	
Other Charges	all the charges are payable by the purchaser

Financial Position	
Annual Income	39962512
Annual Expenditure	23366455
Surplus/Deficit	16596057
Total Reserves with APMC on 31st March	217300836
Total Liabilities (loan etc.)with APMC on 31st March	2803651

APMC JALANDHAR

1. Name of the market : New Sabzi Mandi, Jalandhar
2. Periodicity (Daily/weekly / biweekly) Daily
3. No. of villages served : 173
4. Establishment year: 1995
5. Market Area New Sabzi mandi, Maqsusan, Jalandhar
8. Internet access: YES
9. Composition of market authority:
10. Ownership of market: Punjab Mandi Board
11. Operation & management: Market Committee, Jalandhar City
12. No. of markets functioning under market authority:
Weekly () Daily (1) Retail () F & V (1)
13. No. Of Market Functionaries 375
14. No of Employees: 53
 - i) Administrative 1
 - ii) Technical
 - iii) Supervisory 29
15. Income & Expenditure for last 3 years

	2008-09	2009-10	2010-11
Annual Income	6,39,61,221-00	7,90,60,885-00	8,99,12,482-00
Expenditure on admn/Establishment	1,55,67,019-00	1,81,85,772-00	2,44,05,321-00
Other expenditure	4,57,93,117-00	5,87,96,562-00	6,03,71,124-00
Total Expenditure	6,13,60,136-00	7,69,82,334-00	8,47,76,445-00

16. Shops, Amenities & Services available:

114 Shops, 100 Booths,

Services of Water, Electricity, Sewerage Available

17. Amount spent on monthly/ weekly maintenance of the market:

Annual Maintenance Of Rs. 15-00 Lakh(appx)

18 Infrastructure facilities available in the Market (enclose list with details)

Shops, Booths, Internal Roads, Auction

Platforms, Cover shed

19. Total quantum of produce handled Appx. 25 Lac Quintal Annually

20. Arrival and dispatch pattern for 3 years (in quintals)

Commodities	2010-11		2009-10		2008-09	
	Arrival	Dispatch	Arrival	Dispatch	Arrival	Dispatch
Fruits	795098	780000	713232	699110	786127	770404
Vegetables	1642838	1610000	1546135	1515520	1602862	1570800

APMC GUWAHATI

Name of the Market	Regulated Market Committee, Guwahati
Year of establishment	1986
Population Served	2891
Geographical area served by Market (No. of Villages etc.)	123

Regulation	Regulated
Year of Regulation	1977
Name of the Market Legislation	AAPM Act, 1972
Whether Elected/Nominated/Superseded APMC	Nominated

Details of Staff:	Supervisory	Administrative
Permanent	148	0
Temporary	30	0
Market holidays	N/A	
Market hours	12	

Market Area

Notified area of Market Committee	Entire Guwahati Sub-division
Subyard (If any) and It's exact location	Boko, Nagarbera, Hahim, Maloibari, Singimari
Number of Cold Storages available	2
Capacity of Cold Storages available	2500 MT
Number of Commodities notified under regulation	92
Names of traditional markets(important) to which produce is sent	Boko, Bijaynagar, Nagarbera, Hahim, Ramdia, Hajo

Arrivals

Daily arrivals in Metric Tonnes throughout season of all commodities:

S.No	Name Of Commodity	Average Daily Arrivals	Maximum Daily Arrivals	Minimum Daily Arrivals
11.	Wheat	30	40	35
12.	Peas	10	15	15
13.	Jute	80	90	85
14.	Rice	450	475	450
15.	Potato	150	170	150
16.	Onion	120	140	130
17.	Chilly	2	3	2
18.	Black gram	10	15	10
19.	Green gram	25	35	30
20.	M. Oil	35	55	40

Time at which sale begins in the market	7 AM
Peak trading hours	12 Hours
Time at which sale ends in the market	7 PM
Whether produce is cleaned/graded before sale	Yes
Accepted grade in the market	
Farmer level grading in practice	Yes
Are there quality disputes?	No
How are quality disputes settled?	Does Not Arise

Transactional Methods

(i) System of sale(if different for commodities please clarify)	
(ii) System of weighment	Metric System
(iii) System of payment	Cash
(iv) Degree of transparency on method of Sale, Weighment and Payment	100%
(v) Transactional Disputes and Redressal Mechanism	No dispute

Transportation

Modes of transport generally adopted for the market	Truck, Bullock Carts, Thela, Three Wheelers etc
Modes of transport for despatches to various stations	By Truck
Modal Mix% Mode Wise	

Storage

(i)	Storage facilities available in the market with trade as well as APMC	Yes
(ii)	Availability of Ripening Chambers if available	Nil

Facilities and Services

Information Notice Board/Electric Display Board, Public Address System, Toilets, Internal Roads, Parking, Input/Sundry Shops, Fencing, Drinking Water, Electricity, Auction Platform, Sweeping Facilities, Information Unit, Market office building, Welfare scheme for producers.

Market Charges

Commission	No
Market Fee	1%
Weighment	Yes
Brokerage	No
Charity	No
Trade Allowance	No
Octroi	Nil
Sales Tax	Yes
Other Taxes/Levies	Yes
Other Charges	Nil

APMC KANPUR

- Name of the market :- **A.P.M.C., KANPUR**
2. Periodicity (Daily/weekly / biweekly) :- **Daily**
3. No. of villages served :- **Only A.P.M.C**
4. Establishment year :- **1972**
5. Market Area : (1) Nagar Maha Palika Kanpur
(2) Vikaskhand Sarwankhera
(3) Vikaskhand Kalyanpur
(4) Bidhanu
(5) Sarsoul
6. Internet access :- **Yes**
7. Composition of market authority :- **(1) Secretary (2)**

Chairman

8. Ownership of market :- **Mandi Samiti**
9. Operation & management :- **Mandi Samiti**
10. No. of markets functioning under market authority: **Daily (√)**
Weekly () **Daily (√)** Retail () F & V ()
11. No. Of Market Functionaries :- **Two**
12. No of Employees :- **105**
- i) Administrative :- **01**
- ii) Technical :- **01**
- iii) Supervisory :- **No**

13. Income & Expenditure for last 3 years

	2008-09	2009-10	2010-11
Annual Income	278570412=42	324330116=09	332141778=09
Expenditure on admn/Establishment	17892527=00	18459804=00	33858352=00
Expenditure on Waste disposal	805544=00	1183842=00	189692=00
Other expenditure	202082900=25	292067793=41	277369836=56
Total Expenditure	280780971=25	311711439=41	313124280=56

14. Shops, Amenities & Services available:- **Yes**
15. Amount spent on monthly/ weekly maintenance of the market:- **Monthly**

16 Infrastructure facilities available in the Market (enclose list with details) :-
(1) Office (3) Bank (3) Shops (4) Auction Platform (5) Veterinary Hospital.

17. Total quantum of produce handled:- **Produce handled by Trader's**

19. Arrival pattern for 3 years (in quintals)

Commodities	2010-11	2009-10	2008-09
Fruits	1209449	1342066	1372995
Vegetables	9679079	978107	10061122
Food Grains	4136324	2117097	3114930
Flowers	258	249	587
Others	9142858	8723655	5673975

CHAPTER 4

RESULTS AND DISCUSSION

The major challenge in Agricultural marketing in India is to ensure remunerative prices to the farmers for their produce. As against a production of 180 million mt a year of fruits, vegetables and perishables, India has a capacity of storing only 23.6 million mt in 5,386 cold storages across the country, of which, 80 per cent is used only for potatoes (DIPP paper on Foreign Direct Investment (FDI) in retail). According to industry estimates, 25 to 30 per cent of fruits and vegetables and five to seven per cent of food grains in India get wasted. Indian farmers realize only one third of the total price paid by the final consumer. India's current supply chain does not permit the smooth and reliable functioning of a state of the art retailing practice. Also, high demand and supply fluctuations, lack of back end infrastructure, post harvest management, infrastructure and technology also lead to a high wastage of 30-40% in high value perishables commodities like fruits and vegetables.

The issue of food losses is of high importance in the efforts to combat hunger, raise income, provide food security, ensure food quality and safety which all contribute to the economic development of a Nation. The exact causes of food losses vary throughout the world and are very much dependent on the specific conditions and local situation in a given country. In broad terms, food losses are influenced by crop production choices and patterns, internal infrastructure and capacity, marketing chains and channels for distribution, and consumer purchasing and food use practices. Irrespective of the development status of the Country, every possible measure should be taken to keep food losses to minimum.

