CCP:BA/TF 05/12

E

July 2005

منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Organización de las Naciones Unidas para la Agricultura y la Alimentación

COMMITTEE ON COMMODITY PROBLEMS

INTERGOVERNMENTAL GROUP ON BANANAS AND TROPICAL FRUITS

Fourth Session

Guayaquil, Ecuador, 19 – 23 September 2005

POST-HARVEST HANDLING LOSSES

Table of Contents

	Paragraphs
I. INTRODUCTION	1 - 2
II. THE BASICS OF POST-HARVEST TECHNOLOGY	3 - 5
III. POST-HARVEST LOSSES	6 - 8
IV. RECENT ADVANCES IN POST-HARVEST TECHNOLOGY	9 - 15
V. CONSTRAINTS IN IMPLEMENTING POST-HARVEST PRACTICES	16
VI. CONCLUSIONS	17 - 18

W0000

I. INTRODUCTION

1. Considering that tropical fruit prices have generally been on a downward trend as supplies expanded, and supply chain management optimized, the Sub-Group on Tropical Fruits, requested that the impact of post-harvest losses be examined. As an initial step, this document has been prepared in collaboration with the Tropical Fruits Network (TFNet) to outline the various issues in post-harvest handling of tropical fruits that impact on the growers' economic returns. The Sub-Group is requested to clearly define priorities for researching the economic impact of post-harvest handling losses of tropical fruits, and their implications for trade and food security.

2. The world production of tropical fruits in 2004 was estimated at 67.7 million tonnes, of which 98 percent was produced in developing countries. The major tropical fruits produced and traded included mango, pineapple, avocado and papaya, while minor fruits included rambutan, longan, mangosteen, lychees (litchis), carambola, passion fruit and guava. While the tropics possess an astonishingly vast and diverse number of species of edible fruits, the climatic conditions also tend to hasten spoilage and quality, especially during the period after harvest. Most tropical fruits have a limited post-harvest life or shelf life due to their high perishability. Post-harvest losses in all crops may be due to mechanical, physiological or pathological factors and weak post-harvest technologies can further exacerbate this problem.

II. THE BASICS OF POST-HARVEST TECHNOLOGY

3. The main objectives of applying post-harvest technology to harvested tropical fruits are to maintain quality in terms of appearance, texture, flavor and nutritive value, to maintain food safety and to reduce losses along the supply chain between harvest and consumption.

4. The main causes of post-harvest losses for tropical crops include:

- Mechanical damage due to mishandling along the supply chain;
- Loss of moisture through evaporation and transpiration which causes shriveling;
- Early senescence and death of tissue due to interruption of metabolic rate when stored in higher than optimum or extremely low temperature;
- Low shelf life due to ethylene biosynthesis; and
- Spoilage and rot due to the invasion of pathogens on injured fruits.

5. Generally, post-harvest systems are made up of many interacting operations that involve mainly handling of the produce from harvesting, packing, transportation, storage, packing and packaging and handling at destination. Operations that involve temperature and relative humidity control, together with decay and insect control, are incorporated along the various components of the system. Each tropical fruit type also requires different post-harvest handling and management technologies.

III. POST-HARVEST LOSSES

6. Post-harvest losses in tropical fruits vary widely from 10 percent to 80 percent in both developed and developing countries[1]. These losses occur all along the supply chain, beginning from the time of harvesting right up to packing, storage, transportation retailing and consumption. In most developing countries, this is mainly due to the combination of poor infrastructures and logistics, poor farm practices, lack of post-harvest handling knowledge and a convoluted marketing system.

[1] R.Paull, 2001.

7. In agriculturally developed countries, such as Japan, the Republic of Korea and Taiwan Province of China, it has been reported that the post-harvest losses for fruits are about ten percent[2]. In the Philippines, generally, post-harvest losses could range from 15 to 35 percent. However, fruit like papaya was reported to suffer post-harvest losses of 30 to 60 percent. This roughly illustrates the scenario of average post-harvest losses in the ASEAN region[3].

