

Enhancing Post-Harvest Management and Improving Market Access for Agricultural Sustainability

¹Hardik Tolani

Student, , BBA 4th semester [2024-2025],

Faculty of Management Studies

National P.G. College, Lucknow, India

Abstract

This chapter provides the basic knowledge of post harvesting and management part of it also. The new technologies used or new technique used for post harvesting and also for market reach or could be said as market access of agriculture products. These two topics comes hand in hand as post-harvest management covers the transportation or the access to the market for the sustainable agricultural products. As we all understand, that agriculture is the backbone of our country (sectors contribution to India's GDP is approx. 18 to 19 percent, not only that it is also the supports the livelihood of India about 42 percent approx. and these numbers have increased time to time and the estimations to the future for the contribution to country's growth is also increasing). Not only the agriculture creates the direct impact but the indirect impact on the people who are working in the area of harvesting and for agriculture sector.

Generally, there are drawbacks in everything, so in the process of harvesting. Mainly, there are three stages to it first is simply the harvesting of the product (which is also pre harvesting) and then there is post harvesting (here comes the whole management part of the products harvested and the managing part is different for every product category) and the third is value addition products which will discussed further, so the drawback could lie in any stage, examples the harvesting is done at wrong time or losses mainly occurs in post management where washing, cleaning, wrapping, transporting, etc. are not done properly. This is hindering the growth of the sector and the losses are also impacting the lives of the people involved in it.

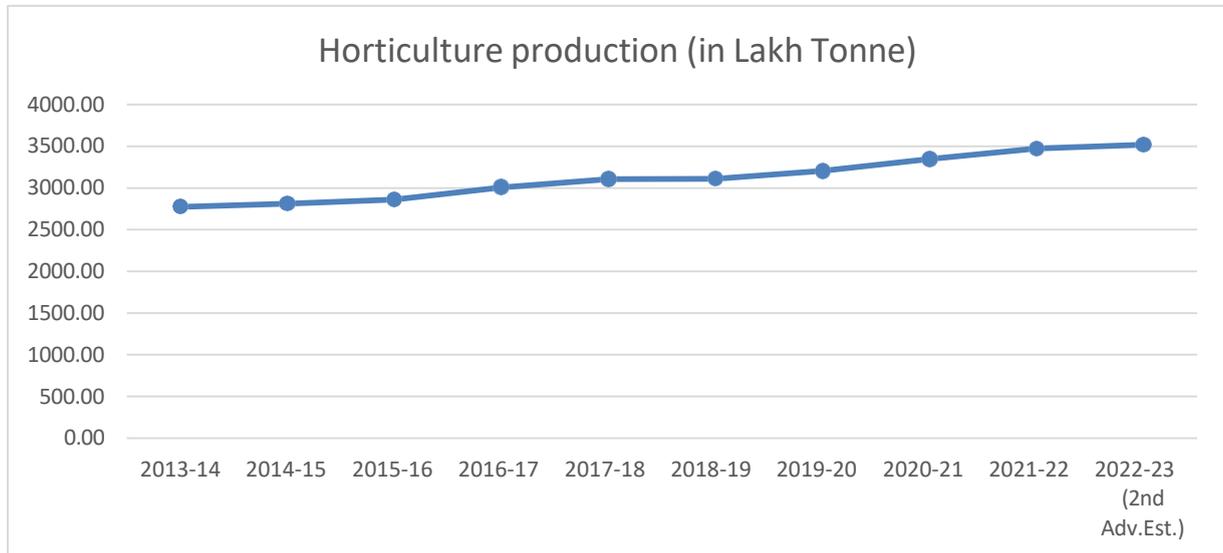
Keywords: Post-harvest loss, horticulture products, shelf-life and technology

Introduction

In India horticulture products and fruits both are largely exported as well as imported very much. And that questions why are we importing horticulture products and fruits, there could be many factors and reasons to this, but mostly the production happening in India is not upto it's mark as fruits and vegetables are the basic needs of the human. Then why it is not upto the mark? The main answer could be the losses from any of the three stages which were mentioned above.

