NAS Food Security Workshop 2: Exploring Sustainable Solutions for Increasing Global Food Supplies

Losses and Waste in the Food Supply Chain

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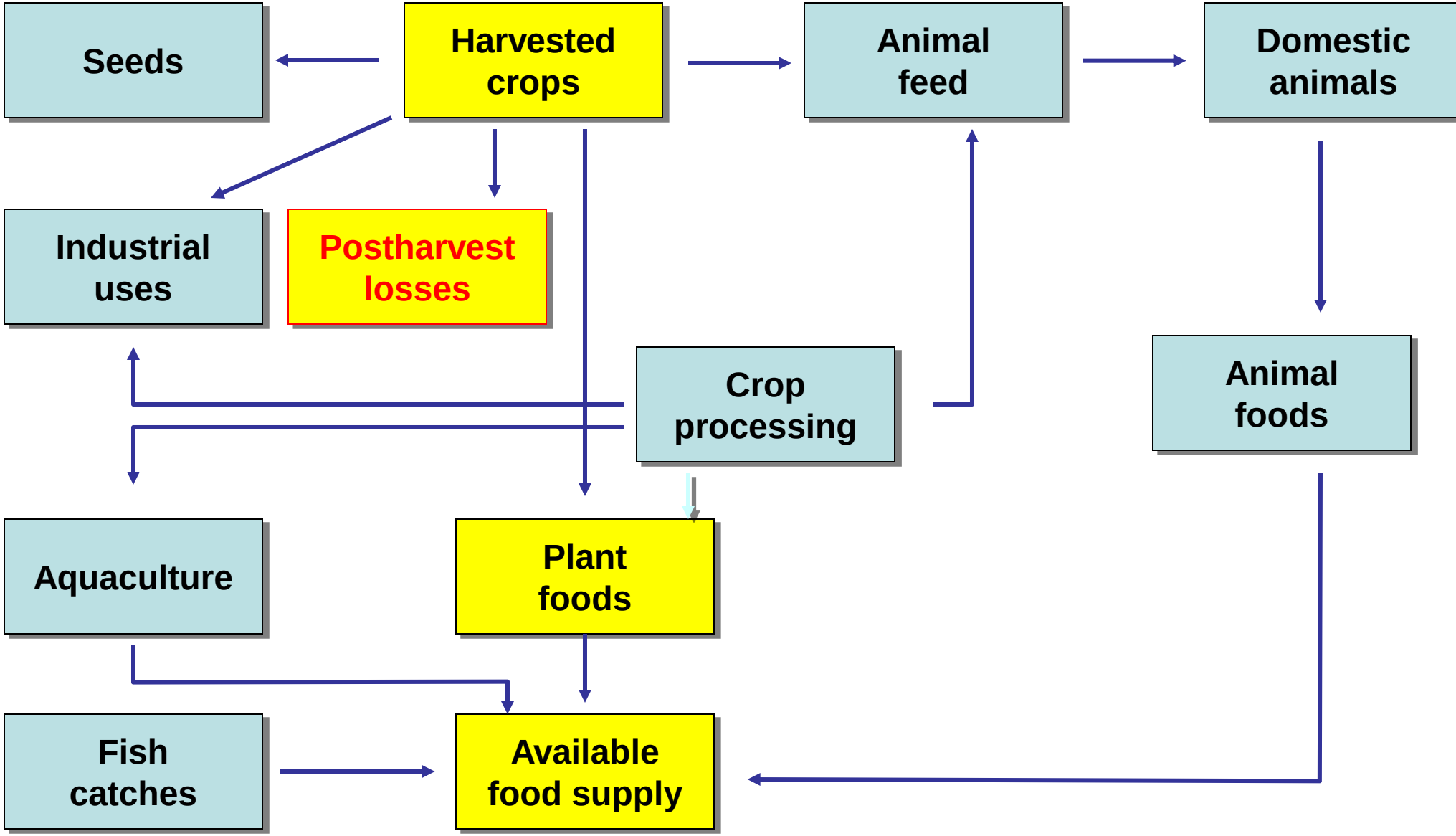
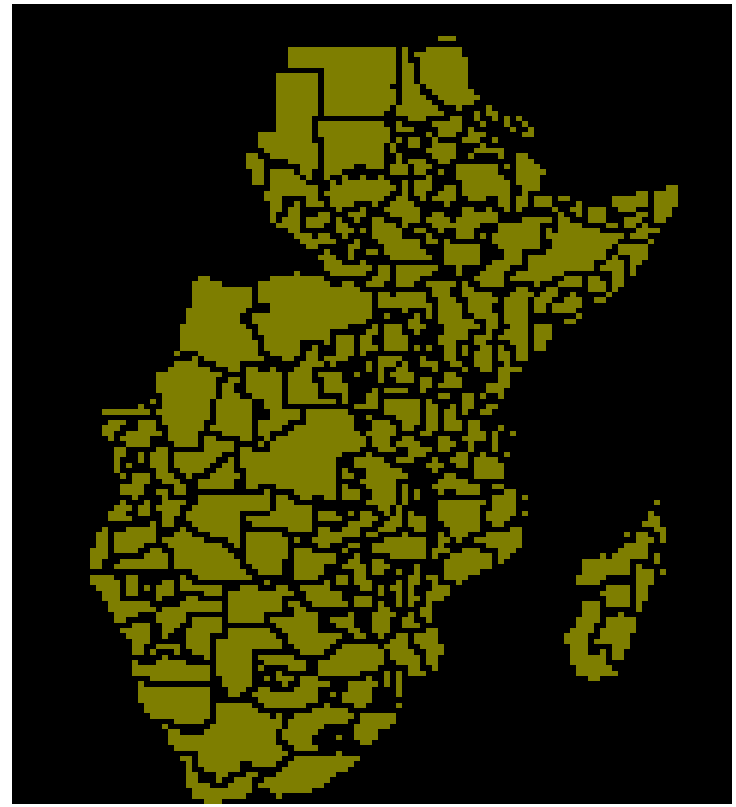