8. The Pakistan National Commission on Agriculture estimated that defects and inadequate facilities in post-harvest handling, transportation, storage and marketing may cause a 20 to 40 percent loss of fruit and vegetables. The value of this loss amounts to millions of rupees annually. Thus, it is apparent that post-harvest losses can affect the nutritious status of the population and economy of the country[4].

IV. RECENT ADVANCES IN POST-HARVEST TECHNOLOGY

9. An expansion in the international fruit trade and growing consumer demand for high quality tropical fruits have created considerable interest and investment in the development of new or improved post-harvest technologies. This is evident in most developing countries, where ongoing research and development on post-harvest technologies is given much emphasis.

10. In formulating such research and development programmes, priorities must first be set in terms of fruit types and research directed accordingly towards suitable technologies. Scientific understanding of biological and physiological process is important in studying the post-harvest handling of any tropical fruit. Most tropical fruits tend to be climacteric (the marked and sudden rise in the respiratory rate of fruit just prior to full ripening), with a limited post-harvest life. Among the climacteric fruit the peak of respiration can occur before or after or coincide with the peak of ethylene production. This knowledge is important for commercial applications such as for the calculation of heat loads and cooling capacity, and the management of mixed loads[5].

11. Generally, the emphasis in post-harvest technology is on reduction in the rate of ripening, reduction of mechanical injury to prevent pathogen entry, requirements of storage and suitable packaging for the export market.

12. There has been considerable work done on the reduction of ethylene biosynthesis which hastens ripening in fruits. Chemicals in the form of 1-aminvinyl glycine and 1-methylcyclopropene (MCP) have been used to reduce ethylene production, which slows down ripening and enhances shelf life for a number of tropical fruits, including banana[6]. MCP also was found to work synergistically with enzymatically hydrolyzed chitosan solution to prevent pathogenic fungi growth and effectively prolonged the life of fruits by 80 to 100 percent, even at room temperature[7]. The use of gamma radiation has also been developed to slow down the ripening process and to disinfect and pasteurize the fruit surface. Techniques like waxing have also been used to reduce the ripening rate.

13. The other area which is being actively researched now is slow ripening by gene manipulation. This field of biotechnology is now the focus of much research to reduce the problem of losses due to poor shelf life of tropical fruits.

---

[2] FFTC, 1993.

[3] F.M. Arshad, 2003.

[4] TelMed Pak Agriculture, 2005.

[5] R.E. Paull, 1993.

[6] E.W. Hewett, 2003.

[7] W.T.H. Chang and J Yeh, 2003.

14. In storage under cold conditions, the use of modified atmosphere packaging (MAP) has been used for temperate fruits. However, for tropical fruits, pineapples seem to respond well, but for mango results have been quite inconsistent[8]. Perhaps more studies need to be done on the use of MAP using perforated plastic films for tropical fruits to ensure less chilling injury during export. It has been reported that chilling injury was reduced in Tommy Atkins and Keith mangoes stored in perforated bags at 12°C[9].

15. Many recent innovations in post-harvest technology in developed countries in the form of high tech handling machines and chemicals are designed to ease the labour problem and the obsession to produce cosmetically 'perfect' produce. However, this may not work in developing countries where there are numerous constraints including logistical inefficiencies and limited infrastructural development. In this case, simple technology and practices have successfully been used to reduce losses and extend storage life of tropical fruits. One such example is the low cost storage of tropical fruits in a zero energy cool chamber which works on the principle of evaporative cooling using locally available materials such as brick, sand, bamboo, straw, gunny bags and a water source[10].

V. CONSTRAINTS IN IMPLEMENTING POST-HARVEST PRACTICES

16. The major constraints faced by developing countries are mainly infrastructural, such as lack of good roads and power supply. These are basic requirements to reduce the incidence of high post-harvest losses. However, these may be exacerbated by the lack of information and knowledge pertaining to good post-harvest practices. For information to be disseminated efficiently, an effective extension system has to be in place. A demand for quality, clean and safe farm produce will prompt the relevant parties involved to be more concerned about post-harvest quality and losses. The convoluted manner in which some fruit is marketed, through farm collectors, middle men, market agents and exporters, before being available to the consumer also poses a problem where handling occurs at every stage.

