

## X. POST-HARVEST TECHNOLOGY IN THE PHILIPPINES

*Susana G. Castro<sup>1</sup>*

### **Abstract**

The Philippines is considered an agrarian economy, with 47% of the total land area or approximately 30 million hectares are agricultural lands. However, the country is still not self-sufficient particularly with its staple food requirements.

To address the problem on food shortage, as well as alleviate the conditions of the marginal farmers especially in the rural areas, the Philippine government approved the Agricultural and Fisheries Modernization Act or AFMA (Republic Act 8435) in 1999. This law allocates approximately 20% of PhP 120 billion (US\$ 2.2 billion) budget to any post-harvest related activities for seven years starting 1999 up to 2006. The present administration of President Gloria Macapagal-Arroyo, on the other hand, fully recognizes the importance of proper post-harvest handling and effective post-harvest technology.

At present, several matured post-harvest technologies need to be transferred to the target sectors. The general strategies being used for the transfer of technology include the conduct of training, the distribution of print media (such as manual, leaflets and brochures) to local extension workers, and the establishment of Post-harvest Technology Demonstration Centers for high value commercial crops. Currently, seven demonstration centers are already constructed in different sites of the country.

Based on the agricultural performance of the Philippine Department of Agriculture (DA) in 2001, high-value crops have significant contribution (around 57%) to the total agriculture performance of the country. Post-harvest losses are approximately 15% for grains (rice and corn), 28% in fruits and 40% in vegetables.

Small-scale post-production machines simple yet useful, post-harvest technologies are the most appropriate to rural areas for employment generation.

Though, it would take some time to realize the benefits derived from post-harvest technologies introduced (mainly due to the constraints in the industry), a great contribution to the economy would be accounted once these technologies take positive effects to the almost 90% small farmers in the country.

### **A. Introduction**

The Philippines is considered an agrarian economy, with 47% of the total land area or approximately 30 million hectares are agricultural lands. However,

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<sup>1</sup> University Extension Specialist, Agricultural Mechanization Development Program (AMDP), University of the Philippines Los Banos (UPLB), Philippines.

the country is still not self-sufficient particularly with its staple food requirements: it has five to ten percent annual shortage in rice and corn needs; has low per capita consumption of fruits and vegetables; and has high post-harvest losses of agricultural crops (about 15% in grains, 28% in fruits, and 40% in vegetables) (Andales et al, 2000).

In order to address the problem on food shortage, as well as to alleviate the conditions of the marginal farmers especially in the rural areas, the Philippine Government approved the Agricultural and Fisheries Modernization Act (AFMA) (Republic Act 8435) in 1999. This law allocates approximately 20% of PhP 120 billion (US\$ 2.2 billion) budget to any post-harvest-related activities for seven years starting in 1999 up to 2006. The present administration of President Gloria Macapagal-Arroyo, on the other hand, fully recognizes the importance of proper post-harvest handling and effective post-harvest technology. In fact, it is shown in the priority projects such as the Philippine Nautical Highway for the roll-on roll-off ferries that will help shorten the transit time of perishable crops from southern to northern part of the country and vice-versa.

It is believed that preventing post-harvest losses is cheaper than to increase yield. And with proper post-harvest handling and post-harvest technologies, people can be sufficiently fed without bringing additional hectares under production or without changing present agricultural practices. Moreover, Bautista (1990) mentioned that if we could cut down PH losses by a mere 10%, we would have more food than by increasing yield by 10% without reducing post-harvest losses.

## **B. Post-harvest situations**

### **1. Support to post-harvest industry**

As evidence of strong support to the post-harvest industry, numerous government and non-government institutions, state colleges and universities and big corporations are now undertaking research and development activities on post-harvest handling (Sebastian, 2002). The major research, development and extension (RDE) arm of the government is the Bureau of Post-harvest Research and Extension (BPRE) of the Philippine Department of Agriculture (DA) and PhilRice. On the other hand, the main RDE arm of the University of the Philippines Los Baños (UPLB) (the leading state university of the country) are: 1) the Agricultural Mechanization Development Program (AMDP) and 2) the Division of Bio-Process Engineering of the College of Engineering and Agro-Industrial Technology (CEAT) for grain post-harvest; and 3) the Post-harvest Horticulture Training and Research Center (PHTRC) of the College of Agriculture (CA) for horticultural crop post-harvest.

