
UNIT 1 IMPORTANCE OF POST HARVEST MANAGEMENT

Structure

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1.0 OBJECTIVES

After going through this unit, you should be able to:

- learn the importance of post harvest management of foodgrains.
- understand the extent of post harvest losses in foodgrains.
- explain the role of temperature and moisture in post harvest management.
- know the availability of foodgrains and nutritional security.
- know how the efficient and scientific post harvest management can generate employment.
- explain how value addition can increase their shelf life and merchantability of foodgrains.
- know the benefits of efficient post harvest management.

1.1 INTRODUCTION

The management of harvesting, threshing, cleaning, drying, storage and marketing of foodgrains upto consumption is known as Post Harvest Management. Efficient and scientific post harvest management involves use of improved techniques of harvesting, threshing, cleaning, drying, storage, and transportation of foodgrains so as to minimize losses.

Efforts made in increasing the agriculture production are nullified due to loss of crops due to inappropriate and in-efficient post harvest management. Scientific post harvest management provides food security to the country and community and ensures availability of foodgrains until the next harvest.

In developing countries like India where production is not stable and depends on monsoon, continuous efforts should be made to develop efficient and scientific post harvest technology so that the post harvest losses in foodgrains are minimized.

In our country, about **10%** of the foodgrains are damaged during post harvest handling which includes losses in harvesting, threshing, processing, storage and transportation. Moisture and temperature are two physical factors which cause considerable losses in foodgrains. Among the biological agents, insects, rodents, birds, bacteria, fungi are the main causes of food damage. About **6.5%** foodgrains are lost due to biotic factors.

Well matured, clean and dry grains can be stored for longer time in scientific storage godowns, silos, storage structures like metal bins, reinforced cement and concrete (RCC) bins, pucca kothis, etc. On the other hand, immature and moist grains (containing more than **16-18%** moisture) and having excess of foreign matter are easily damaged during storage. Higher moisture in grain attracts the insects and moulds, which further degrade the quality and quantity of grains. Storage fungi rarely attack on dry grains. Proper and timely aeration of warm grain reduces its temperature and similarly, drying of moist grain reduces its moisture and makes it conducive for storage.

Storage fungi or moulds like *Aspergillus flavus* and *Penicillium* species not only damage the foodgrains completely but also produce certain mycotoxins in the foodgrains which are toxic for humans and animals. Aflatoxin is one of such mycotoxins produced by the *Aspergillus flavus* in high moisture paddy, rice, corn and groundnuts. Aflatoxin contaminated grain is not fit even for animal feeds. A maximum permissible limit of 30 ppb (parts per billion) of mycotoxin has been prescribed in foodgrains under Prevention of Food Adulteration Act (PFA).

Harvesting of food grains at proper moisture is very important. If paddy is allowed to dry in the field, a high % of shedding of paddy kernels takes place.

1.2 ROLE OF TEMPERATURE AND MOISTURE IN POST HARVEST MANAGEMENT

Temperature

Temperature plays a very important role in safe storage of foodgrains. Warm and moist grain deteriorates very rapidly during storage in a grain bin. Condensation of moisture takes place on top layer of grain when there is variation in inside and outside temperature of a grain bin. Aeration which involves forced or natural circulation of ambient air in a grain mass is widely used for reducing the grain temperature. Therefore, the temperature of a grain bin should be regularly monitored. Thermo samplers and thermo couples are used to monitor the temperature of a grain bin. There should not be more than 5 degree Celsius difference between the temperature of grain in a bin and outside atmosphere temperature. Modern silos are equipped with in-built aeration system. The grain should be properly cooled before storage in a bin or any other storage structure.

Moisture

Moisture plays a very important role in safe storage of foodgrains. High moisture deteriorates the foodgrains rapidly during storage. Discolouration of foodgrains particularly in rice during storage is due to the presence of high moisture. Besides,

the high moisture attracts the insects and mould to further damage the foodgrains. On the other hand, low or safe moisture increases the storability of foodgrains and checks the growth of insects and moulds. Therefore, measurement of correct moisture of the foodgrains before storage is very important. Electronic portable moisture meters are available for the measurement of moisture content of foodgrains.

