



Post-Harvest Management of Plant Products



Learning objectives

- To present the post harvest management of plant products
- To identify type of food losses in value chains
- To show the problem solving approach and protection measures in post harvest



Presentation structure

1. Types of food losses and hot spots in value chains
2. Causes of losses and storage structures
3. Problem solving and protection measures
4. Sustainable harvest and post-harvest management
5. Ecological footprint of food losses



Types of food losses and hot spots in value chains



What is food loss and food waste?

- Food loss refers to a **decrease in edible food mass** throughout the part of the supply chain that specifically provides **edible food** for **human consumption** (FAO)
- This approach distinguishes between **‘planned’ non-food uses** and **‘unplanned’ non-food uses**, with the latter being counted as loss
- Food loss occurring at the end of the food chain (retail and final consumption) is called **‘food waste’** and is the result of retailer and consumer behaviour. Here we are mainly dealing with food losses occurring **from production to processing and traditional marketing**.



Definition Food losses FAO:

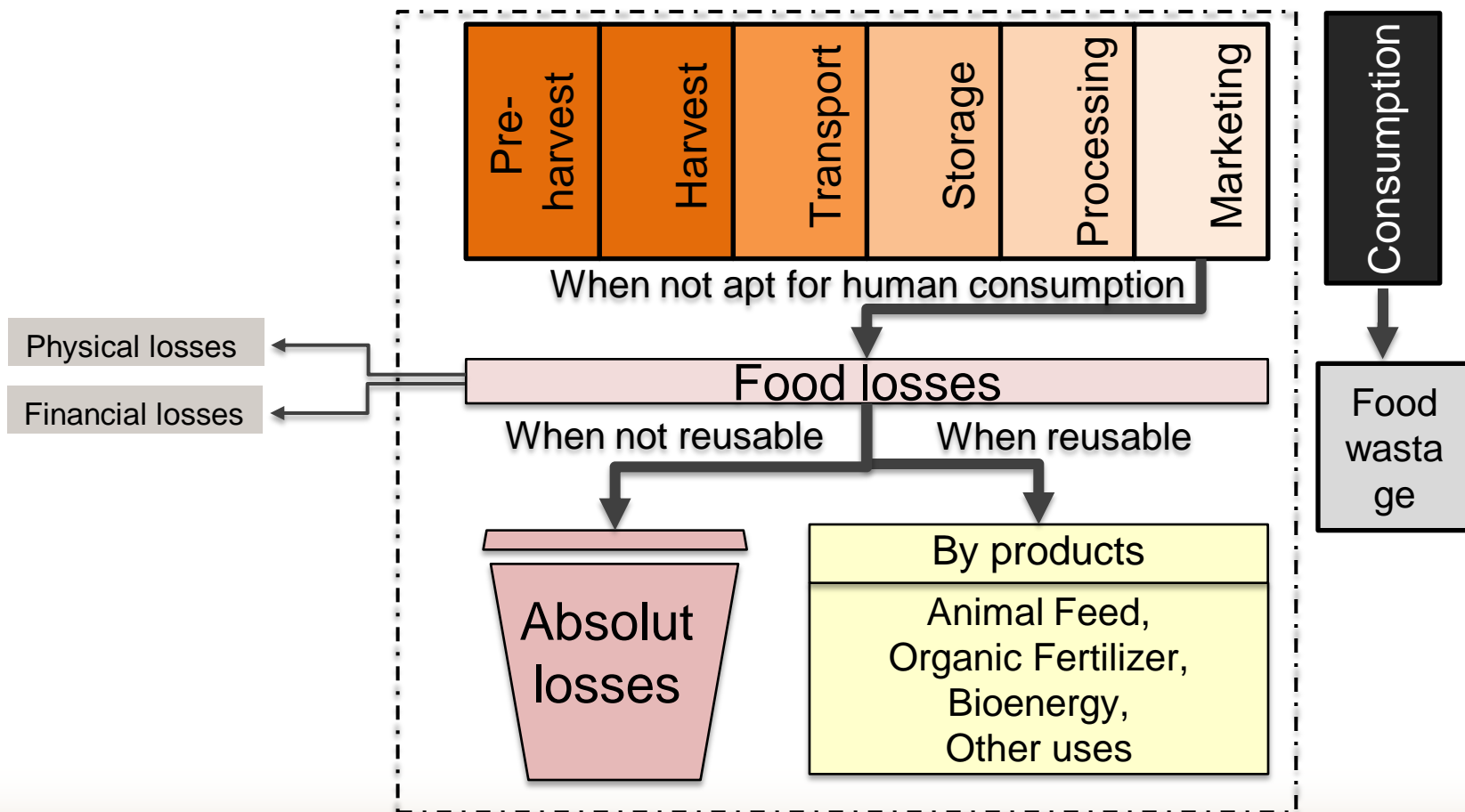
Post-harvest Food Loss (PHL) is defined as measurable qualitative and quantitative food loss along the supply chain, starting at the time of harvest till its consumption or other end uses (De Lucia and Assennato, 1994; Hodges, Buzby and Bennett, 2011).