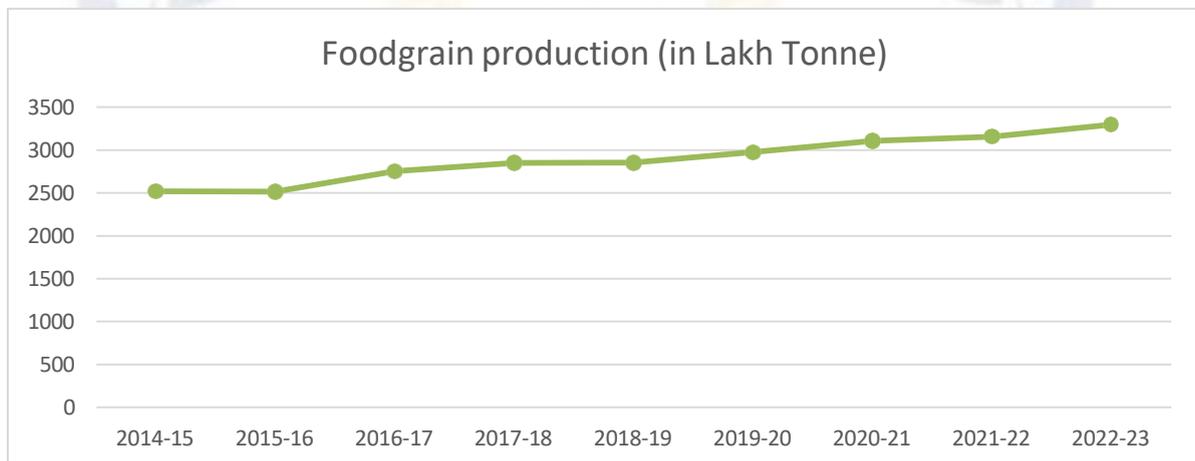
Before we understand the post harvest management we need to know the background also, means how much production is happening year on year in a span of ten years, of horticulture products and foodgrains production. As shown in fig 1 and 2 there is increase in production level of horticulture products and foodgrains which is immensely contributing to the growth of the country and also helping in the growth of the people involved in this agriculture sector (farmers, intermediaries and companies involved in post harvest management)

Figure 1: It tells horticulture production during the last 10 years



Source: combined by authour from static.pib.gov.in

Figure 2: It tells foodgrain production from 2014-15 to 2022-23



Source: combined by authour from static.pib.gov.in

So, post-harvest involves steps which are vital for the products freshness and shelf life. These steps involved in it varies from product to product and also on the pre harvest tings which are done (like time of harvesting, tools used during harvesting, some pre cooling techniques for the products to improve the storage quality, the ripping of the products). In simple words post-harvest management is the process which involves: **sorting/trimming and grading** (these two steps of sorting and grading are very important as it eliminates the low graded products which could stop it for reaching to the end consumer, here there have been many advancements in the technology part to find out the best or proper quality of product for the further post-harvest steps), washing, coating, polishing, packing, transporting and storing. These steps could help in reducing the losses of the products as well as in the monetarily terms.

Post harvest loss is a big issue, as most people do not know about the post-harvest

management or techniques or technologies used in it, which is wholly jeopardizing the sector and also the farmers, as there will be less supply from them or the products will be not up to the mark for the further selling or usings at the first place. Mostly farmers do not know about the techniques and technologies used in it and if they know about it they do not have the financial stability to acquire it. The researches have shown that there is 20-30 percent loss yearly by not doing the proper post-harvest management. There is also the loss in the time and initial money involved by the farmer. The factors involving these losses could be: not grading properly the fruits and vegetables, not polishing or coating which could result in less shelf-life, not packing properly with the suitable products used for those particular fruits and vegetables, not storing at a particular temperature also not in suitable containers or storing facilities and not transporting properly and not at proper time.

To recover these losses there have been advancement in the technology side, but there should be more focus on educating the people in the post-harvest management process and steps involved in it and support the small farmers. This educating thing should be done in a very smart way as mostly the people are rigid in taking up the new further steps in the harvesting. Farmers should feel safe and satisfied by insuring them that this is good for them only and by increasing few more steps after the harvesting their losses will reduce significantly.

One of most important steps after which is done only one percent approx. (researches have shown) is value addition in the products. In simple words value addition of any horticulture product means the products which are semi-finished those products are used for further making of: Jams, jelly, marmalade, sauces, syrups, etc. Basically, by value addition we can get diverse product range, there will be reduction in waste, also the shelf life will increase. Overall, there will be enhancement in the quality of the products and indirectly would increase the employment.

Enhancement in post-harvest management

Post-harvest is the phase which comes just after harvesting a crop, this phase mainly includes: cleaning, sorting and grading, precooling, packing, storing and transporting. These steps affect the freshness of the product and the nutrition it carries, the quality and the flavor of the product.

Cleaning, sorting and grading

First and foremost, step is cleaning the products, in which it removes the dirt, sand or stones from a product. Researches have also shown that chlorine is one of the best agents to perform the cleaning process. Sorting is the process separating the homogenous products and differentiating them for there size, shape and colour, here also there is advancement in the technology where fruit sorting algorithm is designed with fruit detection and a robotic arm which is sorting the products.

Further, grading is done of these sorted products on the bases of its physical parameters, this saves most of the work in handling the products, here new technologies have played an important role where size grading, weight grading, screen grading and electronic colour grading, which is mostly expensive, are used now for more accurate and effective grading. More in this, mobile grading machine system has been developed for citrus fruit grading, here

the data is collected on crops like fruit yield, diameter, and sugar content of fruit. Lastly, machines with machine vision systems, who also collects and store data on fruit quality and stored in the databases.