Food losses represent a waste of resources used in production such as land, water, energy and inputs. Producing food that will not be consumed leads to loss

of economic value of the food produced. Economically avoidable food losses have a direct and negative impact on the income of both farmers and consumers. Hence emphasis should be given to the quantum of food wastes and measures to bring down the food loss. Special focus is required to combat the food supply chain losses which are quite substantial and significant.

AGRICULTURAL WASTES IN THE FOOD SUPPLY CHAIN:

Agricultural/ Food waste or loss refers to the decrease in edible food product throughout the part of the supply chain and hence unavailable for human consumption. Food losses take place at production, marketing, post harvest and processing stages in the food supply chain (Parfitt *et al.*, 2010). Food losses occurring at the end of the food chain (retail and final consumption) are called “food waste”, which relates to retailers’ and consumers’ behavior. (Parfitt *et al.*, 2010).

Loss of agricultural crops in the Food supply Chain occurs as follows:

Agricultural production: losses due to mechanical damage and/or spillage during harvest operation (e.g. threshing or fruit picking), crops sorted out post harvest, etc.

Post harvest handling and storage: including losses due to spillage and degradation during handling, storage and transportation between farm and distribution.

Marketing: including losses and waste in the market system, at e.g. wholesale markets, supermarkets, retailers and wet markets.

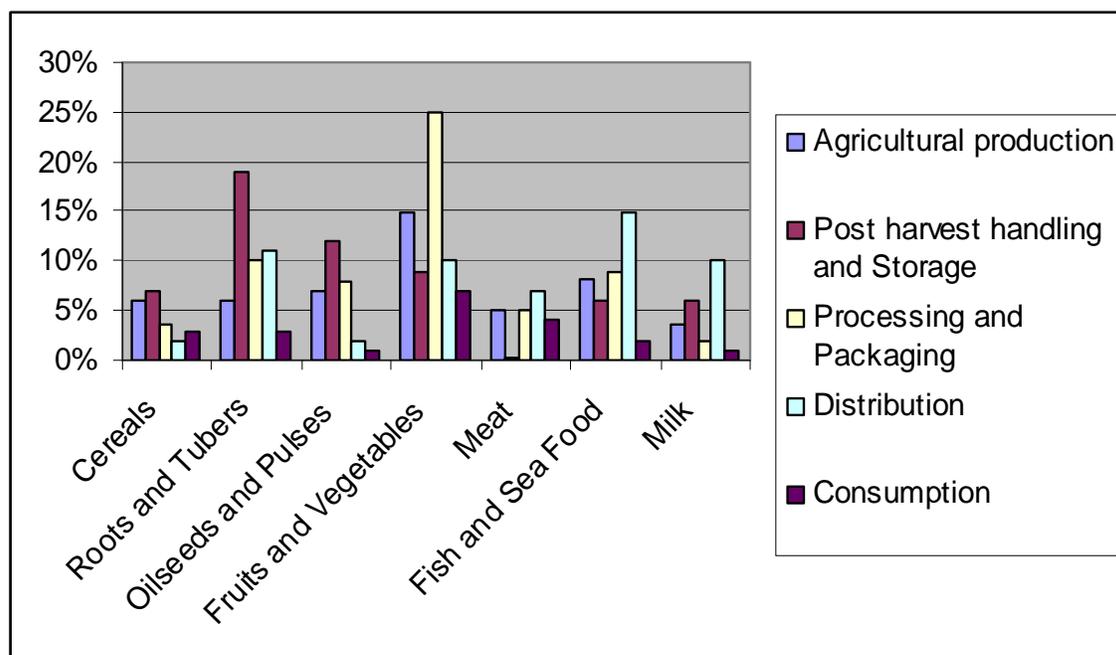
Processing: including losses due to spillage and degradation during industrial or domestic processing, e.g. juice production, canning and bread baking. Losses may occur when crops are sorted out if not suitable to process or during washing, peeling, slicing and boiling or during process interruptions and accidental spillage.

Consumption: including losses and waste during consumption at the household level.

Estimated/assumed waste percentages for each commodity group in each step of the FSC for South & Southeast Asia.

Commodity	Agricultural production	Post harvest handling and Storage	Processing and Packaging	Distribution	Consumption
Cereals	6 %	7%	3.5%	2%	3%
Roots and Tubers	6%	19%	10%	11%	3%
Oilseeds and Pulses	7%	12%	8%	2%	1%
Fruits and Vegetables	15%	9%	25%	10%	7%
Meat	5.1%	0.3%	5%	7%	4%
Fish and Sea Food	8.2%	6%	9%	15%	2%
Milk	3.5%	6%	2%	10%	1%

Source: 'Global Food Losses and Food Waste: Extent, Causes and Prevention', FAO, 2011



In developing countries 40% of losses occur at post-harvest and processing levels while in industrialized countries more than 40% of losses happen at retail and consumer levels.” (FAO Report, May 2011) Until now, India’s Ministry of

Food Processing Industry, Ministry of Commerce (Department of Industrial Policy and Promotion), Ministry of Agriculture and our National Agricultural Research System have asserted that it is encouraging investment in the retail 'back end' (collection, cold storage, logistics, warehousing, modern markets, etc), which will substantially reduce post-harvest food waste/loss, help farmers earn more and help control food inflation. The FAO study has provided some useful data to illustrate the global nature of food loss and waste. The study has shown that the per capita food loss in Europe and North-America is 280-300 kg per year. In Sub-Saharan Africa and South and Southeast Asia it is 120-170 kg per year. The total per capita production of edible parts of food for human consumption is, in Europe and North-America, about 900 kg per year and, in sub-Saharan Africa and South and Southeast Asia, 460 kg per year. Per capita food wasted by consumers in Europe and North-America is 95-115 kg per year, while this figure in sub-Saharan Africa and South and Southeast Asia is 6-11 kg per year. Food waste at consumer level in industrialized countries (222 million tons) is almost as high as the total net food production in sub-Saharan Africa (230 million tons). The difference between food waste in the North and in the South, if taken as averages and mapped to populations and their food wasting habits, then for Bangladesh in 2011 we have a total zwastage of 1.275 million tons!



Agricultural markets for fresh fruits and vegetables in India are experiencing immense challenge in marketing and distribution of these commodities due to lack of adequate infrastructure and post harvest management resulting in huge wastage. Large cities experience problems in their market



facilities where perishable fruits and vegetable³ are distributed each morning. The problems common to large cities can be classified as follows:

(1) **Urban-related**, such as severe traffic congestion near the marketplaces, large amounts of waste products rapidly filling landfills (garbage disposal problems), operating costs that exceed market revenues and dilapidated appearance as well as strong odors creating a bad public image;



(2) **Trading-related**, such as periodic substantial spoilage and loss of revenue for traders because of market gluts, high marketing costs as a result of non-competitive trading practices, and multiple layers of traders; and



(3) **Facility/management-related**, such as commodity losses or damage during unloading and unloading because of insufficient space, poor layout, improper handling and packaging practices, lack of adequate shelter from rain and sunlight, inefficient management practices including little arbitration for disputes, reduced earnings of traders within markets as a result of part-time traders selling at reduced prices outside the facility, and insufficient cold storage space.





APMC in Bangalore



APMC Jalandhar

Recent trends noted in the Marketing system include:

- Stronger preference for high-quality traits in terms of new flavors, freshness, consistent size, improved packaging, and spotless appearance;
- Demand as a result of trading patterns -for more choices than have historically been available;
- Concern about food safety and packaging because of growing apprehension about the negative health effects resulting from excess pesticide residues; and
- Stronger emphasis on environmental issues including recycling of packaging material and proper disposal of urban wastes.
-

Agricultural marketing specialists have developed conceptual frameworks to gain greater insights into trends in marketing fresh produce. The initial concept is useful for understanding the basics of food marketing based on a large number of producers serving the food needs of many consumers. A second concept concerns the efficient movement of commodities from distant production areas to large urban markets through wholesaling.

The actual location where wholesaling of perishable commodities occurs in an urban center is also important. For example, wholesaling might be concentrated within a large, well-organized wholesale marketplace or within several scattered individual shops throughout an urban area. A smaller number of wholesale marketplaces has the advantage of scaled economies in terms of a greater number of transactions, garbage removal, efficient breaking of bulk of large shipments, and better access to market information.