Source:

http://www.fao.org/fileadmin/templates/ess/documents/meetings_and_workshops/GS_SAC_2013/Improving_methods_for_estimating_post_harvest_losses/Final_PHLs_Estimation_6-13-13.pdf



Definition of losses



Categories of critical food loss points



- 1. Post-harvest handling and storage:** including losses due to spillage and degradation during handling, storage and **transportation** between farm and distribution.
- 2. Harvest:** losses due to mechanical damage and/or spillage during harvest operation, crops sorted out after harvest, etc.
- 3. Processing:** including losses due to spillage and degradation during industrial or domestic processing, e. g. juice production.
- 4. Marketing:** including losses and waste in the market system, at e. g. wholesale markets, supermarkets, retailers and wet markets.
- 5. Pre-harvest:** From seed quality, over resistant varieties to implementation of integrated pest management



Causes of losses, aflatoxin and storage structures



What are stored product pests? What are urban pests?



Insects

Beetles (approx. 60 species)

Moths (approx. 20 species)

Dustlice (approx. 10 species)



Rodents

Rats

Mice



Microorganisms

Bacteria, Fungi



[3]

Urban pests (vectors)

Cockroaches , rodents, birds

Flies

Ants



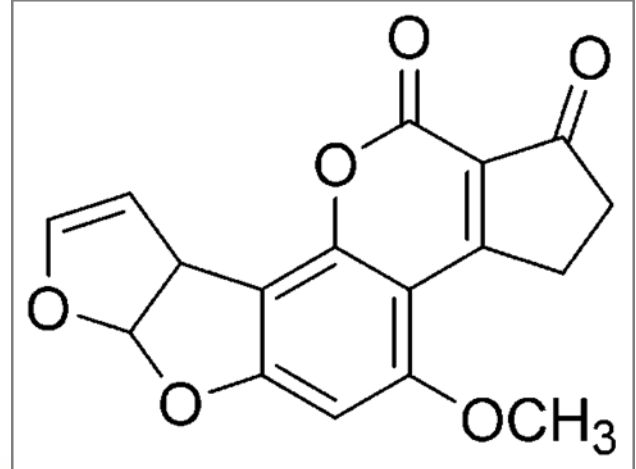
Birds



[3]: https://c1.staticflickr.com/5/4008/4684917072_11af04bcfd_b.jpg

Facts about Aflatoxin

- Highly **toxic metabolite** produced by the ubiquitous *Aspergillus flavus* fungus
- The fungus resides in soil and crop debris, fungus carried from field to store
- **Infects several crops like maize, cereals, ground nuts, oil seeds, spices etc. and produces the toxin in the field and in stores**
- Contamination possible without visible signs of the fungus
- **Causes death, liver cancer, immune suppression, stunted growth**
- Impacts negatively animal productivity and trade



Examples: aflatoxin infestation (often without symptoms to the naked eye)



[2]



[3]

[2]: https://c1.staticflickr.com/5/4008/4684917072_11af04bcfd_b.jpg

[3]: https://c1.staticflickr.com/3/2536/5754294416_49fa2487a3_b.jpg



Industrial storage structures

- Open storage: in bags open air
- Closed storage: in bags in warehouses or on bulk in silos
- Hermetic storage: in barrels, plastic bags or other things (earth)





Regional and traditional storage solutions

Post-harvest management in smallholder paddy farm



Source: Ghazali ibn Zakaria

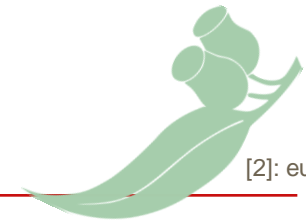




Problem-solving approach and protection measures



[5]