Precooling

In this stage as the name itself says that the cooling of the horticulture products is done immediately as of to increase the shelf life by transfer of the heat of products with the mediums such as cold air, ice, cold water, etc. and by other technical processes. Involvement of pre-cooling systems which utilise mechanical refrigeration, electric-based cooling. Overall, there are many ways of changing the temperature and creating an environment which are reduces the respiration rate and also lowers different physiological activities which is best for the farmers as well as consumers. There are also many cost-effective ways of pre-cooling techniques and also there are advancements like; Solar chiller, Hydro-cooling, Portable forced-air cooling, ColdBot-equipped cold room, etc. Also depending upon the type of fruit or crop the technique is selected.

Packaging

Any default in this stage can damage the product. This process is done to collect homogeneous products, then to further it is easy in the storing and transportation process. Also, it helps to protect it from tampering or contamination from physical, chemical and biological sources. Here also it helps to increase the shelf-life and to market it to further customers. There are many ways of packing a product for further use, mostly there are mainly chemical reactions take place in this process to take the most effective outcome from it. There are methods of active packaging which contains;

Oxygen Scavengers, is the technique or tool or the process of limiting or removing the contents of oxygen form the packed part of the food. This is done because products get spoiled in the natural environment from which it can decrease the vitamins from the crops or fruits. The technique which is used is by creating a vacuum and sealing it and filling it with other gases like nitrogen and carbon dioxide. Disadvantages are this very time consuming and could be costly for most of the people, also it could not be used for each and every product before using this technique the user should know the characteristics and features of the product and after reaction of this process, is it harmful for the crop or not?

Carbon Dioxide Generating System, by using Carbon Dioxide, the growth of microbes (germs) is suppressed, by using is by 60-80% of Carbon Dioxide. Drawback of it is that it could alter the taste of the product, but it could increase the shelf-life of the product.

(iii)*Ethylene Scavengers*, another method to keep up the freshness and increasing the shelf-life. Here, the ethylene is stopped from ripping a fruit or a vegetable by two methods, one is by using potassium permanganate which oxidises the ethylene and gives out Carbon Dioxide and little water. This chemical couldn't be used directly because it is toxic for edible foods. Another method is using special plastic films Low-Density Polyethylene (LDPE) or High-

Density Polyethylene (HDPE) which absorb ethylene and also could eliminate the bad odours.

Antimicrobials, another way of eliminating of germs (bacteria, fungi, viruses) or spoiling from them. Here, antimicrobial packaging is used where sachets are put which releases antimicrobial agents, or coating is done named as antimicrobial layer, which stops the bacteria to increase, or by mixing antimicrobial chemicals such as Carbon Dioxide, Sulphur Dioxide, Chlorine Dioxide, Organic Acids (Sorbic, Benzoic, Propionic Acid, etc.), Essential Oils (Tulsi, Neem, Laung Ka Tel, etc.).

Intelligent Packaging, making packaging more smartly, like packaging which tells time-temperature indicators, seal and leak indicators, freshness indicators or ripening indicators, by using advance technology and by indicating change in the chemicals, this method is used.

Storage

After harvesting, the fruits or the crop still could change and ripe itself until it got proper environment in which there is right temperature for that particular product which is necessary for it to not to damage itself. There are many types for storing which could be used and could effective for the farmer and increase the shelf-life. Also, without using any chemicals this process could be done. One of most popular and cost-effective technique is Zero Energy Cool Chamber (ZECC), where just by creating a structure of bricks and then putting water on that structure can reduce the temperature, prominent for the harvested products. These structures are mostly made where there is little breeze with a shade.

Some other artificial methods are Controlled Atmosphere (CA) Storage; where their usage of carbon dioxide and less of oxygen for making their shelf-life to increase. Also, there is Refrigerated Storage where by reducing the temperature the biological process by harvested products could be slowed down. At last, there are also some common storing techniques where clamps, cellar or above ground warehouses are built.

Transportation

This is the step where most post-harvest losses take place, there could be many factors to it like; poor infrastructure or improper loading and unloading procedures or could be any other human error, as supply chain one of the most complex parts. Involving handling and transferring from one place to another, here the reduction of the losses could be proper contact with the middle men and techniques used by them, like the style of stacking or which route they will cover at a particular time period also to meet off the demand, or what kind of vehicle is used and external factors like the path from where they are crossing there temperature and conditions of the roads, as mostly transportation is done on land. This is also connected with agriculture sustainability.