Seeds
Harvested crops
Animal feed
Domestic animals
Industrial uses
Postharvest losses
Crop processing
Animal foods
Aquaculture
Plant foods
Fish catches
Available food supply

Estimated Postharvest Losses of Cereals (% of total annual production in Africa), 2003-2008

2003	17.0
2004	14.4
2005	14.3
2006	14.8
2007	15.1
2008	17.4



Source: http://www.phlosses.net/index.php?form=losses_estimates

How to Maintain Quality and Reduce Losses of Grains, Legumes, and Other Dried Products

- **Drying to reduce moisture content to below 8%**
- **Insect disinfestation and protection against reinfestation**
- **Storage temperature (storage potential doubles for every 5 ºC reduction in temperature)**
- **Storage relative humidity in equilibrium with moisture content of the product**
- **Proper sanitation to minimize microbial contamination and avoid mycotoxin formation**
- **Protection from birds and rodents**

STORAGE FACILITIES

International development organizations and governments should give highest priority to improving storage facilities of agronomic food crops at the national, regional, village, and household levels in all developing countries.

Postharvest Losses of Foods of Plant Origin

- **Quantitative**
- **Qualitative**

  Loss of acceptability by consumers

  Loss of caloric and nutritive value

  Loss of edibility

33% of Marketed Produce worldwide

Estimated Postharvest Losses (%) of Fresh Produce

Locations	Developed countries		Developing countries	
	Range	Mean	Range	Mean
From production to retail sites	2-23	12	5-50	22
At retail, foodservice, and consumer sites	5-30	20	2-20	10
Cumulative total	7-53	32	7-70	32

Source: Kader, 2005

Postharvest losses of potatoes, tomatoes, and grapes in Egypt based on sampling

Marketing system level	Percentage loss of commodity		
	Potatoes	Tomatoes	Grapes
Farm	11.9	9.0	15.1
Wholesale	1.5	17.9	6.9
Retail	4.2	16.3	6.0
Total	17.6	43.2	28.0

Source: University of California - Egypt, Agricultural Development Systems Project Final Report (edited by Blond, 1984)