VI. CONCLUSIONS

17. In developing countries, the main constraints identified in implementing a post-harvest programme are the lack of infrastructural facilities and lack of knowledge and information amongst farmers. Infrastructural development is normally a government issue, while the problem of lack of information and knowledge can be overcome by various forms of training programmes and information availability. Information on the various post-harvest technologies is complemented by prioritized research and development.

18. As mentioned in the Introduction to this paper, the Sub-Group is requested to clearly define and prioritize areas for further detailed analysis of the economic impact of post-harvest handling losses of tropical fruits, and their implications for trade and food security. To guide the Sub-Group in its discussion on the issue, several areas have been defined by TFNet as priorities that could be developed further for funding consideration by the Common Fund for Commodities, among others. Some of these are:

- A needs assessment workshop on *Suitable post-harvest technologies for selected tropical fruits in developing countries*. This workshop will discuss the technologies required for every component of the supply chain;

---

[8] SC. Morris and J. Jobling, 2000.

[9] Pesis *et. al.*, 1999.

[10] S.K. Mitra, 2003.

- Research and development in the reduction of biosynthesis of ethylene and slowing down of the ripening process of fruits. This involves research on the chemical and physical methods that are suitable for delayed ripening in selected tropical fruits;
- Studies on suitable technologies and packaging for export by sea of selected tropical fruits to reduce losses, for example – use of Modified Atmospheric Packaging,
- The Training of trainers program in post-harvest technologies for selected tropical fruits in developing countries,
- Setting up of a global tropical fruit post-harvest information system website – this will be a compilation of all information on post-harvest technologies for tropical fruit.

REFERENCES

Arshad F.M., Radam, A., Mohamed, Z. (2003). An Economic Analysis of the Malaysian Fruits Industry. Proceedings of the International Seminar on Post-harvest Handling & Processing of Tropical and Subtropical Fruits. & TFNet General Assembly Kuala Lumpur, Malaysia. 2003.

Heyes, J.A. (2003). New Global Initiatives for Post-harvest Intervention. Proceedings of the International Seminar on Post-harvest Handling & Processing of Tropical and Subtropical Fruits. & TFNet General Assembly Kuala Lumpur, Malaysia. 2003.

Hewett. E.W. (2003). Recent Technological Advances in Post-harvest Handling and Processing of Tropical Fruits. Proceedings of the International Seminar on Post-harvest Handling & Processing of Tropical and Subtropical Fruits. & TFNet General Assembly Kuala Lumpur, Malaysia. 2003.

Kitnoja, L. (2005). Training in Post-harvest Technology. www.postharvest.org.

Mitra, S.K. (2003) Low Cost Storage of Tropical Fruits in Zero Energy Cool Chamber. Proceedings of the International Seminar on Post-harvest Handling & Processing of Tropical and Subtropical Fruits. & TFNet General Assembly Kuala Lumpur, Malaysia. 2003.

Moris, S.C. , Jobing, J. (2000). Recent Advances in the Postharvest Packaging and Handling of Tropical Fruit. Proceedings of the International Symposium on Tropical and Subtropical Fruits. Cairns, Australia. 2000.

Paull, R.E. (2001) Advances in Postharvest Technology for Tropical and Subtropical Fruits. Proceedings of the International Technical and Trade Seminar on Tropical and Subtropical Fruits. Kuala Lumpur. 2001.

TelMed Pak Agriculture (2005). Post-harvest handling. www.telmedpak.com/agriculture/post_harvest.

William, T.H.C., Yeh, J. (2003). Recent Developments in Post-harvest Preservation Technology using Biomaterial. Proceedings of the International Seminar on Post-harvest Handling & Processing of Tropical and Subtropical Fruits. & TFNet General Assembly Kuala Lumpur, Malaysia. 2003.