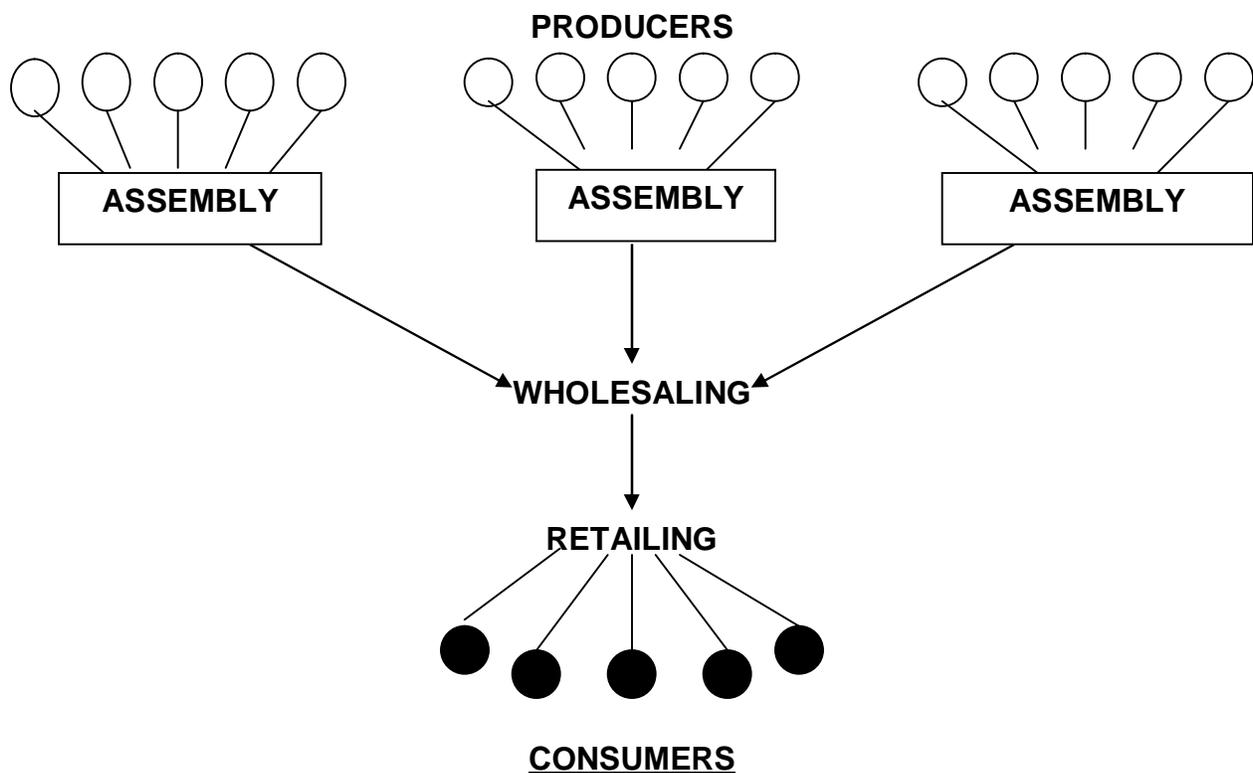
At the retail level, large numbers of vendors still sell fresh fruits and vegetables to consumers from small stands and carts throughout Asian cities. These retailers,

as well as their clients, depend on the performance of the urban wholesale markets.

Key points include:

- (1) demand-driven systems -consumer preferences;
- (2) duality of prominent channels servicing foreign versus domestic consumers;
- (3) demand implications based on the dual major forms possible in terms of processed products versus fresh commodities; and
- (4) pivotal position of urban wholesale marketplaces in demand areas relative to alternative types of consumers, channels, and forms.

ILLUSTRATIVE FUNCTIONS OF AN AGRICULTURAL MARKETING SYSTEM



At every step, there is a substantial lot of waste generated. Effective measures need to be taken to reduce the generation of wastes at each step and also reuse or manage the wastes generated.

Arrival of Fruits and Vegetables in Selected APMCs of India (in Tonnes)

Name of the APMC	2010-11		2009-10		2008-09	
	Fruits	Vegetables	Fruits	Vegetables	Fruits	Vegetables
Azadpur Mandi	2292619.6	2239825.8	2041758.3	2179323.8	2265244.5	2162844.6
Mumbai	492676	673864	484824	674304	522072	617441
Pune	106189.3	910589.5	101758.4	727681.5	81174.1	813612.5
Jalandhar	79509.8	164283.8	71323.2	154613.5	78612.7	160286.2
Kanpur	120944.9	967907.9	134206.6	978107	137299.5	1006112.2

Source: Data collected from Market Committee

Arrival of food grains in selected APMCs

Name of the APMC	2010-11	2009-10	2008-09
Najafgarh APMC (New grain market) New Delhi	911733	979296	1347033
Narela APMC (New grain Market) , New Delhi	6405104	6582286	4877917
Mumbai APMCs	1617798	1674652	1575408
Pune APMCs	421216	376876.1	377864.3
Kanpur APMC	413632.4	211709.7	311493.0

Source: Data collected from Market Committee

Total Agricultural waste generated commodity wise (in Tons) in the Selected APMCs in 2010-11

Commodities	Agricultural Waste Generated				
	Mumbai APMC	Pune APMC	Azadpur, New Delhi	Kanpur APMC	Jalandhar APMC
Fruits	8235	1410		20561	1509
Vegetables	7162	16470		106469	3283
Food Grains	1145	630		413.6	
Flowers		945			
Others	2207				
Total waste generated	18749	19455	36,500 to 45, 625 (100-125 tons daily as per data available)	127443.6	4792

Source: Data collected from Market Committee

Total Arrival versus total wastes generated

Fruits and vegetables

Name of the APMC	Total Arrival	Total Waste generated in F&V	Percent Waste Generated in F & V
Azadpur Mandi	4532445.4	45, 625	1 %
Mumbai APMC	1166540	15397	1.31%
Pune APMC	1016778.8	17880	1.75%
Jalandhar	243793.6	4792	1.96%
Kanpur	1088852.8	127030	11.6%

Source: Data collected from Market Committee

Total Arrival versus total wastes generated

Food Grains

Name of the APMC	Total Arrival	Total Wastes Generated	Percent waste Generated
Najafgarh APMC (New grain market) New Delhi	911733	880	0.09%
Narela APMC (New grain Market) , New Delhi	6405104	-	-
Mumbai APMCs	1617798	1145	0.07%
Pune APMCs	421216	630	0.14%
Kanpur APMC	413632.4	413.6	0.09 %

Source: Data collected from Market Committee

Total Arrival Vs Waste Generated at Trader's level

Name of the APMC	FRUITS		VEGETABLES	
	Total Arrival (in tons)	Percent waste Generated (in %)	Total Arrival (in tons)	Percent waste Generated (in %)
Jalandhar	13422	2.6	44974	3.15
Patna	47000	11.42	33660	8.18
Guwahati	22127.7	4.08	47558	13.3
Kolkata	51758	8.25	109730	12.6
Ahmedabad	-	-	195560	4.03
Pune	180580	3.61	127400	4.63
Delhi	135600	4.41	186680	4.0
Bangalore	132480	4.8	206970	3.24
Chennai	157212	5.66	433209.6	2.53
Mumbai	44900	3.41	197260	2.85
Kanpur	184490	3.88	159990	12.5

Source: Primary data collected from traders of selected APMCs

It was found that a huge quantum of fresh fruits and vegetables arrive and transacted daily in these Markets. As per traders survey, waste generated in fruits range from 2.6% to as high as 11.4 %. Wastage in Vegetables ranged from 3.15% to 12.6%. Markets like Azadpur generate approximately 4% wastages of both fruits and Vegetables.

Percent wastage reported by the Market Committee is comparatively quite low as against traders survey. This clearly indicates that a huge amount of food commodity wasted goes unreported. This also account for the lack of statistics and data on the quantum of food waste actually generated.