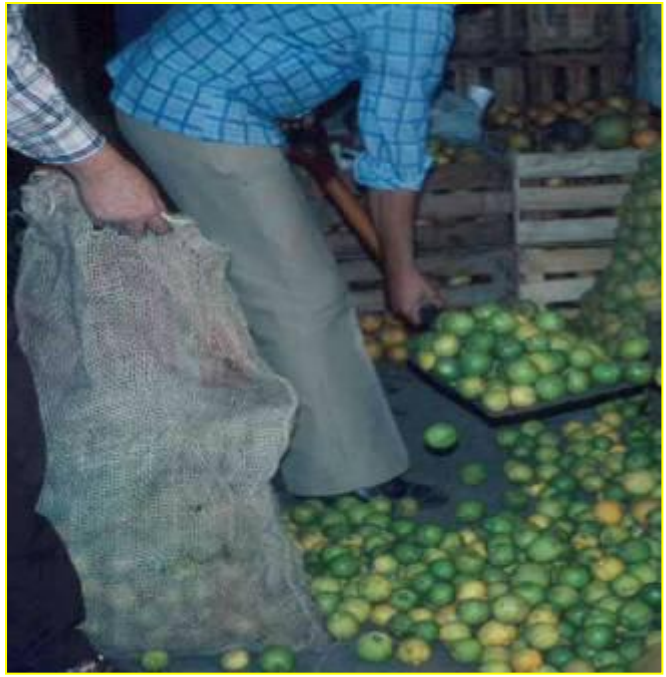
Postharvest Losses of Selected Vegetables in Northern Thailand based on Sampling at the Collection Center (Boonyakiat, 1999)

	Range of	losses (%)	due to:
Vegetable	Bruises	Pests & Disorders	Total
Head lettuce	21.3 – 27.4	20.7 – 40.1	48 - 61
Red leaf lettuce	19.0 – 26.5	16.6 – 28.9	43 – 48
Butterhead lettuce	23.5 – 36.0	20.9 – 36.8	57 – 60
Cos lettuce	23.3 – 30.0	19.5 – 35.9	50 - 60
Spinach	17.5 – 24.8	17.6 – 30.0	35 – 52
Cabbage	13.8 – 19.2	10.9 -18.5	28 – 32
Celery	21.9 – 24.5	17.5 – 35.9	42 - 58

Handling of Horticultural Perishables in Developing vs Developed Countries-1

- Requirements for maintaining quality & safety of horticultural perishables between harvest and consumption sites are the same in developing and developed countries.
- The extent of adoption of the necessary harvesting and postharvest handling procedures & technologies vary greatly among countries & within each country, depending on scale of operation, intended market & the return on investment of each technology.

Examples of Shipping Containers Used in Developing Countries

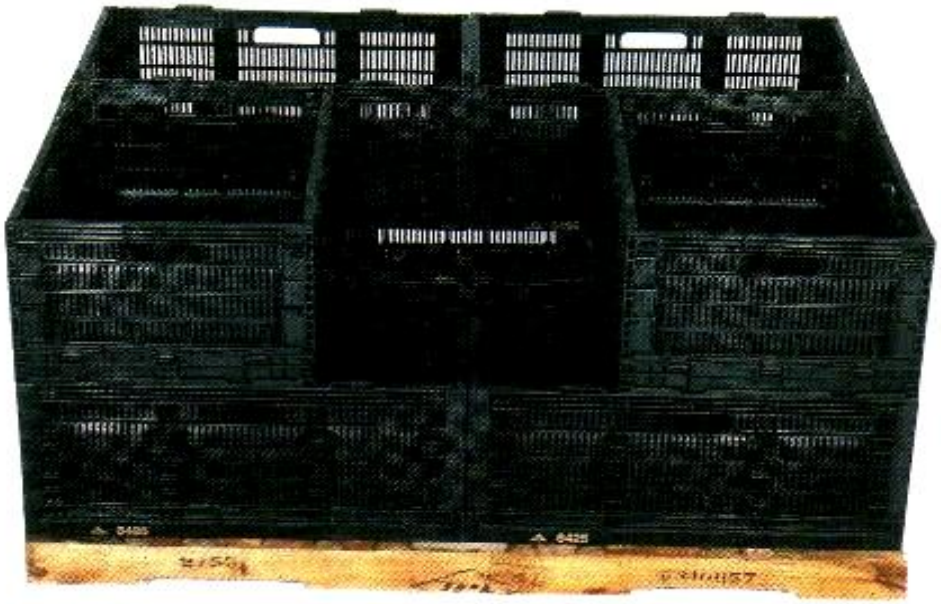


Examples of Shipping Containers Used in Ghana

Proper Containers for Harvest and Shipping of Produce are Badly Needed in Developing Countries