Moisture is also very important in rice milling. Paddy should have optimum moisture content (about 14.5%) at the time of milling. High moisture paddy or very low moisture paddy results in high percentage of broken rice grains. Mechanical dryers are used for drying of paddy in the modern rice mills. Sun drying of paddy also results in excessive broken grains during rice milling. Therefore, the paddy should be dried under shed with continuous turning by foot or other means.

The safe moisture of some foodgrains is given below:-

Table 1. : Safe moisture upper limit of various commodities

| S.No. | Commodity | Moisture content (% wet basis) |
|-------|--|-----------------------------------|
| 1. | Paddy, rice (raw) | 14 |
| 2. | Rice (Parboiled) | 15 |
| 3. | Bengal gram | 12 |
| 4. | Wheat, sorghum, maize, barley, bajra, ragi, wheat atta and basin | 12.5 |
| 5. | Ground nut in pods | 6-7 |
| 6. | Mustard seeds | 5-6 |

From the Table 1, it is known that paddy and raw rice can be safely stored at 14% moisture content and parboiled rice may be stored safely at 15% moisture content. Wheat and wheat products and other coarse grains like sorghum, maize, barley and bajra may be stored safely at about 12.5% moisture content.

1.3 STORED GRAIN INSECT PESTS AND THEIR CONTROL

Stored grain insect pests cause, both quantitative and qualitative losses, during storage of foodgrains. At high moisture their growth and multiplication is very fast. The optimum conditions of temperature and relative humidity for the rapid growth and multiplication of stored grain insect pests range from 25 to 35 degree Celsius and 60 to 65% respectively. Stored grain insect pests also contaminate the foodgrains with harmful and unhygienic materials like uric acid which causes rheumatic pain in human beings.

The crawling insect infestation in the warehouses/godowns may be controlled by spraying effective prophylactic chemicals such as Malathion 50% EC, Deltamethrin 2.5% WP at recommended doses on walls, floor, alleyways and surface grain bags. Malathion 50% EC may be diluted with water in the ratio of 1 : 100 and 3 liters emulsion may be sprayed on 100 sq. mtr. surface area after 15 days interval. Similarly, 40 gms. of deltamethrin 2.5% WP may be dissolved in 1 liter of water and 3 liters emulsion may be sprayed on 100 sq. mtr. surface area after 90 days.

The insects may also be eliminated by using fumigants like Methyl bromide and aluminium phosphide (phosphine) at recommended doses in a closed air tight storage system or under gas proof fumigation covers. The foodgrains should be properly aerated after fumigation and brushing of grain bags should be carried out to remove the residue of aluminium hydroxide.

1.4 FOOD AVAILABILITY

The food availability is directly related to food production. Despite the continuous growth of population, the food availability has not changed much. During 1955, the per capita food availability was 157 kg. per annum (cereals), which had increased upto 167 kg. per annum in 1995. The data from 1997 onwards shows that per capita net availability of cereals is decreasing (Table 2). The foodgrain production has also decreased during this period. The reasons for less food availability are:

- i) Deficit of food production over consumption.
- ii) Instability in cereal production.
- iii) No. of people/States affected by flood, drought and other natural calamities.