Improving Market Access for Agricultural Sustainability

For improving market access there have been many advancements technologically,

cooperative wise and also polices by government (programs launched by them). Corporations have been built up like Horticultural Producers' Cooperative Marketing and Processing Society who are helping the farmers in many ways. There have been many programs set up by government like; Country Programming Framework (CPF), where; smallholder farmers are been helped out in many ways, their targets were to reduce post-harvest loss and enhancement in the production and also educating the farmers as well, and they have achieved their target significantly. Also there have been improvement in farmer cooperatives from where farmers are having bargaining power. Digital platforms like; Hyperpure provide ingredients directly from farmers and suppliers. At last, contract farming is profitable for small farmers in every part of India.

But for real sustainability in agriculture there should real connect with the farmers and educate them the advancement taking place in their field and how take the benefit from it, as they could be ridge in changing their methodologies and techniques used earlier.

Conclusion

This paper provides the basics of the post-harvest management. Starting from the productions of the horticulture products in a decade and related to that their losses which is a big problem. Further, the discussion of the step-by-step process of post-harvest management, where the goal was to increase the shelf-life of the harvested product and methods related to them and also how there is advancement in the technological part in this sector, from the use of which there could be more helpful for both producer and buyer and could be more cost-effective.

References

1. Kulkarni, S. D., & Dhupal, C. V. (2022). *Chapter 6: Post-Harvest Management*. In R. N. Kharbikar (Ed.), *Innovative Agriculture for Farmers' Prosperity* (pp. 66–79). Agrotech Publishing Academy.
2. Patil, K. A., & Das, A. K. (2024). Business intelligence in e-commerce: A systematic literature review. *International Journal of Future Generation Communication and Networking*, 17(2), 54–58.
3. Kandpal, S., Singh, A., Sharma, S., & Pandey, P. (2022). *Comparative analysis of feature reduction techniques in microarray data using machine learning techniques*. *Bulletin of Electrical Engineering and Informatics*, 11(5), 2594–2602.
4. Thakare, H. G., Baheti, D. G., & Wadaskar, P. M. (2021). *Grader: A review of different methods of grading for fruits and vegetables*. *International Research Journal of Modernization in Engineering Technology and Science*, 3(3), 1407–1411.
5. Battineni, G., & Sharma, R. (2023). *Exploring consumer's adoption of mobile payments – A qualitative study*. *Journal of Innovation and Entrepreneurship*, 12(1), Article 17.
6. Dandamrongrak, R., Young, G., & Mason, R. (2002). Pre-cooling systems for small-scale producers. *Postharvest Handling: A Systems Approach*, 403–423.
7. Soares, N. de F. F., Silva, L. H. M., & Piccoli, R. H. (2009). Active packaging in food industry: A review. *Brazilian Journal of Food Technology*, 12(2), 119–132.
8. Pandey, S., & Vishwakarma, A. K. (n.d.). *Storage methods for fruits and vegetables*.

9. Friedman, M. (1970). *The social responsibility of business is to increase its profits*. The New York Times Magazine, September 13, 1970.
10. Kumari, S., & Dhingra, D. (2024). *Post-Harvest Management of Fruits in India: A Review*. Journal of Agricultural Engineering (India), 61(2), 181–201
11. <https://egyankosh.ac.in/bitstream/123456789/11928/1/Unit-8.pdf>
12. https://www.agricorn.in/2023/08/post-harvest-processing-fruits-vegetables-importance.html#google_vignette
13. <https://openknowledge.fao.org/server/api/core/bitstreams/3f6f5ce5-3cb0-4b77-b177-ea36faa2315f/content>
14. <https://openknowledge.fao.org/server/api/core/bitstreams/b97e9839-f501-4e2c-ad71-36bc28e428bd/content>
15. <https://www.technoserve.org/fight-poverty/projects/12917-2/>
16. <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/dec/doc20231212285001.pdf>
17. <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/dec/doc20231212285201.pdf>
18. [file:///D:/Downloads/Sawicka2020 Reference WorkEntry Post-harvestLossesOfAgricultur.pdf](file:///D:/Downloads/Sawicka2020%20Reference%20WorkEntry%20Post-harvestLossesOfAgricultur.pdf)
19. <https://factly.in/data-major-vegetable-fruit-production-in-india-increased-over-the-years-while-trends-vary-in-major-producing-states/#:~:text=India%20is%20the%20second%2Dlargest,production%20grew%20by%2032%25%20nationally.>
20. <https://repository.unescap.org/bitstream/handle/20.500.12870/4232/ESCAP-2015-PB-Post-harvest-management-sustainable-agriculture.pdf?sequence=1&isAllowed=y>
21. <https://rvsagri.ac.in/modules/academics/timetable/HOR%20311.pdf>
22. <https://link.springer.com/article/10.1007/s00170-009-2411-2>
23. <https://www.grainpro.com/better-post-harvest-management#:~:text=Post%2Dharvest%20management%20is%20a,drying%20and%20fermenting%20as%20well.>