In addition, out of the PhP 444.37 million (US\$ 8.1 million) budget for comprehensive primary and secondary post-harvest processing programs 2002, the Philippine DA has allotted PhP 33.8 million (US\$ 614,545.50) for the establishment of trading posts, village level processing equipment, warehouses

and refrigerative storage facilities to cut PH losses in high value crops (DA Press Release, 2002).

At present, several matured post-harvest technologies need to be transferred to the target sectors. The general strategies being used for the transfer of technology include the conduct of training, the distribution of print media (such as manual, leaflets and brochures) to local extension workers, and the establishment of post-harvest Technology Demonstration Centers for high value commercial crops. Currently, seven demonstration centers are already constructed in different sites of the country.

## 2. Major agricultural crops of the Philippines

Based on the 2001 agricultural performance of the DA, high value crops have significant contribution (about 57%) to the total agriculture performance of the country as shown in Table 10.1.

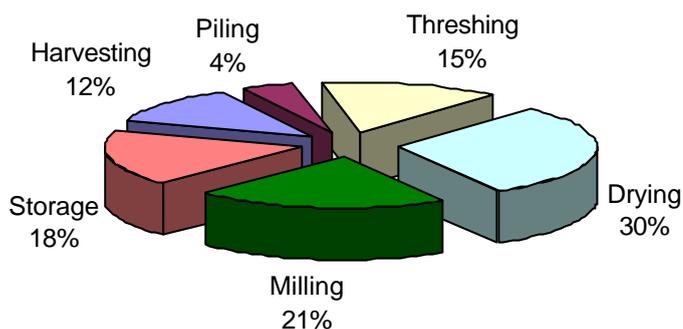
**Table 10.1. The Philippine agricultural performance from Jan. to Dec. 2001**

<b>Crops</b>	<b>Value of Production (million pesos)</b>	<b>% contribution to total agricultural production</b>
AGRICULTURE CROPS	145,333.26	100.00
GRAINS	63,210.27	43.49
PALAY	42,621.52	29.33
CORN	20,588.75	14.17
HIGH VALUE CROPS	82,122.99	56.51
COCONUT	19,953.00	13.73
BANANA	9,058.80	6.23
SUGARCANE	9,036.13	6.22
MANGO	6,428.64	4.42
COFFEE	3,011.13	2.07
PINEAPPLE	2,908.03	2.00
CASSAVA	2,329.36	1.60
CAMOTE	1,036.26	0.71
RUBBER	1,008.38	0.69
CALAMANSI	927.89	0.64
EGGPLANT	809.99	0.56
GARLIC	709.31	0.49
TOBACCO	704.73	0.48
TOMATO	518.41	0.36
ONION	517.08	0.36
ABACA	459.24	0.32
CABBAGE	413.63	0.28
PEANUT	221.26	0.15
OTHER FIBER CROPS	223.66	0.02
OTHERS	21,721.91	14.95

### 3. Post-harvest losses of major crops

#### (a) Rice

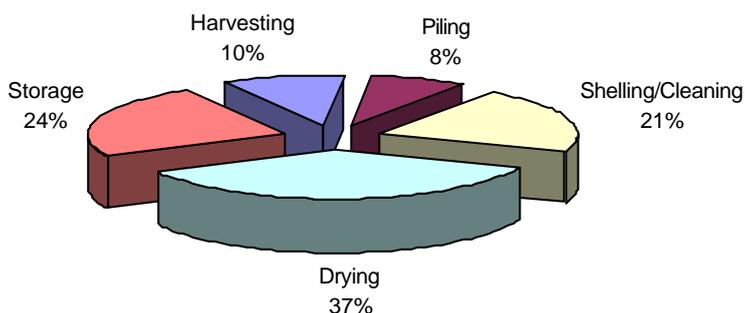
For rice, losses from harvesting to storage average at 14.85% with a range of 1.13 to 31.94%. The most critical operation was drying with an estimated average loss of 4.50% constituting about 30% of the total losses; this was followed by losses during milling operation at an average of 3.10% or about 21% of the total losses (Figure 10.1).



