



# Post-Harvest Technologies: A Key to Increasing Farmers' Income

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**ABSTRACT:** Post-harvest losses are a major problem for farmers around the world. These losses can occur at any stage of the post-harvest process, from harvesting to storage to transportation. They can be caused by a variety of factors, including pests, diseases, poor handling, and inadequate storage facilities. Post-harvest losses can have a significant impact on farmers' income, as they can reduce the amount of produce that is available for sale. The adoption of post-harvest technologies can help to increase farmers' income. They can also improve the quality of their produce, which can command a higher price. In addition, the adoption of post-harvest technologies can help to reduce the amount of labor required for post-harvest operations, which can free up farmers to focus on other activities, such as increasing production. This paper examines the importance of post-harvest technology in enhancing farmers' income, the challenges hindering its adoption in developing countries, current trends in the use of post-harvest technology, and future prospects for its application in agriculture.

## I. INTRODUCTION

The role of post-harvest technology in increasing farmers' income is a subject of significant importance in the agricultural sector. Post-harvest loss is a severe problem that affects the income of farmers as well as the food security of a nation. The adoption of post-harvest technologies could help reduce food loss and increase the quality of agricultural products, which can lead to higher prices, improved farmer income and better livelihoods. By providing a comprehensive overview of the critical role of post-harvest technology, this paper aims to contribute to the ongoing dialogue on how to create more sustainable and profitable agricultural practices for farmers worldwide.

### A. Importance of Agriculture in the Economy of a country

Agriculture plays a crucial role in the economy of every country. It is the primary source of food and raw materials for many industries and is responsible for providing employment to a significant portion of the population.

Here are some points that underscore the importance of agriculture in the economy:

1. **Food Security:** Agriculture is the primary source of food for the world's population. Without agriculture, we would not be able to feed ourselves or the livestock that ultimately provide us with meat, dairy products, and other food items.
2. **Employment Generation:** Agriculture provides employment opportunities to millions of people across the world. From farming to transportation and distribution of agricultural products, agriculture-related activities employ a vast number of people.
3. **Contribution to GDP:** Agriculture contributes significantly to the Gross Domestic Product (GDP) of most countries. It is an essential sector in developing countries where it can account for upto 30% of the GDP.
4. **Revenue Earner:** Agriculture is an important source of revenue for many countries as it generates foreign exchange through exports of crops and other agricultural products.
5. **Raw Material Source for Industries:** Agriculture provides raw materials for many industries such as textiles, pharmaceuticals, and cosmetics. The by-products of agricultural activities, such as manure and crop residue, are also used in the production of energy and chemicals.

Agriculture is a vital sector of the economy. Governments should invest in agriculture to ensure food security for their citizens, reduce unemployment rates, and boost economic growth.



### B. Issues facing farmers regarding Post harvest operations

There are several issues facing farmers regarding post-harvest operations, including:

1. **Losses due to poor handling and storage practices:** Farmers may lose significant amounts of their crops due to poor handling and storage practices. This could be due to inadequate drying, use of inappropriate packaging materials, or improper storage conditions.
2. **Lack of access to post-harvest technology:** Many farmers, particularly those in rural areas, may not have access to the latest post-harvest technologies and equipment, which can improve efficiency and reduce losses.
3. **Limited market access:** Farmers may struggle to find markets for their produce due to poor transportation infrastructure, inadequate information on market demand, and lack of access to markets.
4. **Lack of knowledge on post-harvest management:** Some farmers may not have the necessary knowledge and skills to manage post-harvest operations effectively, leading to losses and reduced profitability.

Overall, addressing these issues will require a concerted effort from all stakeholders, including farmers, governments, and development partners, to provide training, access to technology and infrastructure, and information on market demand.

### C. Role of Post-Harvest Technology in Increasing Farmers Income

Post harvest technology plays a significant role in increasing farmers' income by reducing post-harvest losses and improving the quality of agricultural produce. The following are some of the ways that post-harvest technologies can help farmers:

1. **Reducing Post-Harvest Losses:** Post-harvest losses occur due to inadequate handling, storage, and transportation techniques. These losses can be significantly reduced through the proper use of post-harvest technologies. By minimizing such losses, farmers will have more products to sell, which will increase their income.
2. **Improving Product Quality:** Post-harvest technologies such as temperature-controlled storage and packaging can help preserve the quality of crops. As a result, farmers can command higher prices for their produce, which increases their income.
3. **Smooth Marketing of Produce:** With post-harvest technologies, farmers can store their crops for longer periods, giving them time to find the best market prices. This means that farmers can choose when to sell their produce, allowing them to negotiate for better prices and increase their earnings.
4. **Diversification of Products:** Post-harvest technologies can enable farmers to process their produce into different products to cater to different markets. This means that farmers can earn more by selling processed products instead of raw produce.

