A Review of Post-harvest Technologies for Semi-Perishable and Non-Perishable Produce in Developing Countries

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Introduction

Post-harvest food loss is one of the largest threats to food security, contributing significantly to hunger and undernutrition in low income countries (Costa 2015). In addition, it implies waste of agricultural resources, financial investment and energy, that aggravates existing conditions of resource scarcity in rural communities (Gustavsson 2011).

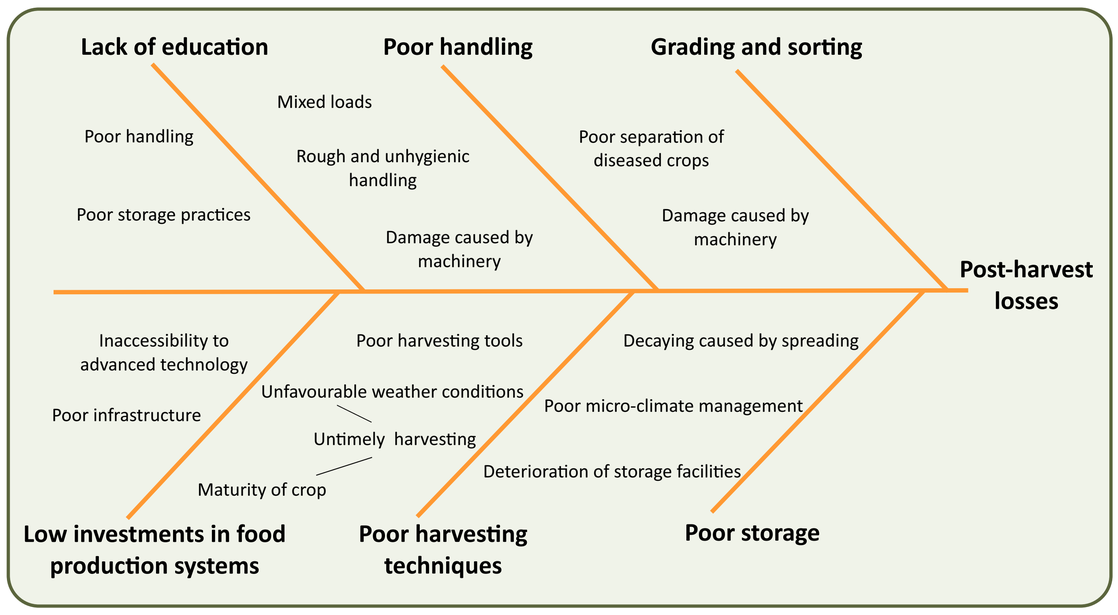
Cause and effect of post-harvest losses diagram showing factors contributing to post-harvest losses (from Kiaya 2014; Kitinoja 2016)

Image a (http://worldfoodscience.com/article/postharvest-losses-and-food-waste-key-contributing-factors-african-food-insecurity-and)
Image b (https://www.slu.se/en/ew-news/2017/2/food-security-in-sub-saharan-africa---one-step-towards-bridging-the-research-policy-gap/)
Image c (https://www.readkong.com/page/post-harvest-losses-in-potato-value-chains-in-kenya-6685868)

Aim

To investigate the causes of post-harvest loss in rural communities and their use of indigenous solutions.

Causes of Post Harvest



Key Findings

Approximately 80.4% of the post-harvest loss takes place during the storage phase (Affognon *et al*. 2015).

Roots and tubers

Experiment of sweet potato sand-pit storage in Malawi and Ghana (Abidin *et al*. 2016).

- Stored for < 4 months in Savannah areas
- Stored for < 7 months in the drier areas
  - ⇨ ~62% consumed
  - ⇨ ~27% replanted
  - ⇨ ~21% damaged/infected by disease

Orange-flesh sweet potato removed from a storage pit
(https://cipotato.org/blog/storing-sweetpotato-sand-improve-diets-incomes-west-africa/)

A comparison of 4 storage methods was conducted in a drought-prone area of Gairo, Tanzania (Mpagalile *et al*. 2007).

1. Traditional pit storage: Shed built above pit.
2. Improved open pit: Pit layered with dambo sand and sprinkled with water.
3. Improved housed pit (Mjinge): Improved open pit with slightly ventilated hut (smeared) built over it.
4. Woven hut (Kihenge): Raised floor with roof.

Kihenge storage of sweet potatoes resulted in significantly ($P<0.05$) better quality than traditional pit storage after 3 months.

Storage method	# roots showing sprouting	# rotten roots	# wilty roots	Weight loss (kg)	# infested roots
1: Traditional pit storage	1.50	166.0	0.5	48.0	123.0
4: Woven hut (Kihenge)	39.0	3.8	5.3	31.5	49.5

Grain

Silos made of mud, wood and straw are among the storage methods utilized in most developing countries (Nagnur *et al*. 2006; Affognon *et al*. 2015).

- **Mud silos**
  - ⇨ Indigenous structure
  - ⇨ Store maize better in dry climates
  - ⇨ Attract moisture to their walls

Small farmers keep them dry by having cooking fires near them (Goodier 2013).

Straw silo called a Kihenge
(http://notebookafrica.com/reflections-on-months-sseds-and-granaries/)

- **Metal silos**
  - ⇨ Limits aerobic bacterial activity
  - ⇨ Protects from cereal rot (George 2011; Danso *et al*. 2019)
  - ⇨ Keeps insects away and deprive existing insects of oxygen
  - ⇨ Higher moisture content during rainy seasons
  - ⇨ Higher temperatures compared to bags and cribs (Danso *et al*. 2019)

Mud silo where grain is stored
(http://innovatedevelopment.org/2014/11/15/mud-silos-protect-harvests-in-ghana)

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CONCLUSIONS AND RECOMMENDATIONS

- Research and interventions are inclined to focus on post-harvest storage as more loss occurs at that stage, particularly in the rural areas.
- Traditional methods of storage adhere to scientific principles.
- Rural communities also use other approaches to address some short comings of traditional methods.
- Most literature suggested airtight technologies, namely metal silos and hermetic bags should be used for storage.
- Analysis should include measurements of CO_2 to O_2 ratio to determine the influence on the rate of food quality loss.
- Communities and scientists working together could develop post-harvest methods using easily available resources to improve the status quo.

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