Mode of Waste disposal

Waste disposal	Mumbai APMC	Pune APMC	Azadpur, New Delhi	Jalandhar APMC	Kanpur APMC
Garbage	18749 tons	194550 tons	36,500 to 45, 625 tons (100-125 tons daily as per data available)	4792 tons	Nil
Feed	Nil	Nil	Nil	Nil	Nil
Fuel	Nil	Nil	Nil	Nil	Nil
Compost	Nil	Nil	Nil	Nil	Nil
Earth filling	Nil	Nil	Nil	Nil	127443.6 tons
Recycling/Reuse	Nil	Nil	Nil	Nil	Nil
Others (pl specify)	Nil	Nil	Nil	Nil	Nil

Source: Data collected from Market Committee

The total wastes generated are disposed mostly in the form of garbage or as earth filling. Hence the entire volume of food waste is unutilized and results in food loss and hence economic loss.

AGRICULTURAL WASTE MANAGEMENT SYSTEM

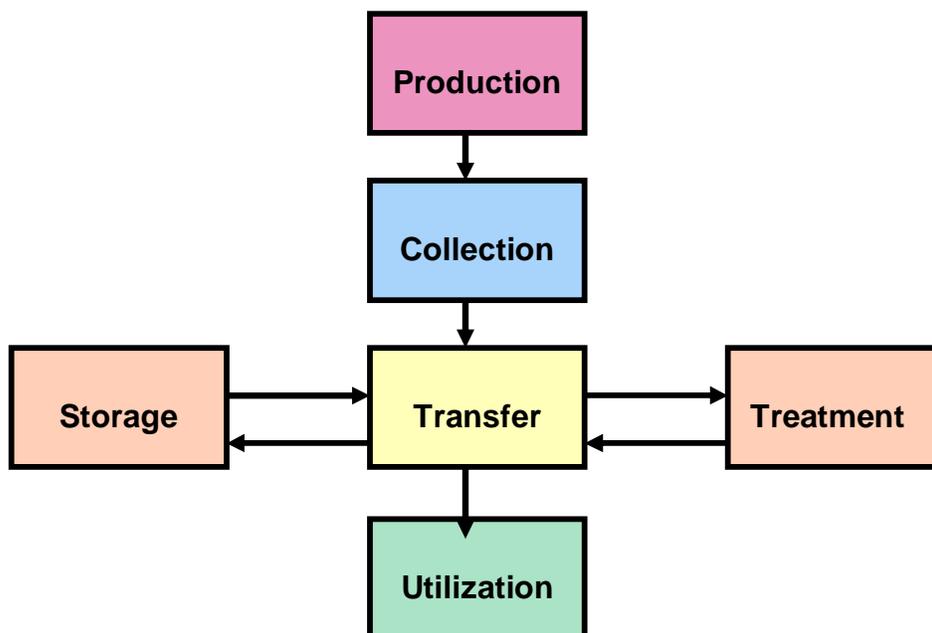
An agricultural waste management system (AWMS) is a planned system in which all necessary components are installed and managed to control and use byproducts of agricultural production in a manner that sustains or enhances the quality of air, water, soil, plant, and animal resources. In short, it is the management of all the waste, all the time, all the way.

Waste management functions

An agricultural waste management system consists of six basic functions:

- Production
- Collection
- Storage
- Treatment
- Transfer
- Utilization

For a specific system these functions may be combined, repeated, eliminated, or arranged as necessary.



(a) Production

Production is the function of the amount and nature of agricultural waste generated by an agricultural enterprise. The waste requires management if quantities produced are sufficient enough to become a resource concern. A complete analysis of production includes the kind, consistency, volume, location, and timing of the waste produced. The waste management system may need to accommodate seasonal variations in the rate of production. The production of unnecessary waste should be kept to a minimum. For example, a large part of the waste associated with many livestock operations includes contaminated runoff from open holding areas.

The runoff can be reduced by restricting the size of open holding areas, roofing part of the holding area, and installing gutters and diversions to direct uncontaminated water away from the waste. A proverb to remember is, "Keep the clean water clean." Leaking watering facilities and spilled feed contribute to the production of waste. These problems can be reduced by careful management and maintenance of feeders, watering facilities, and associated equipment. A record should be kept of the data, assumptions, and calculations used to determine the kind, consistency, volume, location, and timing of the waste produced. The production estimates should include future expansion.

(b) Collection

This refers to the initial capture and gathering of the waste from the point of origin or deposition to a collection point. The AWMS plan should identify the method of collection, location of the collection points, scheduling of the collection, labor requirements, necessary equipment or structural facilities, management and installation costs of the components, and the impact that collection has on the consistency of the waste.

(c) Storage

Storage is the temporary containment of the waste. The storage facility of a waste management system is the tool that gives the manager control over the scheduling and timing of the system functions. For example, with adequate storage the manager has the flexibility to schedule the land application of the waste when the spreading operations do not interfere with other necessary tasks, when weather and field conditions are suitable, and when the nutrients in the waste can best be used by the crop. The storage period should be determined by the utilization schedule. The waste management system should identify the storage period; the required storage volume; the type, estimated size, location, and installation cost of the storage facility; the management cost of the storage process; and the impact of the storage on the consistency of the waste.

(d) Treatment

Treatment is any function designed to reduce the pollution potential of the waste, including physical, biological, and chemical treatment. It includes activities that are sometimes considered pretreatment, such as the separation of solids. The plan should include an analysis of the characteristics of the waste before treatment; a determination of the desired characteristics of the waste following treatment; the selection of the type, estimated size, location, and the installation cost of the treatment facility; and the management cost of the treatment process.

(e) Transfer

This refers to the movement and transportation of the waste throughout the system. It includes the transfer of the waste from the collection point to the storage facility, to the treatment facility, and to the utilization site. The waste may require transfer as a solid, liquid, or slurry, depending on the total solids concentration. The system plan should include an analysis of the consistency of the waste to be moved, method of transportation, distance between points,

frequency and scheduling, necessary equipment, and the installation and management costs of the transfer system.

(f) Utilization

Utilization includes recycling reusable waste products and reintroducing non reusable waste products into the environment. Agricultural wastes may be used as a source of energy, bedding, animal feed, mulch, organic matter, or plant nutrients. Properly treated, they can be marketable.

A common practice is to recycle the nutrients in the waste through land application. A complete analysis of utilization through land application includes selecting the fields; scheduling applications; designing the distribution system; selecting necessary equipment; and determining application rates and volumes, value of the recycled products, and installation and management costs associated with the utilization process.

Agricultural Waste Management in the Sample APMCs

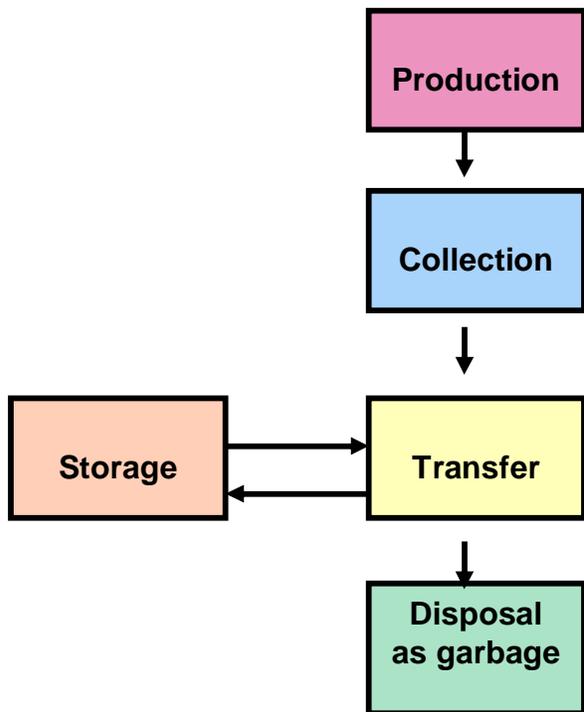
Waste Collection and Disposal Mechanism

Name of the APMC	Existing Waste Collection and Disposal Mechanism
Azadpur APMC, New Delhi	<ul style="list-style-type: none"> ➤ The garbage generated in the market yard is collected from lanes, by-lanes, roads through manual labour with the help of mini-dumpers/hand carts. ➤ The jetting machine is also use for removing the sewer blockage and sewer line cleaning etc. ➤ The market committee has purchased three skid loaders which are use for scrapping, brooming and loading of garbage from inner side of the market yard and these are very effective and successful to maintain & improve the sanitation condition at the market yard.