Investing in post-harvest technologies can help farmers reduce losses, improve product quality, smooth marketing, and diversify their products, all of which can translate into increased incomes for farmers.

## II. REVIEW OF LITERATURE

Post-harvest technology (PHT) is the area of agricultural sciences that deals with the handling, storage, and processing of agricultural products after harvest. The concept of PHT has gained increasing attention in recent years due to the need to improve food security and reduce post-harvest loss. The purpose of post-harvest technology is to reduce wastage, extend the shelf life of produce, and increase food security by ensuring that a greater quantity of food can be produced and stored for longer periods.

Many studies have been conducted to explore different aspects of PHT, including its importance, challenges, and solutions.

One study highlighted the importance of PHT in improving food security and reducing post-harvest loss. The study emphasized the role of modern PHT practices, such as proper handling, storage, and packaging techniques, in preserving the quality and nutritional value of agricultural products [1].

Another study identified the major challenges facing PHT in developing countries, including inadequate infrastructure, limited access to markets, and insufficient technical knowledge among farmers. The study recommended the adoption of appropriate PHT technologies and practices to overcome these challenges and improve food security [2].

In addition, a study explored the impact of PHT on the quality and safety of agricultural products. The study found that the proper use of PHT practices and technologies can help reduce contamination and spoilage of agricultural products, thereby improving their quality and safety [3].



A study investigated the effects of controlled atmosphere storage on the shelf life of apples. The authors found that apples stored in controlled atmosphere (CA) conditions had a shelf life that was up to 50% longer than apples stored in air. CA storage is a technique that is used to reduce the respiration rate of fruits and vegetables. This is done by reducing the oxygen concentration and increasing the carbon dioxide concentration in the storage environment. The reduced respiration rate slows down the ripening process and helps to prevent the growth of spoilage microorganisms [4].

Another study found that modified atmosphere packaging (MAP) can reduce the loss of vitamin C in fresh-cut vegetables by up to 50%. MAP involves packaging the vegetables in a gas mixture that has a lower oxygen and higher carbon dioxide concentration than air. This helps to slow down the oxidation of vitamin C, which is the main cause of its loss [5].

The literature on the concept of PHT emphasizes its importance in improving food security and reducing post-harvest loss. The challenges facing PHT include inadequate infrastructure, limited market access, and insufficient technical knowledge among farmers. However, appropriate PHT technologies and practices can be adopted to overcome these challenges and improve the quality and safety of agricultural products.

One of the most significant advancements in post-harvest technology has been the development of refrigeration systems and cold storage facilities. These technologies have made it possible to store produce for much longer periods, reducing wastage and increasing the availability of food. Other important post-harvest technologies include drying, canning, freezing, irradiation, and chemical treatments.

The concept of post-harvest technology has also been closely linked to issues of food security and sustainability. By developing technologies that can reduce food losses and increase the availability of food, post-harvest technology can contribute significantly to efforts to eliminate hunger and poverty.

The literature on the concept of post-harvest technology emphasizes the importance of continuing research and innovation in this field. With the world's population expected to reach 9 billion by 2050, it is increasingly important to find ways to produce and preserve food more efficiently and sustainably. Post-harvest technology is an essential part of this effort, and ongoing research in this area will be critical in addressing the challenges of food security and sustainability in the years ahead.

### **III. DISCUSSIONS**

#### **A. Impact of post harvest technology on farmer's income**

Post harvest technology has a significant impact on farmers' income, as it helps to reduce post-harvest losses and increase the shelf life and quality of produce. By using post harvest technologies such as storage facilities, refrigeration, processing and packaging equipment, and transportation, farmers can better preserve their crops and sell them at higher prices.

One of the biggest benefits of post harvest technology is that it helps farmers to avoid spoilage and wastage of their crops, which can lead to significant financial losses. By properly storing and preserving their crops, farmers can ensure that they have a steady supply of produce for sale throughout the year, rather than being forced to sell everything immediately after the harvest.