**Table 2. : Per capita net availability of cereals
(kilograms per annum)**

| Sl.No. | Year | Rice | Wheat | Others | Total |
|--------|------|------|-------|--------|-------|
| 1. | 1981 | 72.2 | 47.3 | 32.8 | 152.3 |
| 2. | 1982 | 70.5 | 46.7 | 34.6 | 151.8 |
| 3. | 1983 | 62.0 | 52.7 | 30.4 | 145.1 |
| 4. | 1984 | 72.2 | 51.4 | 36.1 | 159.7 |
| 5. | 1985 | 68.9 | 50.6 | 32.1 | 151.6 |
| 6. | 1986 | 77.4 | 55.1 | 25.8 | 158.3 |
| 7. | 1987 | 75.2 | 57.6 | 25.9 | 158.7 |
| 8. | 1988 | 68.7 | 56.3 | 25.1 | 150.1 |
| 9. | 1989 | 78.5 | 57.0 | 29.3 | 164.8 |
| 10. | 1990 | 77.4 | 48.4 | 31.7 | 157.5 |
| 11. | 1991 | 80.9 | 60.0 | 29.9 | 170.1 |
| 12. | 1992 | 79.2 | 57.9 | 21.5 | 158.6 |
| 13. | 1993 | 73.4 | 51.2 | 31.6 | 156.2 |
| 14. | 1994 | 75.7 | 58.2 | 24.5 | 158.4 |
| 15. | 1995 | 80.3 | 63.0 | 23.7 | 167.0 |
| 16. | 1996 | 74.8 | 64.4 | 22.7 | 161.9 |
| 17. | 1997 | 78.5 | 65.7 | 26.7 | 170.9 |
| 18. | 1998 | 73.7 | 55.7 | 22.9 | 152.3 |
| 19. | 1999 | 75.0 | 59.8 | 23.4 | 158.2 |
| 20. | 2000 | 75.3 | 58.4 | 21.9 | 155.6 |
| 21. | 2001 | 75.9 | 45.3 | 21.3 | 142.5 |

States like Punjab, Haryana, Western part of U.P. where the cereal production has increased considerably and there is surplus availability of foodgrains as well as stability in cereal production, have abundant food availability. These States are

also not generally affected by flood, drought and other natural calamities. On the other hand, Gujarat, Rajasthan and Bihar are food insecure States in terms of food grain availability because cereal production has not shown much increase in these States. Besides, there is instability in cereal production and these States are generally prone to drought, floods and other natural calamities.

1.5 NUTRITIONAL SECURITY

Cereals (Wheat, rice, maize, barley and sorghum) continue to be the most important source of nutrients. According to the Food Balance Sheet, cereals currently supply 59.0% of total calories, 58% of total protein and 13% of total fats. However, data collected by National Sample Survey (NSS) indicate that cereals provide about 65% of protein. In India, cereals are much cheaper source of nutrition. The poorer population in our country get much larger calories from cereals which was about 75% for the 40% bottom line population in 1999-2000.

It has been observed that diversification away from cereals increases the cost per unit of nutrient intake and corresponding increase in calorie and protein is less than increase in food expenditure. Thus, cereals contribute nutrient intake. Food Balance Sheet shows larger improvement in per capita calories availability rising from 2000 Kcal/day during 1970s to 2200 Kcal/day in 1980s and 2400 Kcal/day in 1989. Efficient public distribution system of foodgrains has played an important role in meeting average nutritional requirements. The state wise nutritional availability for the year 1999-2000 is given below:-

Table 3. : State wise nutritional availability for the year 1999-2000

| Sl.No. | Name of the state | Per capita cereal out put in Kg/year | Per capita nutritional (total calories) intake in Kcal/day |
|---------------|--------------------------|---|---|
| 1. | Andhra Pradesh | 166 | 2021 |
| 2. | Assam | 139 | 1960 |
| 3. | Bihar | 125 | 2121 |
| 4. | Gujarat | 92 | 1986 |
| 5. | Haryana | 582 | 2455 |
| 6. | Himachal Pradesh | 213 | 2454 |
| 7. | Karnataka | 167 | 2028 |
| 8. | Kerala | 24 | 1982 |
| 9. | Madhya Pradesh | 198 | 2062 |
| 10. | Maharashtra | 104 | 2012 |
| 11. | Orissa | 159 | 2119 |
| 12. | Punjab | 969 | 2381 |
| 13. | Rajasthan | 193 | 2425 |
| 14. | Tamil Nadu | 139 | 1826 |
| 15. | Uttar Pradesh | 235 | 2327 |
| 16. | West Bengal | 183 | 2095 |

From the Table 3, it is inferred that Assam, Gujarat, Kerala and Tamil Nadu were having lower per capita total calorie intake than the average national calorie intake of 2000 kcal per day. It is also observed that per capita cereal output in these States was also lower. Therefore, calorie intake is directly related to cereal output. Continuous efforts should be made to increase the foodgrain production in these States so that the per capita total calorie intake may be increased.