[2]: eucalyptus

Natural methods- Plant parts as traditional insecticides

Identified plants	plant parts used	protected stored products
<i>Clausena anisata</i> (Rutaceae)	leafy branches	maize, beans
<i>Cypressus sempervivens</i> (Cypr.)	leafy branches	maize, beans, cowpea
<i>Capsicum frutescens</i> (Solanac.)	fruits	beans, cowpea
<i>Chenopodium ambros.</i> (Chenop.)	leaves	maize, beans, potato
<i>Eucalyptus spp.</i> (Myrtaceae)	leaves	maize, beans, cowpea
<i>Lantana camara</i> (Verbenaceae)	leaves	beans, potato

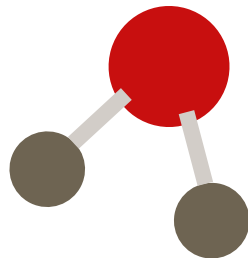
Oil of neem seeds (dried in the sun) protect maize against pests a few months (JKI)



Chemical methods- for stored product protection

Gases:

- Phosphine [PH_3] from Al-/Mg-phosphide or bottled gas
- Sulfurylfluoride (structures only and nuts)
- [N_2 until 2004]
- Carbon dioxide [CO_2] at normal / high pressure



Contact pesticides:

- Pirimiphos-methyl (grain only)
- Pyrethrum (natural)
- Deltamethrine
- Diatomaceous earths (DE)

Biocides:

- Chemical products that destroy or deter harmful organisms (e.g. vectors) outside of agricultural land



Biocide Aflasafe – for displacing aflatoxin-producing fungi



dead sorghum grains coated with a mixture of atoxigenic strains,
a polymer and a blue dye



Sustainable harvest- and post-harvest management



Where does aflatoxin come from?

- from fungus *Aspergillus flavus*



e.g. Biocide Aflasave

- fungus is carried from field to store



not to take affected crops into warehouse

- humidity causes increase of fungus



dry and well ventilated storage option



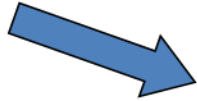
Where do the pests come from?

- from infested raw materials/ suppliers



improve inspection!

- from latent infestation in the premise



improve sanitation!

- from the outside environment



improve structural design!



Integrated storage protection based on three pillars

Integrated Stored Product Protection in organic production

Pest prevention

- Structural design
- Store quality
- Inspection
- Sampling
- Drying
- Cooling
- Sanitation
- Packaging

Early pest detection

- Visual inspection
- Check:
- Temperature
 - Moisture
 - Movements
 - Structural design
 - Product density
 - Bioacoustics
 - Traps

Pest control

- Physical
- Biological
- Biotechnical
- CO₂ / N₂ / DE
(Diatoma-
ceous earths)



Stages of agricultural production: What to consider for post-harvest?

Stages	Activities
Seeding / planting	Selection of variety with regard to storability and durability of the product
Production	Reduction of pests and diseases which may do harm during storage, selective NPK fertilization as needed
Time of harvest	Good timing to get products which are mature and with relatively low moisture content
Manner of harvest	Avoidance of any damage to the product, collection of all products
Follow-up of harvest	Cleaning and sorting according to purpose: consumption, market, side product, seeds or planting material
Packing	Appropriate for the product and the men / women who have to carry it - max. 50 kgs according to ILO
Transport	Careful and safe loading and transport
Storage	Packing acc. to needs, rule "first in – first out", monitoring and control of mould, insects and rodents



Women in harvest- and post-harvest management

What is the role of women and men in harvest, storage and processing in your region?



- Are women involved in diagnosis and assessment of pests?
- Who applies storage protection measures?
- If losses occur, who loses money? Is the income of women reduced?
- Do women deal with pesticides in storage protection?
- Do women process, package and sell products at family level or in self-help-organizations?
- Which are the experiences of women in marketing (transport, market place, storage)?
- Are children involved in harvesting, storing and processing of agricultural products?



Ecological footprint of food losses



Ecological footprint of food losses

- Food loss is a highly important factor in efforts to combat hunger and raise incomes.
- Food loss has a significant impact on the environment. The later food loss occurs in the supply chain, the more resources have already been wasted
- However, food loss also represents **wasted production resources** such as:
 - Natural resources: land and water
 - Energy and fuels
 - Inputs like seeds / planting material, fertilizers, pesticides
 - Use (and damage) of equipment and tools
 - Unnecessary use of capacities for storage, transport, processing, marketing
 - Human capacity and working time



Thank you!

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