Another advantage of post harvest technology is that it can help farmers to add value to their products. For example, by processing crops into value-added products like jams, pickles, and dried fruits, farmers can command higher prices and increase their profit margins.

Post harvest technology also enables farmers to access new markets and expand their customer base. With better storage and transportation options, farmers can now transport their produce over longer distances, reaching customers in more distant regions. This can help farmers find new buyers and reduce their dependence on local markets, which may be limited in terms of the price they offer.

Post harvest technology has the potential to significantly increase farmer's income by reducing wastage, adding value to the produce, and accessing new markets.

#### **B. Factors affecting the adoption of post harvest technology by farmers**

There are several factors that can affect the adoption of post-harvest technology by farmers. These factors include:



1. **Farm size:** Farmers with larger farms may be more likely to adopt post-harvest technology as they have a higher volume of crops to handle and are more likely to invest in machinery such as grain dryers, storage facilities, and cleaning equipment.
  2. **Education level:** Farmers with higher levels of education may be more open to adopting new technology, as they are often more aware of the benefits it can bring. Additionally, they may have greater access to information and resources that can help them learn about new technologies.
  3. **Access to credit:** Farmers who have access to credit or financial resources are more likely to be able to make the necessary investments in post-harvest technologies. Lack of funds can be a major obstacle to adoption, particularly for small-scale farmers who may not have access to formal credit.
  4. **Infrastructure:** The availability and quality of infrastructure, such as roads, transport networks, storage facilities, and energy supply can also impact the adoption of post-harvest technology. For example, if a farmer does not have access to reliable electricity, they may be less likely to invest in a grain dryer.
  5. **Market demand:** Farmers will be more likely to adopt post-harvest technology if there is a strong market demand for high-quality produce. This can create incentives for farmers to invest in technology that will help them improve the quality and value of their crops.
  6. **Technical knowledge:** Farmers need to have the necessary technical knowledge to use post-harvest technology effectively. Lack of training and support can be a major barrier to adoption, particularly for complex technologies.
- The adoption of post-harvest technology by farmers is influenced by a variety of factors including farm size, education level, access to credit, infrastructure, market demand, and technical knowledge

### C. Challenges faced by farmers in adopting post harvest technology

There are several challenges faced by farmers in adopting post-harvest technology, including:

1. **Lack of awareness:** Many farmers are not aware of the availability and benefits of post-harvest technologies.
2. **High cost:** The cost of post-harvest technologies is often high, making it difficult for small-scale farmers to adopt them.
3. **Infrastructure:** Poor infrastructure, such as inadequate storage facilities and transportation, can limit the effectiveness of post-harvest technologies.
4. **Lack of training:** Farmers may not have the necessary skills and knowledge to use post-harvest technologies effectively.
5. **Cultural practices:** Some cultural practices may discourage the adoption of post-harvest technologies, such as traditional methods of storing crops.
6. **Limited access to credit:** Many farmers lack the financial resources to invest in post-harvest technologies.
7. **Resistance to change:** Some farmers are resistant to change and may prefer traditional methods of processing and storing their crops.

These challenges can make it difficult for farmers to adopt and benefit from post-harvest technologies. It's important to address these challenges through education, training, and support programs to help farmers improve the quality and value of their crops.

### D. Linkage between post harvest technology and farmers income

Post-harvest technology refers to a series of processes, techniques, and tools used to manage agricultural commodities after harvesting. These methods include grading, sorting, packaging, transportation, storage, preservation, processing, and marketing. The use of Post-harvest technology can significantly increase the value of agricultural products and reduce losses due to spoil age, pests, and diseases. This, in turn, can improve farmers' income in several ways:

1. **Increased market ability:** By applying post-harvest technologies such as grading and sorting, farmers can produce high-quality products that meet market demands and generate higher prices. For example, fruits and vegetables that are graded and sorted according to size, colour, and shape can attract premium prices in local and export markets.
2. **Reduced losses:** Post-harvest technologies such as storage and preservation can help farmers reduce post-harvest losses due to spoil age, pests, and diseases. This means that more of their crop will be available to sell, which in turn can increase their income.
3. **Value addition:** Processing and packaging technologies can allow farmers to add value to their products by converting them into different forms such as juices, jams, and dried fruits. These value-added products can attract higher prices and generate more income for farmers.