**Figure 10.1. Breakdown of post-harvest losses in rice**

#### (b) Corn

For corn, the total losses ranged from 3.7% to 25% with an average of 12.7%. Drying, assessed at 4.6% constituting 37% of the total losses, was the most critical among the various post-production operations. This was followed by storage losses at an average of 3.1% or 24% of the total losses (Figure 10.2).



**Figure 10.2. Breakdown of post-harvest losses in corn**

***(c) High-value crops***

Horticultural crops such as fruits and vegetables are often called high-value crops due to its significant contribution to the agricultural economy. These types of crops that account for 44% of the total volume of food crops, is a very important source of export earnings. The average post-harvest losses are 42% for vegetables and 28% for fruits. Below are range of losses for some specific fruits and vegetables:

High-value crops	Post-harvest losses
FRUITS	15-35%
Pineapple	30-40%
Banana	25-35%
VEGETABLES	20-42%
Cabbage	20-30%
Garlic	20-42%

***(d) Constraints in the post-harvest industry***

In general, the Philippine post-harvest industry is beset with several constraints. This include the following as cited by Andales (2000):

- a. Wide economic gap between farmers and businessmen, the major recipients of modern post-harvest technologies are usually traders and processors. The farmers, due to inadequacy of capital, cannot afford to buy appropriate post-harvest machineries.
- b. Low adoption of improved post-harvest facilities, the absence of strong linkage between producers and the market can effectively limit the benefits that can be derived from them.
- c. Technical inefficiencies leading to post-harvest losses:
  - This arise from the usual problems associated with the lack of farm to market roads, packinghouse and cold storage facilities, appropriate containers, packaging materials and container vans.
  - The inability of producers to sort their commodities according to size and quality leads to multiple handling and, consequently, greater loss.
  - This can be attributed also to the absence of workable standards.
- d. Insufficient post-harvest training and extension activities on other crops:
  - Agricultural extension services have traditionally focused their efforts on traditional crops such as rice and corn.
  - Little attention was given to other agricultural commodities such as high value crops, livestock and fisheries.

- e. Weak information system
  - The problem of untimely delivery of information (i.e., technology, prices, etc.) to the stakeholders of the post-harvest industry has heavily constrained the development of the post-production system.
  - Information on improved technologies and prices are not usually accessible to small farmers and farmers' organizations. This results to their inability to engage in profitable production programming and equitable postproduction system.
- f. Failure of majority of farmer's cooperatives
  - Since the success of the post-harvest development programs depend on the availability of qualified farmers cooperatives-recipients.
  - Post-harvest facilities must be distributed to successful cooperatives throughout the country.
- g. Small land holding of farmers, the small farm lot and the limited volume of harvest make ownership of agricultural machinery or crop processing facilities among small farmers difficult.

### **C. Post-harvest technologies in the Philippines**

#### **1. Grain (Rice and Corn)**

##### *Drying Machinery*

- AMDP Recirculating Flow Dryer
- UPLB Flatbed Dryer
- IRRI Batch Dryer
- PCARRD Multicrop Dryer
- BPRE Mobile Flash Dryer
- BPRE In-Store Dryer
- PCARRD-NTA Multicrop Solar Dryer
- PCARRD Rotary Flash Dryer

##### *Rice Milling Machinery*

- UPLB Village Ricemill
- PhilRice Micromill
- IRRI Micromill
- IRRI Portable Grain Cleaner

##### *Shelling/Threshing Machinery*

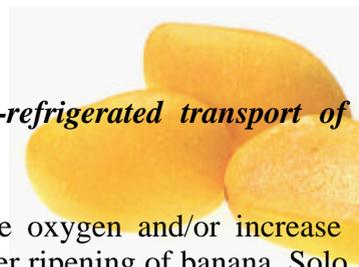
- AMDP Two-Drum Corn Sheller
- BPRE Improved Corn Sheller
- IRRI TH12 Axial Thresher/Sheller
- IRRI TH8 Axial Thresher

- IRRI TH6 Portable Thresher

## 2. High-value crops (Fruits and Vegetables)<sup>2</sup>

### *(a) Technologies which enhance the quality of mango export technologies now being used by exporters:*

- Hot water treatment - controls disease that is the biggest problem of exporters; reduced incidence of disease by as much as 70%.
- Modified vapor heat treatment procedure - eliminate mango pulp abnormality due to previous treatment procedure; consumer acceptability of Philippine mangoes in Japan restored and export increased again.
- Flotation technique of maturity determination defects due to immaturity is avoided (immature fruits develop internal breakdown of pulp when vapor heat treated); maturity determined with 100% efficiency compared to 20-50% of previous method.
- Use of cartons and foams - quality of exported fruits is maintained; lesser shriveling and lesser damage hence lesser premature ripening.