Najafgarh APMC (New grain market) New Delhi	<ul style="list-style-type: none"> ➤ Product received in dry form (food grains) and no significant waste generated. Routine cleaning and maintenance of hygiene is done by sweepers engaged by the APMC
Narela APMC (New grain Market) , New Delhi	<ul style="list-style-type: none"> ➤ Product received in dry form (food grains) and no significant waste generated. Routine cleaning and maintenance of hygiene is done by sanitation agency engaged by the APMC
Mumbai APMC	<ul style="list-style-type: none"> ➤ The waste generated is collected in the form of garbage (including agricultural waste) from the market yard to a dumping spot within the market complex The collected garbage is then disposed off by the use of compactors to the nearest dumping ground of the municipal corporation. ➤ Mumbai APMC maintains hygiene in the market yard by disposing off the garbage.
Pune APMC	<ul style="list-style-type: none"> ➤ Carried in two steps 1) The agricultural wastes (vegetables, fruits and other commodities) collected as garbage by in house staff in containers at particular location designated for waste disposal 2) The garbage collected in Containers is collected by the Contractor's workers in tractor trolley and disposed off the Market
Jalandhar	Nothing specific
Kanpur APMC	Waste generated in the Market yard is disposed by Tractor, trolley by Contractor in earth filling

Agricultural Waste Management -Functions

PRESENTLY IN PRACTICE



Waste Collection and Disposal Mechanism

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Jalandhar	Nothing specific

Kanpur APMC	Waste generated in the Market yard is disposed by Tractor, trolley by Contractor in earth filling
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Regarding waste collection and disposal, the wastes generated in the market yard are collected and then disposed off by engaging contractors. Some of the Markets like APMC Mumbai use compactors for waste disposal. APMC Azadpur uses Jetty machines and skid loaders. Other APMCs use tractor/trolley or open truck/dumpers for the purpose. Most of them have outsourced the sanitation to a contractor.

Number of Persons engaged in Waste Disposal

Name of the APMC	No. of Person engaged
Mumbai APMC	225 sweepers on contractual basis
Pune APMC	147 sanitation workers.
Jalandhar APMC	Nil
Kanpur APMC	Skilled: 05 Unskilled: 35
Najafgarh APMC (New grain market) New Delhi	By APMC staff, 8 Sweepers
Narela APMC (New grain Market) , New Delhi	None specified. Engaged 25 personnel through Sanitation agency for maintaining hygiene in Market

New innovation/machinery introduced for waste disposal

Name of the APMC	New innovation/Machinery/Technology
Mumbai APMC	Introduced compactors for waste disposal from September 2011 replacing the previous mode of disposal of garbage by open trucks/Dumpers
Pune APMC	Nil
Azadpur APMC, New Delhi	Use of jetting machine for removing the sewer blockage and sewer line cleaning etc.The market committee has purchased three skid loaders for scrapping, brooming and loading of garbage from inner side of the market yard

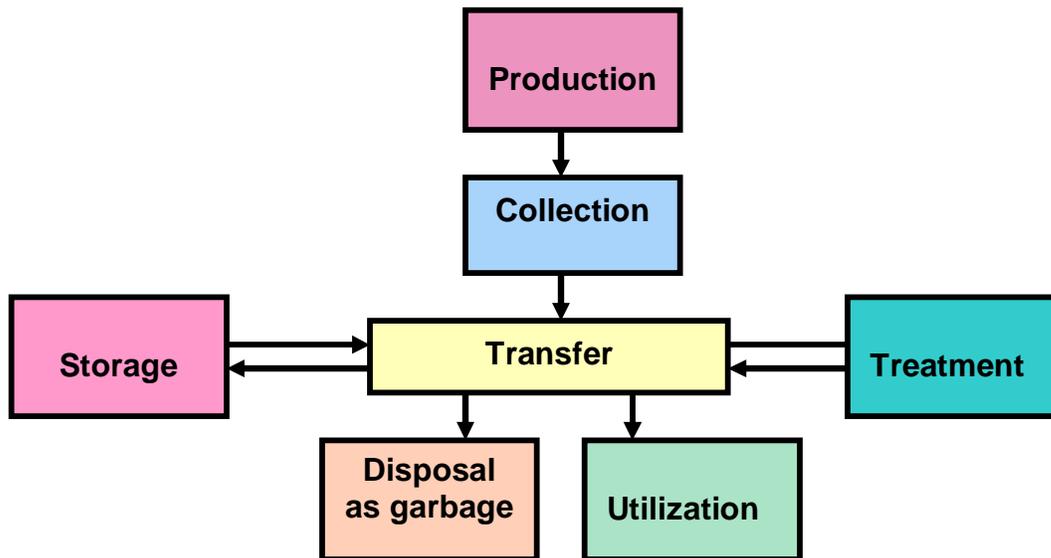
Jalandhar APMC	Nil
Kanpur APMC	Use of Tractor/Trolley
Najafgarh APMC (New grain market) New Delhi	Nil
Narela APMC (New grain Market) , New Delhi	Nil

Measures taken by some of the APMCs to utilize the Agricultural Wastes

Name of the APMC	Measures taken
APMC Mumbai	Making efforts to utilize the agricultural waste generated within the market yard (specifically fruit, vegetable, onion, potato and other agri commodity) for power generation and biogas production. Proposal prepared with assistance of B.A.R.C Mumbai and submitted to Director (Marketing), Govt. of Maharashtra
APMC Chennai	Agriculture Marketing Board Koyambedu Chennai is producing 250KW electricity in collaboration with RAMkY Group, however, it requires 150metric Ton agriculture waste daily. It is a model project and they are planning to extend capacity of the plant. A MOU is signed between marketing board and RAMKY group, whereas RAMKY is using electricity and board is counting Carbon Credit.
APMC Kolkata	Kolkata Agriculture Trader Association is planning to produce electricity by paddy husk, however they are producing oil with paddy husk, moreover, and it is also used as a catalyst in factories for ignition. Kolkata is using Bananas straws for making Tobacco and medicine.
APMC Pune	Utilizing this waste for land filling
APMC Delhi	Utilizing Agriculture waste to produce compost and they are trying to venture with some private companies for Power generation.
APMC Jalandhar	APMC Jalandhar is using sunflower waste for ignition purpose

Agricultural Waste Management -Functions

INITIATED



Regulation regarding Waste Management

Name of the APMC	Rules & Regulations of waste disposal in market	Existing State policy on waste management
Mumbai APMC	Nil	Not aware
Pune APMC	No specific rules. The sanitation workers are supervised by senior sanitary Officers of the Committee to maintain discipline and commitment in work	Not aware
Azadpur APMC	Not specified	Not aware
Jalandhar APMC	Nil	Not aware
Kanpur APMC	Nil	Not aware
Najafgarh APMC (New grain market) New Delhi	Nil	Not aware
Narela APMC (New grain Market) , New Delhi	Nil	Not aware

One of the major constraints in waste management is that we have no regulation for waste management or any State level intervention for handling the agricultural wastes.

Annual Expenditure of Waste Disposal

Name of APMC	Mode of Expenditure on Waste Disposal	Amount
Mumbai APMC	Annual Contract –allotted to Contractor for Waste Disposal by Compactors	Rs. 1,54,79,100/-
	Expenditure on Waste disposal in 2010-11	Rs. 3,65,55,000/-
Pune APMC	Contractor on Tender basis	Rs. 86,60,334/-
Jalandhar APMC	Nil	Nil
Kanpur APMC	Contractor	Rs. 1,89,692/-
Najafgarh APMC (New grain market) New Delhi	APMC staff engaged for sanitation	Rs. 27,000/-
Narela APMC (New grain Market) , New Delhi	Sanitation agency	Expenditure not specified

Percent share of Expenditure on Waste disposal in total Expenditure of the APMCs in 2010-11

Name of the APMC	Expenditure on Waste Disposal	Total Expenditure in the APMC	Percent
Mumbai APMC	Rs. 3,65,55,000/-	Rs. 61,19,50,000/-	5.97%
Pune APMC	Rs. 86,60,334/-	Rs. 21,64,47,936/-	4.0%
Jalandhar APMC	Nil	Rs. 8,47,76,445/-	-
Kanpur APMC	Rs. 1,89,692/-	Rs. 31,31,24280/-	0.06%
Najafgarh APMC (New grain market) New Delhi	Rs. 27,000/-	Rs. 2,05,81,000/-	0.13%

The expenditure incurred on waste disposal ranges from a significant 5.97% in APMCs like Mumbai who use scientific and mechanized waste disposal mechanism to as low as 0.06% in APMC Kanpur where waste disposal mechanism is involves maintaining basic sanitation and cleanliness. Even in APMC Mumbai, the expenditure incurred is only for disposal of the Waste. No significant expenditure is reported in terms of utilization of these agricultural wastes for any significant use.