Check Your Progress 1

- Note:** a) Use the spaces given below for your answers.
b) Check your answer with those given at the end of the unit.

1. What do you understand by post harvest management?
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2. What are the extents of post harvest losses in foodgrains?
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3. How food availability is related to food production/output?
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4. How much per capita total calories intake, protein and fat is derived from cereals ?
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1.6 EMPLOYMENT GENERATION

A large number of young people in the villages in our country are unemployed. There is a need that these people should be provided employment in their villages itself. A well planned and efficient post harvest management strategy may provide employment to large number of such people. These people in rural areas may be employed in construction of small rural godowns for the storage of foodgrains. The small godowns may also be maintained and operated by educated and trained young people in the villages. Small scale paddy processing units, paddy parboiling plants, dal or pulse mills may provide employment to rural unemployed people. Rural artisans may be imparted training in construction of scientific grain storage structures like metal bins, pucca khoties, RCC bins.

Government of India through Ministry of Rural Development has initiated Sampoorna Gramin Rozgar Yojana (SGRY) on 15th Sept 2001 to provide

employment in rural areas. The people are engaged in creation of infrastructure facilities in villages such as construction of roads, ponds, rivers and houses. The scheme has cash and foodgrain components and the Central Government bears 75% and 100% cost of the two components respectively and balance is borne by the State Governments and UTs. In 2004-05, 82.23 crores man days were generated and central Government has released Rs 4,496 crores cash and 50 lakh tonnes of foodgrains to State and UTs.

Besides, under special component of SGRY the Central Government has released 26 lakh tones of foodgrains to 13 draught affected states. In 2005-2006 (up to Nov 2005). 48.75 crores man days were generated and the government of India has contributed Rs 4,651 crores and 35 lakh tonnes of foodgrains.

1.7 VALUE ADDITION

Post harvest losses in foodgrains have been reported to be about 10%. In some of the developing countries, these post harvest losses are much higher. The various factors contributing post harvest losses in foodgrains are moisture, temperature, insects, micro-organisms (fungi) and rodents. The losses are caused during harvesting, threshing, processing, storage, transportation and marketing.

One of the important methods to minimize these post harvest losses in foodgrains is to increase local value added food products by developing rural agro industries in the producing areas. These agro industries may be developed and managed at community level. Processing of food items in a form which has a longer shelf-life, better merchantability and thus adding value to the original crop helps the farmers and growers in reducing spoilage and post harvest losses.

Besides, the value added products fetch more price and can be safely transported to long distance urban and semi-urban markets. These value added products have also good prospects for export. Production of peanut butter, flour meal, papad, noodles corn flakes, puffed and beaten rice are some of the areas which are very useful for farmers as well as traders. The production of semi-processed food products may also be explored.

The Government and semi-government organizations provide technology, training as well as marketing facilities for such value added products. Thus, value addition of agricultural produce in the producing areas is one of the most efficient methods of post harvest management.

1.8 EXPORTS

Indian basmati rice is in great demand in USA, UK and gulf countries. At present, India is not having surplus wheat and the country is importing wheat from some countries. However, the economist and agriculture scientists are of the view that due to the continuous efforts made by the farmers and the Government, the production of wheat would increase sufficiently in future and India would be one of the major wheat exporting countries.

Quality-wise Indian wheat is similar to Australian wheat. Strict quarantine and pesticide residues are some of the impediment which discourages the export of foodgrains and their milled products. There is a great demand of organic foodgrains like basmati rice and durum wheat in Europe and America which are grown without

the use of chemicals and fertilizers. Some of the Indian farmers in Punjab, Haryana and Uttaranchal have started producing such organic foodgrains.