- Harvest bags, buckets, and boxes
- Shipping containers: plastic returnable containers (PRC) that can be rented may be an economically feasible option.
- Consumer packages: plastic bags, mesh bags, clamshell plastic containers.

Reusable Plastic Containers



Reusable Plastic Containers in Use at a Supermarket in Accra, Ghana

Transportation of Fresh Produce in Developing Countries

Handling of Horticultural Perishables in Developing vs Developed Countries-2

- Although labor cost is lower in developing countries, labor training, productivity, and management are generally better in developed countries.
- Effective training of workers and their supervisors along with delegation of responsibility and authority to the supervisors are more common in developed countries than in developing countries.
- The tendency in many operations in developing countries to limit authority for making any changes in the procedures to the owner or very few trusted persons often leads to poor management and problem-solving expertise among the supervisors and reduced productivity of the workers.

Food Safety Issues

- Naturally-occurring toxicants
- Contamination with heavy metals
- Mycotoxins
- Pesticides residues
- Microbial contamination

Avoiding microbial contamination is the most important factor in assuring safety of fresh produce: Good Agricultural Practices (GAP), HACCP, Good Manufacturing Practices

Availability and Utilization of the Cold Chain

- Availability and efficient use of the cold chain is much more evident in developed countries than in developing countries
- Unreliability of the power supply, lack of proper maintenance, and inefficiency of utilization of cold storage and transport facilities are among the reasons for failure of the cold chain in developing countries.
- Cost of providing the cold chain per ton of produce depends on energy cost plus utilization efficiency of facilities throughout the year.

Proposed Loss Reduction Interventions-1

- **Improved containers** to better protect produce from damage
- **Providing shade** to reduce temperature and provide a natural source of cooling
- **Improved field packing** methods during harvest to reduce handling damage and add value
- **Improved Curing** of root and tuber crops
- **Improved sanitation:** Use of water disinfection methods and other sanitation procedures
- **Effective insect control:** Disinfestation and protection against reinfestation

Shading to Protect Produce from the Sun

Proposed Loss Reduction Interventions-2

- **Low cost cooling methods:** Evaporative forced air cooling or hydro-cooling with well water
- **Low energy cool storage practices** (bricks and sand model cool chambers, "pot-in-pot" designs)
- **Small-scale cool transport**
- Cool & Ship **portable forced air cooler**
- **Small-scale Cold room with CoolBot**
- **Alternative cooling technologies**

Maintaining the Cold Chain


Hydrocooler

Small-scale Forced Air Cooler

Refrigerated Truck

Proposed Loss Reduction Interventions-3

- **Improved ripening practices:** Methods to slow or speed ripening of fruits
- **Improved solar drying methods**: low-cost, low-technology solar drying methods
- **Improved small scale food processing methods:** low-cost, low-technology food processing methods
- **Production practices** that affect postharvest losses and quality
- **Marketing strategies** that help maintain quality and reduce postharvest losses
- **Extension and training strategies** for outreach and promotion of appropriate postharvest technologies

Strategies for Improving Handling of Fresh Produce Worldwide

- **Application of current knowledge to improve the handling systems of horticultural perishables and assure their quality and safety**
- **Removing the socioeconomic constraints, such as inadequacies of infrastructure, poor marketing systems, and weak R&D capacity.**
- **Overcoming the limitations of small-scale operations by encouraging consolidation and vertical integration among producers and marketers of each commodity or group of commodities.**

CONCLUSIONS-2

Reducing Postharvest Losses by 50% by 2025 is an attainable goal

Reducing land, chemical, energy and other inputs needed for production of agronomic and horticultural crops

Conserving natural resources (land, water, energy, etc.) and protecting the environment