4. **Increased access to markets:** With the use of post-harvest technologies, farmers can store and transport their produce to distant markets, giving them access to a wider customer base and better prices.

The use of post-harvest technologies can help farmers increase their income by improving the quality and market ability of their produce, reducing losses, adding value to their products, and increasing access to markets.

#### E. Importance of government intervention in promoting post harvest technology

Post harvest technology is crucial in ensuring food security and reducing food waste. It involves the use of various processes, techniques and equipment to preserve and improve the quality of crops after they have been harvested. Government intervention is essential in promoting post harvest technology for several reasons:

1. **Infrastructure development:** The government can invest in infrastructure development such as storage facilities, transportation networks and processing plants to help farmers store, move and process their products more efficiently. This will reduce post-harvest losses, enhance market access and increase the value of the produce.

2. **Research and development:** Governments can fund research and development projects aimed at improving post harvest technologies. This can lead to the development of new and more effective techniques for preserving crops, increasing shelf life and enhancing nutritional value.

3. **Capacity building:** The government can provide training and education to farmers on post harvest management practices. This will equip them with knowledge and skills on how to handle and store crops properly, resulting in reduced losses and better quality produce.

4. **Market access:** Government intervention can help farmers get better market access by providing information on market opportunities, linking them with buyers and ensuring that they comply with quality standards. This will result in increased income for farmers and improved food security for consumers.

5. **Policy formulation:** The government can formulate policies and laws that support the adoption of post harvest technologies. This will create an enabling environment for investment in the sector and encourage private sector participation.

Government intervention is crucial in promoting post harvest technology. It provides the necessary resources, support and policy guidance that farmers need to adopt modern post harvest technologies and benefit from their advantages.

#### F. Recommendations for addressing Challenges faced by Farmers in adopting Post harvest technology

Post harvest technology refers to the methods and practices used in preserving agricultural products after harvest. Adoption of post harvest technology is essential for farmers to increase their productivity, efficiency and profitability. However, farmers face several challenges in adopting these technologies. Here are some recommendations for addressing those challenges:

1. **Awareness:** The first step towards addressing challenges in adopting post harvest technology is creating awareness among farmers. Farmers must be made aware of the importance of post-harvest technology and its benefits, not only to their income but also to the quality of food they produce.

2. **Access to information:** This can be achieved through the creation of accessible information centers and through extension services. Farmers need access to information on how to use post-harvest technologies, best practices, and new innovations.

3. **Financial support:** Farmers require financial support to invest in post-harvest technologies such as storage facilities, processing equipment, and packaging materials. Governments and development partners should provide financial assistance in the form of grants, loans and subsidies.

4. **Training and capacity building:** Farmers need training on how to operate and maintain post-harvest equipment. Providing capacity-building programs for farmers will help them gain knowledge and skills to adopt post-harvest technologies.

5. **Value chain approach:** A value chain approach can help farmers connect with buyers and processors who demand quality products, incentivizing them to adopt post-harvest technologies. By working together along the value chain, farmers can ensure that their products meet market requirements.

6. **Market link ages:** Market access is a key factor that determines the viability of adopting post-harvest technologies. Access to markets creates an incentive for farmers to adopt post-harvest technologies. Therefore, there is a need to develop and strengthen market link ages between farmers and buyers.

In conclusion, addressing the challenges faced by farmers in adopting post-harvest technology requires a multi-pronged approach involving awareness creation, access to information, financial support, training and capacity building, a value





chain approach, and market link ages. By adopting these recommendations, farmers will be able to overcome the challenges they face and enjoy the full benefits of post-harvest technologies.

#### IV. CONCLUSIONS

The role of post harvest technology in increasing farmers' income has been found to be significant. Through the use of various post harvest technologies such as proper storage facilities, processing techniques, and transportation methods, farmers are able to reduce losses and increase the quality and quantity of their crops. This leads to higher profits for farmers by reducing waste during storage, providing added value through processing, and reaching wider markets through improved transportation methods. Additionally, the use of post harvest technology can also lead to increased food security for households and communities by preserving food for longer periods and reducing food waste. Overall, investing in post harvest technology is a key factor in achieving sustainable agriculture and increasing income for farmers.