Ministry of Commerce had set up Agricultural and Processed Food Products Export Development Authority (APEDA) with a view to promote export of agricultural products as well as processed food items. The Authority provides information about foreign markets where there is demand of Indian basmati rice and other foodgrains. The Authority also provides information about the quarantine and pesticide residues standards prevalent in those countries.

Some of the Indian laboratories have been authorized to carry out these tests for export purposes for the benefit of exporters. A number of private Indian companies, including joint venture have set up their own Production and Processing Centres for the export of Indian basmati rice. Semi-processed basmati rice (brown rice without polishing) is also exported to U.K. and some other European countries from India. Some of the countries like UK provide subsidy on import of such semi-processed food items.

1.9 RURAL INDUSTRIALIZATION

Scientific and well planned post harvest management of foodgrains has vast scope for rural industrialization.

There are no proper and scientific storage facilities for foodgrains at farm level in the producing areas except in few States like Punjab and Haryana. Therefore, scientific rural godowns, individual and community level rural storage structures should be developed in the rural areas. Government of India has launched a scheme wherein individuals, unemployed youths, cooperative sectors are provided subsidy for construction of rural godowns and cold stores. Considerable storage capacity has been created under this scheme. Large number of unemployed youth have got employment in construction of these storage structures. Further, employed youths after proper training may be deployed in maintenance and operation of these small rural godowns.

Similarly, small rice mills, dal mills, parboiling plants, puffed rice and beaten rice plants may be set up in rural areas with the financial assistance of banks, cooperative societies and other organizations. Ministry of Food Processing Industries, Ministry of Agro Industries and Ministry of Agriculture provide technical training and incentives for setting these agro based industries. The State Governments also provide financial and technical assistance to unemployed rural youths to set up such industries in the villages. These rural industries may solve the problem of unemployment in villages and migration of rural population to urban areas may be checked. Keeping in view the importance of agro industries, the Government of India has set up a separate Agro Industries Ministry.

Check Your Progress 2

- Note:** a) Use the spaces given below for your answers.
b) Check your answer with those given at the end of the unit.

1. How efficient post harvest management helps in employment generation?

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2. What is the way to avoid losses in foodgrains and how value addition helps in increasing their shelf life?

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3. Which is the important cereal grain exported from our country?

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1.10 BENEFITS OF POST HARVEST MANAGEMENT

Efficient post harvest management involves using improved and scientific technique in harvesting, threshing, cleaning, grading, processing, handling, storage, transportation and marketing of foodgrains. High temperature during storage, high moisture content, insects and fungal infestation and damage during handling (packaging, storage & transportation) are the main causes of post harvest losses in foodgrains and other agricultural produce. Stored grain insect pests also cause quantitative and qualitative losses in foodgrains during storage. The benefits of an integrated efficient post harvest management are as follows:

- i) Storage and transit losses in foodgrains and their milled products are reduced.
- ii) Storability of foodgrains is increased.
- iii) Quality of the foodgrains and their milled products is maintained.
- iv) Farmers/growers/traders get higher market price of their agricultural produce.
- v) Availability of foodgrains and milled products is increased.
- vi) Post harvest operations including value addition generates employment in the rural and semi rural areas.
- vii) Merchantability of the foodgrains and milled products is increased.
- viii) Efficient post harvest management provides food security.
- ix) Nutritional requirement of population from cereals and pulses are met.
- x) Surplus foodgrains may be exported which can earn foreign exchange required to import advance technology.
- xi) The farmers/growers may store their foodgrains in scientific godowns/ warehouses at time of glut in the market and sell them in the off season at higher prices.

1.11 LET US SUM UP

Efficient and appropriate post harvest management involves use of improved and scientific code of practices in handling, grading, drying, processing and storage and transportation of foodgrains. Considerable losses are caused in foodgrains due to inefficient post harvest management. The post harvest losses in foodgrain have been estimated to be about 10%. Temperature, moisture, insects, rodents, birds and moulds are main causes of past harvest losses in foodgrains. Temperature may be

reduced by aeration of foodgrains and high moisture may be reduced by drying techniques.