Awareness of the market functionaries regarding Waste Management

Name of the APMC	Awareness Creation
Mumbai APMC	Market committee has taken initiative generate awareness in functionaries regarding disposal of garbage and waste in the dumping spot
Pune APMC	Nil
Jalandhar APMC	Nil
Kanpur APMC	None
Najafgarh APMC (New grain market) New Delhi	None
Narela APMC (New grain Market) , New Delhi	None

It was also found that the traders perception on effect of wastage on various components varied but majority of them were of the view that these wastes had an adverse effect on human health, hygiene and environment.

Not much effort is being made by the market committees except APMC Mumbai in generating awareness among the market functionaries regarding waste management.

Future strategies/plan for development / improvement of waste disposal mechanism

Name of the APMC	Future Strategy/Plan for Waste Management	Future plan for procurement of equipment and services for Waste management
Mumbai APMC	From the 5 wholesale markets under Mumbai APMC, 60 to 70 M.T garbage per day is generated. The market committee has a plan to utilize this waste to generate electricity and biogas	- Open land is required for which proposal has been submitted to CIDCO ltd. - Technical Proposal prepared with assistance of B.A.R.C Mumbai and submitted to Director (Marketing), Govt. of Maharashtra
Pune APMC	Nil	Nil
Jalandhar APMC	Nil	Nil
Kanpur APMC	Nil	Nil
Najafgarh APMC (New grain market) New Delhi	Nil	Nil
Narela APMC (New grain Market) , New Delhi	Nil	Nil

Some of the APMCs have made strategic plans for waste management such as APMC Mumbai who plan to utilize the agricultural waste generated within the market yard (specifically fruit, vegetable, onion, potato and other agri commodity) for power generation and biogas production. Concrete efforts are being taken for implementation of this Plan.

CHAPTER 5

SUMMARY AND RECOMMENDATION

SUMMARY

The major findings of the Research Study on handling of Agricultural Wastes in APMCs is summarized as below:

1. Food and agricultural commodity is wasted through the Food Supply Chain in various stages starting from Agricultural production till consumption.
2. In developing countries like India, 40% of losses occur at post-harvest and processing levels while in industrialized countries more than 40% of losses happen at retail and consumer levels.
3. Lack of storage facilities, high demand and supply fluctuations, lack of back end infrastructure, post harvest management facilities and infrastructure and lack of state of the art retailing practice in fresh produce lead to a high wastage of 30-40% in high value perishables commodities like fruits and vegetables in India.
4. Food losses represent a waste of resources used in production such as land, water, energy and inputs. Producing food that will not be consumed leads to loss of economic value of the food produced.
5. Economically avoidable food losses have a direct and negative impact on the income of both farmers and consumers. Irrespective of the development status of the Country, every possible measure should be taken to keep food losses to minimum.

6. Special focus is required to combat the food supply chain losses which are quite substantial and significant.
7. The Study was conducted in some of the major APMCs of India including Azadpur Mandi which is designated as the largest wholesale market for fruits and vegetables in Asia.
8. It was found that a huge quantum of fresh fruits and vegetables arrive and transacted daily in these Markets. As per traders survey, waste generated in fruits range from 2.6% to as high as 11.4 %. Wastage in Vegetables ranged from 3.15% to 12.6%. Markets like Azadpur generate approximately 4% wastages of both fruits and Vegetables.
9. Percent wastage reported by the Market Committee is comparatively quite low as against traders survey. This clearly indicates that a huge amount of food commodity wasted goes unreported.
10. This also account for the lack of statistics and data on the quantum of food waste actually generated.
11. Majority of the wastes generated in the APMCs are disposed off as garbage. Seldom is it used as earth filling or feed. Hence the entire volume of food waste is unutilized and results in food loss and hence economic loss.
12. Regarding waste collection and disposal, the wastes generated in the market yard are collected and then disposed off by engaging contractors. Some of the Markets like APMC Mumbai use compactors for waste disposal. APMC Azadpur uses Jetty machines and skid loaders. Other

APMCs use tractor/trolley or open truck/dumpers for the purpose. Most of them have outsourced the sanitation to a contractor.

13. Some of the APMCs have taken new initiatives to utilize the waste generated as below:

APMC	Initiative
Chennai	Electricity Generation
Kolkata	Oil from Paddy husk Banana straw for making tobacco and medicines
Pune and Kanpur	Land/Earth filling
Delhi	Compost production
Jalandhar	Using sunflower waste for ignition purpose

14. However, these efforts are just a beginning and need to be strengthened into concrete action so that the wastes generated in the APMCs can be utilized to the maximum extent possible.

15. Some of the APMCs have made strategic plans for waste management such as APMC Mumbai who plan to utilize the agricultural waste generated within the market yard (specifically fruit, vegetable, onion, potato and other agri commodity) for power generation and biogas production. Concrete efforts are being taken for implementation of this Plan.

16. Kolkata Agriculture Trader Association is also planning to produce electricity by paddy husk.

17. These efforts are the stepping stone and we need to build up a strong foundation with a holistic effort and concerted measures for waste management.

18. One of the major constraints in waste management is that we have no regulation for waste management or any State level intervention for handling the agricultural wastes.
19. The expenditure incurred on waste disposal ranges from a significant 5.97% in APMCs like Mumbai who use scientific and mechanized waste disposal mechanism to as low as 0.06% in APMC Kanpur where waste disposal mechanism involves maintaining basic sanitation and cleanliness. Even in APMC Mumbai, the expenditure incurred is only for disposal of the Waste.
20. No significant expenditure is reported in terms of utilization of these agricultural wastes for any significant use.
21. Efforts are underway by Mumbai APMC and in near future power generation can be a significant output of these agricultural wastes generated.
22. It was also found that the traders' perception on effect of wastage on various components varied but majority of them were of the view that these wastes had an adverse effect on human health, hygiene and environment.
23. Not much effort is being made by the market committees except APMC Mumbai in generating awareness among the market functionaries regarding waste management.
24. Also, efforts are needed to reduce the wastage generated in addition to managing those produced significantly.

RECOMMENDATION

Based on the findings of the Study, the following suggestions are made for promoting Agricultural Waste management.

1. Post harvest food loss during harvesting and preparation for market:

Since majority of crop loss in developing countries like India takes place post harvest starting from harvesting till marketing and processing, the management of food waste is directly related to post harvest management.

Apart from production, food loss can take place during harvesting if adequate measures are not taken. Crops should be harvested as per the harvesting indices. Premature harvesting or harvesting of over mature crops leads to crop loss. Harvesting should be done at the proper maturity stage during appropriate time of the day by proper harvesting methods. Care should be taken to prevent any injury to the produce during harvest in order to prevent damage and decay. Poor farmers often harvest crop early for need of cash. Sometimes they even use chemical colours to make the produce presentable for marketing. This results in loss of nutritional value of the crop besides posing a food safety hazard. This would further lead to economic loss as the food may be wasted if not suitable for consumption. If consumed, it may be a health hazard further involving financial loss due to costs involved in treatment and cost to Society.

Recommendation:

Awareness Creation:

Awareness creation of the farmers regarding proper post harvest management techniques so that they can harvest and market their produce following techniques which would result in less crop loss.

Farmers Group and Group Marketing

In case of small and marginal farmers, farmers may be organized into groups to pool in resources and bring economies of scale. In this way they can receive credit from agricultural financial institutions or advance payments from buyers of the produce. This would also increase their bargaining power and result in better price realization.

2. Lack of post harvest infrastructure and cool chain facilities resulting in post harvest food loss

Lack of infrastructure causes post harvest food losses in developing countries. Fresh products like fruits, vegetables, etc immediately after harvest can be spoiled in hot climates due to lack of cool chain infrastructure for transportation, storage, cooling and markets.

As such, 25 to 30 per cent of fruits and vegetables and five to seven per cent of food grains in India get wasted. Lack of post harvest and cool chain infrastructure for storage, transport and markets contribute significantly to this loss.