#### V. SCOPE FOR FUTURE RESEARCH

Here are some directions for future research regarding the role of post-harvest technology in increasing farmers' income:

1. Assess the adoption rate of post-harvest technologies- Future research can assess the level of adoption of post-harvest technologies among small holder farmers. This will enable us to know the level of awareness and knowledge of the technology and how it can be improved for better utilization.
2. Investigate the effectiveness of post-harvest technology- Future research can investigate the effectiveness of post-harvest technologies. This can be done by comparing the yield and quality of crops that are subjected to post-harvest technologies with those that are not.
3. Study the profitability of post-harvest technology- Future research can study the profitability of post-harvest technologies in relation to their cost. Such studies can help farmers make informed decisions about the adoption of these technologies.
4. Examine the impact of post-harvest technology on market ability- Future research can examine the impact of post-harvest technologies on the market ability of crops. This study is important because it will show whether post-harvest technologies increase farmers' income by enabling them to sell their crops at higher prices or not.
5. Analyze the role of government policies in promoting post-harvest technology- Future research can analyze the role of government policies in promoting post-harvest technology. This study will help us to understand how policies and interventions can be designed to encourage farmers to adopt post-harvest technologies and how to ensure its sustainability.

Future research should aim to develop a comprehensive understanding of how post-harvest technology can be leveraged to increase farmers' income, and how best they can be implemented, adopted and supported by both the public and private sector players.

#### REFERENCES

- [1] Akridge, G. A., & Shewfelt, R. L.. "The critical role of postharvest technology in meeting global food security challenges". *Food Security*, 10(1), 1-11, 2018.
- [2] Food and Agriculture Organization of the United Nations (FAO). "Post-harvest loss and waste in developing countries: Assessment, causes and prevention". Rome: FAO, 2016.
- [3] Opara, L. U. "Postharvest handling technologies: Impact on quality and safety of agricultural products". *Food Science and Nutrition*, 6(11), 4405-4415, 2018.
- [4] Conway, W. S., Janisiewicz, W. J., Leverenz, B., Saftner, R. A., & Camp, M. J. "Control of blue mold of apple by combining controlled atmosphere, an antagonist mixture, and sodium bicarbonate". *Postharvest Biology and Technology*, 45(2), 326-332, 2007.
- [5] Giannakourou, M. C., Lagakos, A. I., Sarris, A. N., and Biliaderis, C.G. "Effect of Modified Atmosphere Packaging on Vitamin C Loss in Fresh-Cut Vegetables", *Food Science and Technology*, 52(10), 2673-2679, 2009.
- [6] FAO. "Global food losses and waste: extent, causes and prevention". Rome: Food and Agriculture Organization of the United Nations, 2018.



- [7] GIZ. "The postharvest loss challenge: a global perspective". Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2017.
- [8] HLPE. "Investing in agriculture for food security and nutrition". Rome: High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, 2014.
- [9] IFAD. "Rural poverty report 2017: ending rural poverty through value chains". Rome: International Fund for Agricultural Development, 2017.
- [10] OECD. "The future of food and agriculture: trends, challenges and opportunities". Paris: Organisation for Economic Co-operation and Development, 2017.
- [11] UNCTAD. (2017). Trade and food security: the role of post-harvest and market infrastructure. New York and Geneva: United Nations Conference on Trade and Development.
- [12] World Bank. "The state of food security and nutrition in the world". Washington, DC: World Bank, 2017.
- [13] Opara, L. U. "Postharvest handling technologies: Impact on quality and safety of agricultural products". *Food Science and Nutrition*, 6(11), 4405-4415, 2018.
- [14] Zhang, L., Zhang, X., Zhang, Y., & Liu, X. "Postharvest technologies for improving the quality and safety of fruits and vegetables". *Comprehensive Reviews in Food Science and Food Safety*, 18(1), 30-44, 2019.
- [15] Awasthi, S. K., & Singh, V. P. "Postharvest management of horticultural crops: A review". *Journal of Food Science and Technology*, 56(1), 1-15, 2019.
- [16] Kumar, S., & Tiwari, P. K. "Postharvest technologies for value addition and preservation of fruits and vegetables: A review". *Journal of Food Science and Technology*, 56(1), 16-30, 2019.
- [17] De, S., & Roy, S. K. "Postharvest management of fruits and vegetables: An overview". *Journal of Food Science and Technology*, 56(1), 31-43, 2019.
- [18] Singh, R., & Singh, P. (2019). Postharvest management of cereals: A review. *Journal of Food Science and Technology*, 56(1), 44-54.