Stored grain insect pests which cause, both quantitative and qualitative losses, may be controlled by using effective prophylactic chemicals such as Malathion 50% EC, Deltamethrin 2.5% WP and fumigants like Methyl bromide and aluminium phosphide (phosphine) at recommended doses. The treated grain should be properly aerated after fumigation and cleaning of grain bags should be carried out to remove the residual part of fumigant.

The processed food items may be transported safely to long distances urban markets. Besides, their shelf-life and merchantability are increased and framers/growers get better price of their produces. High quality value added foodgrains may also be exported. The farmers can store their foodgrains in scientific godowns and warehouses set up in the rural areas at the time of glut in the markets and sell them in the off season when prices are higher.

An integrated efficient post harvest management has several benefits such as storage and transit losses are minimized, storability is increased, quality of the foodgrains and their milled products is maintained, their merchantability is increased, farmers/traders get higher market price of their agricultural produce and availability of foodgrains and milled products is increased. Besides, value addition of foodgrains (cereals and pulses) generates employment in the rural and semi rural areas.

The most important advantage is that efficient post harvest management provides food security and nutritional requirements. By exporting surplus food grains and milled products, foreign exchange may be earned. The Indian basmati rice is in great demand in UK, Europe and several gulf countries.

Check Your Progress 3

Note: a) Use the spaces given below for your answers.
b) Check your answer with those given at the end of the unit.

1. What are the benefits of good post harvest management?
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2. What are the methods of reducing temperature and moisture in foodgrains?
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3. What is the role of moisture in safe storage of foodgrains ?
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1.12 KEY WORDS

- Post Harvest Management** : The threshing, cleaning, grading, cooling, drying, handling, processing, storage and marketing is known as post harvest management.
- Cereals** : The foodgrains such as wheat, paddy, rice, maize barley bajra are known as cereals
- Aeration** : Circulation of forced or natural ambient air in grain mass to reduce its temperature.
- Safe moisture** : The upper limit of moisture of a commodity on which it can be stored safely.
- Food availability** : The accessibility to food and is measured in term of kilogram of food available/consumed per person per year.
- Nutritional Security** : The required nutritional intake in terms of kilocal per day per person

1.13 SOME USEFUL REFERENCES

1. Handling and Storage of Foodgrains in Tropical and Sub Tropical Area. FAO Plant Protection and Plant Production Series by DW Hall, 1970. Published by FAO Rome Italy. 350 pages
2. Manual of Fumigation for Insect Control. FAO Agricultural Studies No.79. FAO Plant Production & Plant Protection Series No. 20 by HAU Monro, 1961. Published by FAO Rome Italy.

1.14 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1. The harvesting, cleaning, grading, cooling, processing, storage, packaging and the marketing of foodgrains at the time of harvest and after harvesting upto consumption is known as Post Harvest Management.
2. The post harvest losses in foodgrains are about 10% in India.
3. Food availability is directly related to food output or food production. If food production is more, then more food is available/ accessible to the people in that region.
4. Nutritionally, about 59.0% of total calories, 58% of total protein and 13% of total fats are derived from cereals alone.

Check Your Progress 2

1. Unemployed young people in the villages may be engaged in construction, maintenance and operation of rural godowns, cold stores, in the fabrication of storage structures for foodgrains, in the processing of paddy into rice and dal milling.
2. Value addition of foodgrains such as cereals and pulses are the ways to minimize losses in foodgrains and to increase their shelf life.
3. Basmati rice is the main cereal which is exported from our country.

Check Your Progress 3

1. An integrated and efficient post harvest management has several benefits such as storage and transit losses are minimized, storage period is increased, quality of the foodgrains is maintained, their merchantability is increased, farmers/traders get higher market price of their agricultural produce and availability of foodgrains is increased.
2. Aeration by introducing forced or natural air of ambient temperature is used for reducing the temperature of grain. Drying techniques by using mechanical dryers are used to reduce the moisture content of foodgrains during storage and processing.
3. High moisture spoils the foodgrains rapidly during storage and attracts the insects and moulds to further degrade their quality and quantity.