Recommendation:

Investment in infrastructure and cool chain facilities, transportation and storage. Since such infrastructure requires huge investments, Private sector should be encouraged to invest in infrastructure development for agricultural marketing. Government should develop strategy to build up public private partnership for developing these infrastructures and integrate it with the food supply chain for their proper utilization. Many APMCs have constructed cold storage and pack houses with grading/ packaging, ripening chambers etc but are unable to link it with the supply chain. Hence these infrastructures involving huge investments remain unutilized and do not contribute for preventing food loss as the farmers are not able to derive benefit from them. Such unproductive infrastructures results in additional economic loss.

3. Lack of adequate Storage facilities

Storage is an important marketing function, which involves holding and preserving goods from the time they are produced until they are needed for consumption. The storage of goods, from the time of production to the time of consumption, ensures a continuous flow of goods in the market.

Storage protects the quality of perishable and semi-perishable products from deterioration. It also helps in the stabilization of prices by adjusting demand and supply. Storage is a vital component in the food supply chain for efficient performance of other marketing functions.

As against a production of 180 million mt a year of fruits, vegetables and perishables, India has a capacity of storing only 23.6 million mt in 5,386 cold storages across the country, of which, 80 per cent is used only for potatoes. Lack of adequate storage facilities results in significant food loss and distress sale by farmers amounting to economic loss.

Recommendation:

Enhancing the scientific Storage facilities (Warehouses) –

Warehouses are scientific storage structures especially constructed for the protection of the quantity and quality of stored products. The product is protected against quantitative and qualitative losses by the use of such methods of preservation as are necessary. Warehouses meet the financial needs of the person who store the product. Nationalized banks advance credit on the security of the warehouse receipt issued for the stored products to the extent of 75 to 80% of their value.

Warehouses help in price stabilization of agricultural commodities by checking the tendency to making post-harvest sales among the farmers. The warehouses (Central Warehousing Corporation and State Warehousing Corporations) work under the respective Warehousing Acts passed by the

Central or State Govt. Parliament has enacted the Warehousing (Development and Regulation) Act, 2007 (37 of 2007).

Encouraging Innovative Instruments like pledge financing and negotiable warehouse receipts to meet financial needs of producers: In order to meet the storage and financial requirements of the farmers, Govt. of India has introduced innovative instruments like pledge financing and negotiable warehouse receipts along with strengthening the warehousing and scientific storage facilities. Warehouse Receipt (Warrant) is a receipt/warrant issued by the warehouse manager/owner to the person storing his produce with them. This receipt mentions the name and location of the warehouse, the date of issue, a description of the commodities, including the grade, weight and approximate value of the produce based on the present prices. The warehouse receipt serves as a collateral security for the purpose of getting credit.

- **Awareness creation regarding warehouses and WDRA Acts and provisions:** The knowledge about the warehousing and WDRA Act 2007 is meager among the various stakeholders of Agricultural Marketing. To create awareness about the. Efforts should be made to generate awareness among various stakeholders including farmers regarding warehousing and Scientific Storage facilities available in the Country, various provisions of the WDRA Act 2007, benefits, mechanics and risks involved in pledge financing and negotiable warehouse receipts etc

4. Demand for high quality Produce by Supermarkets, Exporters and Processing Industries

Various retail supermarkets selling fresh fruits and vegetables give emphasis to high quality standards in terms of appearance like weight, size, shape, colour etc. Quality and safety standards are also rigorous for export and processing. This leads to rejection of a substantial portion at the farm gate leading to food waste.

Therefore, large portions of crops never leave the farms. Even though some rejected crops are used as animal feed, the quality standards divert the food originally aimed for human consumption to other uses (Stuart, 2009). This results in economic loss of high value food crop.

Recommendation:

Practicing Grading and Standardization at the farm level: Farmers should be encouraged to grade their produce after harvest.

Benefits of Grading:

- Grading would help them to sort their produce according to quality and market value. There is a clientele for every kind of produce. Farmers should grade and market their produce as per consumer preference. There are consumers who prefer high quality produce. For some consumers, price is a criteria. They are willing to buy medium quality produce for less as long as the taste does not vary. Produce for supermarkets demanding high appearance quality may be packed separately. Produce for wholesale and local markets can be packed separately as per consumer preference and demand in terms of quality, appearance and price. This results in minimizing a substantial amount of food loss and at the same times helps in maintaining the quality of the produce.
- Grading helps in maintaining uniformity of the produce increasing its market value and minimizes food loss due excessive handling of the produce at different points of the supply chain.
- During grading and sorting operations, decayed or damaged produced can be discarded before packing. This would prevent the other produce of the lot from getting damaged and wasted at the end of the supply chain.

Practice Direct Marketing and Contract Farming:

The shorter the marketing chain, the lesser would be the food loss during storage and transportation. Hence farmers should be encouraged to sell their produce directly to the consumers. This can be done by farmers market and farmers Shop

near farm gate, directly marketing to retailer, hotel and restaurants, processor, exporter etc.

Contract farming also helps in reducing food loss as crops are grown under an agreement between the producer and buyer where the producer grows the crop as per requirement of the buyer under pre agreed terms of sale in terms of quantity, quality, price etc. Contract farming also has an advantage in terms of variability of the contract to suit the requirements of the producer and buyer. Since the crop produced is as per specification of the buyer and as per input provided by him, the buyer directly procures the produce from the farmers as per agreed price. Thus scope of food loss and waste is minimum.

5. Food quality and safety hazard - *Unsafe food is not fit for human consumption and therefore is wasted.*

Wastage can occur at the consumer level. Failure to comply with minimum food safety standards can lead to food losses and, in extreme cases, impact on the food security status of a country. A range of factors affect the food safety and make them unfit for consumption. These include contamination of food crops by harmful microorganisms, toxins produced by many pathogens like aflatoxin contamination, naturally occurring toxins in food itself, contaminated water, unsafe and indiscriminate use of pesticides, using unsafe and non permitted colouring agents, unsafe additives etc. Poor and unhygienic handling and storage conditions, and lack of adequate temperature control also make the food unsafe for consumption. Such unsafe and hazardous food are discarded at the wholesaler or retailer level and if not, they are often discarded by the consumers. Consumption of such food is more hazardous as they pose a direct threat to health.

Unsafe foods are more stringently discarded during export and procurement by processing industries thus resulting in huge food loss and wastage.

Recommendation:**Awareness Generation among Producers, marketing channel stakeholders and Consumers:**

Developing knowledge and capacity of food chain stakeholders to practice safe food handling practices. Some food are not produced unsafe but made unsafe due to faulty practices.

Farmers should be educated on the importance of producing and marketing safe food and how food safety is intricately associated with health and economic loss. Marketing channel stakeholders including market Committee Officials, wholesalers, retailers etc should also be aware of the significance of food quality and safety and be vigilant on the quality of produce they are procuring from the producers/ food chain operator. The last link of the food chain i.e consumer is a vital link in maintaining the food safety . Since demand for food is generated from this link, if the consumer is aware of the hazards associated with consuming unsafe food, this would automatically lead to demand driven production for safe food and help to maintain food quality and safety throughout the food supply chain and prevent wastage of food that was produced but could not be consumed for being unsafe.

Implementation of Food Safety Management System like GAP, GMP, GHP

Food chain stakeholders should be skilled and knowledgeable in how to produce and handle safe food. Foods need to be produced, handled and stored in accordance with food safety standards. This requires the application of good agricultural and good hygienic practices by all the stakeholders involved in the food supply chain to ensure that the final food product is safe for the consumers.

6. Lack of processing facilities causes high food losses in developing countries.

India stands second in the production of fruits and vegetables in the world. It contributes about 10% and 14% of fruit and vegetable production in the World.

30 -40% of these foods is wasted. Lack of processing facilities is major factor for food loss. In spite of such huge production each year, processing is quite low in Fruits and vegetables i.e only 2.2 % as against 70% in case of developed countries. Part of the problem is due to seasonality of production and the cost of investing in processing facilities that will not be used year-round.

Recommendation:

Encourage Food Processing by Contract farming and Direct

Marketing:

Adequate measures should be taken to encourage food processing which would play a vital role in minimizing food wastage. Contract farming between farmer and processor should be encouraged so that the processor gets his desired food product as per his requirement and time and farmer gets reasonable price for his produce. Processor can also procure raw materials from farmers by direct marketing.