### *(b) Technologies which reduce losses during non-refrigerated transport of produce from Mindanao to Manila:*

- Modified atmosphere packaging (MAP) - reduce oxygen and/or increase carbon dioxide to reduce biological activity; slower ripening of banana, Solo papaya, and tomato; slower deterioration of calamansi, okra, orchids, anthuriums and roses. MAP of papaya can be used to transport papaya by sea from Mindanao to Manila prior to VHT treatment and export to Japan. Exporters of banana to the Middle East use MAP.
- Ethylene adsorbent - ethylene ripens fruits. Fruits give off ethylene so if adsorbed, ripening will slow down; a Filipino company is now using 10,000 a week of such adsorbents. Taiwanese and Australian companies are also interested.
- Improved non-refrigerated van design for ships transporting fruits - one shipping line now has 300 units of a modified ventilated van for fruits.

### *(c) Fabrication of post-harvest equipment for more efficient operations:*

<sup>2</sup>The post-harvest technologies of high-value crops were mainly sourced out from Post-harvest Horticulture Training and Research Center (PHTRC) of the College of Agriculture, University of the Philippines Los Baños (UPLB), College, Laguna.



- Hot water tank - mango exporters and two cooperatives selling mango and papaya are now using or fabricating it. Others would like to get the blueprint. Mango exporters are using their own designs.
- Sizers.
- Packinghouse line for round fruits.
- Sorting table for baby corn.

***(d) Developed the post-harvest handling systems for 'Solo' papaya fruits from Balingasag, Misamis Oriental to be shipped to Manila for VHT treatment prior to export to Japan:***

- Harvesting index
- Fungicide treatment
- Hot water treatment
- Curing
- Modified atmosphere packaging and ethylene adsorbent

***(e) Developed and improved village level technologies:***

- Optimized use of calburo, kakawati leaves, passion fruit, Saba banana and squash peel for ripening.
- Non-refrigerated storage methods using evaporative cooling - the evaporation of water near the produce makes the environment cool and moist; a company used it for temporary storage of about 20,000 ears of sweet corn with good results. A Filipino consultant transferred the technology to Gambia with even greater success than in the Philippines.



***(f) Technologies to promote cut-flower trade:***

- Establishment of refrigerated storage conditions for local varieties
- Adapted dry pack storage technique (storage without the use of water) for roses, mums and glades.
- Developed a cut flower preservative
- Developed appropriate pulsing treatments - pre-storage addition of sugar for added storage life - absorbed sugar can be used by cut flowers for respiration; a grower raising gladiolus in 1000 square meters can earn PhP 10,000 (US\$ 182) more by sugar pulsing.

**D. Implications of post-harvest technology for employment generation in the rural sector**

Agricultural lands in the Philippines are predominantly small and non-contiguous. Farmer's produce are usually collected and combined by traders who in turn transport and sell the commodity to the wholesale and retail market. With this scenario, the strategies being implemented by the Philippine government are on the right track. Small-scale post-production machines and simple, yet useful, post-harvest technologies are the most appropriate to rural areas for employment generation.

Though, it would take some time to realize the benefits derived from post-harvest technologies introduced (mainly due to the constraints in the industry), a great contribution in the economy would be accounted once these technologies take positive effects to the almost 90% small farmers in the country.

The proper post-harvest handling and technologies would not only reduce losses and improve the quality of produce but it will also help the people establish their own farm-level secondary handling and value-added processing businesses, resulting in more job opportunities, thus empower and improve the lives of farmers.

### **E. Conclusions and recommendations**

The agriculture sector gears towards global competitiveness. Proper post-harvest handling and sound post-harvest technologies are thus needed. Different stakeholders in the post-harvest industry, such as the farmers, farmers' groups and cooperatives, local government units, government and non-government agencies and the private sector should join together to give their full support in pursuing the priorities of industry.

Continued conduct of training on post-harvest and sustained monitoring of the farmers cooperatives are recommended, to be able to succeed in any post-harvest handling and technologies interventions.

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