Encouraging development of Food processing facilities:

Government has initiated many schemes for increasing food processing. Private sector should be encouraged to invest in developing food processing industries and food processing infrastructure.

7. Lack of adequate Waste Management and Recycling Initiatives:

As per the findings of the study, majority of food wastes in the APMCs is disposed off as garbage. This is true in any other sphere like household (at consumer level), retail outlets etc.

Food is also lost during processing because of spoilage down the production line. Errors during processing lead to final products with the wrong weight, shape or appearance, or damaged packaging, without affecting the safety, taste or nutritional value of the food. In a standardized production line these products often end up being discarded (Stuart, 2009).

A lot of efforts and initiatives are required to utilize and recycle the wastes generated. It is much simpler to merely dispose off the garbage which is the reason that agricultural waste management is in its infancy particularly in developed countries like India.

Recommendation

Initiatives should be taken for recycling and reusing the food wastes generated through biomass utilization.

A) Utilizing the Agricultural wastes for productive uses:

As evident from the findings of the Study, a huge amount of Agricultural wastes are generated at every stage of the food supply chain such as harvesting, transportation, storage, marketing and processing. Due to their nature and composition, they deteriorate easily and cause foul smell. The vegetable wastes generated in the markets disposed off in municipal landfill or dumping grounds. These wastes can be reused for productive purpose such as Compost preparation, biogas generation, electricity production, etc.

Some of the APMCs have taken new initiatives to utilize the waste generated as such as Mumbai. These efforts are the stepping stone and need to be strengthened into concrete action with a holistic and concerted measures for waste management in the APMCs.

State Government initiatives for Waste management:

In order to promote waste management in APMCs, Government should provide incentives and subsidy for dealing with food waste such as to set up “fruits and vegetables waste/agro-waste compost production units”.

B) Professional and scientific approach for Waste management:

Mechanized and scientific disposal of garbage:

Looking into the quantum of food wastes generated, mechanized and scientific disposal is necessary for maintaining sanitation and hygiene as well as collecting and transferring the wastes to a suitable destination where it can be stored, treated and utilized for productive use.

There are several modern equipments such as compactors for such mechanized disposal. From the present study, it was found that only APMC mumbai is using the Compactors. Other APMCs should be encouraged to adopt the mechanized approach for waste disposal.

Equipments for waste management:

There are several equipments for waste disposal such as **Compactors, Balers, Crushers, Shredders, Grinders, Recycling Equipment, Waste Equipment etc.**

Trash Compactors:

HI-RISE COMPACTOR COMBO FOR TRASH AND RECYCLING

Both Waste & Recycling Materials are accommodated through one chute system. A Deposit Door on each floor with Pushbutton Selector allows for the selection of either Waste materials or Recycling materials.





WANG JING / CHINA DAILY
Sanitary workers put kitchen waste into a special garbage tank in a residential community in Beijing. Residents are encouraged to sort out their rubbish for recycling but often plead lack of space.

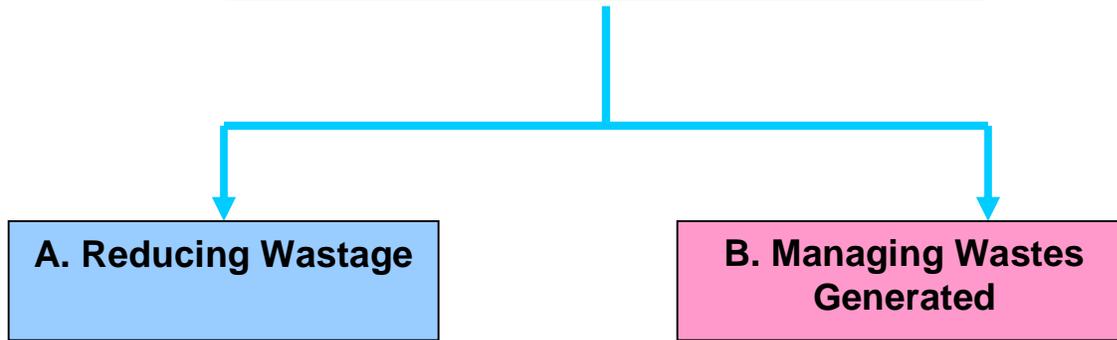


PROVIDED TO CHINA DAILY
Beijing Goldenway Bio-Tech's food waste treatment factory at Gao'antun, Beijing. The company plans to seek a stock market listing next year.

CHAPTER 6

PLANNING FOR WASTE MANAGEMENT IN APMCS

AGRICULTURAL WASTE MANAGEMENT IN APMC



A. REDUCING WASTAGE

In most of our APMC, there is a huge quantum of arrival of perishables each day. The APMCs are not well equipped to handle such a huge quantum of produce in terms of facility and management. Insufficient space, poor layout, no proper platform for trade, improper handling and packaging practices, lack of adequate shelter from rain and sunlight, and insufficient cold storage facilities. This results in distress sale, spoilage of the produce and huge wastage of fruits and vegetables.

The measures that can be taken in APMC to reduce the generation of wastage are:

1. **Reducing arrival in APMC by way of Alternative Marketing** – Farmers should have the choice of selling their produce by alternative channels instead of bringing their produce to the APMCs. **Direct Marketing and Contract farming should be encouraged.**
2. **Developing Proper Marketing Facilities:** Markets should be designed or reorganized in proper layout. There should be proper platform for sale of commodities. There should be adequate space for arranging the Produce.

There should also be sufficient passage for transit without mutilating the produce. Market layouts can be planned as per the financial capacity of the Markets. Big Markets can go for sophisticated Market Planning and Designing while small Markets with limited budget can also design a simple but effective layout for marketing. Professional Market Planners can be hired for this purpose.

3. **Developing adequate cold storage facilities and Post harvest management infrastructures** so that the surplus produce can be stored by the farmers and traders.

B. MANAGING THE WASTES GENERATED

A huge amount of Agricultural wastes are generated daily in the APMCs. Due to their nature and composition, they deteriorate easily and cause foul smell. In order to maintain sanitation and cleanliness in the Market as well as utilization of the food wastes, adequate measures should be taken for Waste Management in the APMCs.

A. Sanitation and Hygiene

- i) **Maintaining Good hygienic practices:** Good hygienic practices should be maintained in the Market yard. All the market functionaries should be trained in Good hygienic practices. In order to maintain hygiene and sanitation, waste collection bins should be placed at frequent intervals in the markets. The market functionaries should be urged to dispose all their wastes in these bins. The sanitation workers in the market should also collect the scattered wastes in the bins at regular intervals.

- ii) **Imposing fine and Penalty:** Small penalty or fine can be imposed on those who do not maintain the sanitation. This way strict discipline can be maintained in terms of maintain sanitation.

B. Reusing the Agricultural Wastes

Setting up Fruit and Vegetable Compost Unit in APMC: The huge amount of food waste generated in the APMCs can be used in making organic manure like compost. Preparation of compost is not a very difficult process. With little expertise and training compost can be formed by the APMC staff. These compost can be made available to the farmers on subsidized rates.

Besides APMC, compost preparation can be taken up by Farmers Group or Traders associations within the APMC itself. For this the farmers and traders have to organize themselves. The APMC has to organize training programmes for compost preparation with help of SAU. For setting up the units, State government can provide incentives and subsidy. APMC can also set up compost unit from their own budget.

Biogas Preparation from Agricultural Wastes in APMC:

The waste from fruit and vegetable processing industries can be used for production of biogas. Biogas is produced by anaerobic digestion of fruit and vegetable wastes. The conversion of fruit and Vegetable Wastes to biogas using anaerobic digestion process is a viable and commercial option. Bioconversion processes are suitable for wastes containing moisture content above 50% than the thermo- conversion processes. Vegetable wastes, due to high biodegradability nature and high moisture content (75 – 90%) are a good substrate for bio-energy recovery through anaerobic digestion process. However,

most of the technologies for the waste utilization are developed at the laboratory scale, so these technologies needed to be standardized for commercial utilization. Collaboration with the concerned agencies and SAU having expertise in this area can be fruitful.

Power generation:

The wastes generated in the markets are disposed off in municipal landfill or dumping grounds. These wastes can be reused for productive purpose such as electricity production. Collaboration with Atomic research station and thermal power plants can be effective in convert these wastes into a valuable source of energy.

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