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TACKLING FOOD LOSSES

Outlook for Postharvest Research and Innovation in Mozambique

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Farmers throughout sub-Saharan Africa (SSA) incur huge postharvest (PH) losses. For many families, such losses threaten household food security, while for others, early selling at low prices for fear of heavy losses, is a threat to their incomes. In Mozambique, domestic food production is barely sufficient to meet the national demand. The deficit is met by imports, which means, households have to purchase a significant proportion of the food they need. Poverty and low incomes further aggravate the problem. Not many studies have been conducted to quantify and mitigate PH losses in Mozambique. No systematic assessments of losses exist, and only a few interventions, which focused on transfer of single-level technologies, particularly for grain storage to individual smallholder farmers, can be traced. Their success cannot be ascertained as details of adoption and impacts are unavailable. Since the food crisis that began in 2006, there is renewed interest to mitigate PH losses as part of a major effort to overcome food insecurity and poverty in food deficit countries. The glaring lack of data loss for major food commodities in Mozambique should move the government, development agencies, donors and research institutions to invest more on rigorous and systematic field-based studies to assess losses, and to identify matching loss mitigation innovations. Moreover, building local capacity and strengthening policy on PH will be of essence.

DID YOU KNOW?

- **PH losses are a constraint to food security in sub-Saharan Africa.**
- **Annual value of PH losses in SSA for grains alone exceeds USD 4 billion.**
- **Up to 47% of USD 940 billion that needs to be invested to eradicate hunger in SSA by the year 2050 will be required in the PH sector.**

Mozambique, like many other SSA countries, experiences endemic food shortages. One reason for this predicament is inherent weaknesses in the country's PH system. Smallholder farmers still continue with traditional practices. For example, use of traditional storage methods is still rampant. Adoption of improved technologies has been very low for a number of reasons, among them, cost of innovations, socio-cultural practices and perceptions, and lack of technical knowhow. Food losses contribute to high food prices by removing part of the food from the supply chain. They also impact on environment, land, water, and non-renewable resources such as fertiliser and energy which are used to produce, handle, and transport food that does not get to the consumers. Mitigating PH losses can increase food availability, improve food security, nutrition and incomes without the need to employ extra production resources, and causing environmental harm. But what is the real magnitude of losses in Mozambique? And what direction should PH innovations take so as to achieve meaningful reduction of losses, without the risk of reinventing the wheel? In efforts to mitigate PH losses, the government of Mozambique supported programmes to popularise loss reduction innovations specifically at storage level. The initiatives which include construction of communal granaries, promotion of metal silos and enforcement of insect pest management programmes, aim at enhancing storage capacity of smallholder farmers. However, even with these initiatives reduction of losses has been difficult to ascertain because the baseline loss magnitudes are unknown and the mitigation strategies do not necessarily resonate with needs and dynamics of commodity value chains.

Magnitude of PH losses in Mozambique

There is uncertainty on the level of PH losses in Mozambique. A systematic review of original studies was carried out by International Centre of Insect Physiology and Ecology (*icipe*) with financial support from International Development Research Centre (IDRC) to ascertain magnitude of PH losses in Mozambique, and innovations that were promoted to mitigate those losses. Twelve (12) commodities: maize, beans, cowpea, sorghum, cassava, cabbage, tomato, banana, mango, groundnuts, sweetpotato and fish were considered in the review that traced through relevant online databases and institutional libraries dated 1980 to 2012. These were screened for relevance and methodological appropriateness of loss assessment. Those that passed certain preset criteria were reviewed to extract data on losses and innovations for loss mitigation.

Fig. 1: Geographical location of Mozambique. Mozambique is in southeastern Africa bordering the Indian Ocean

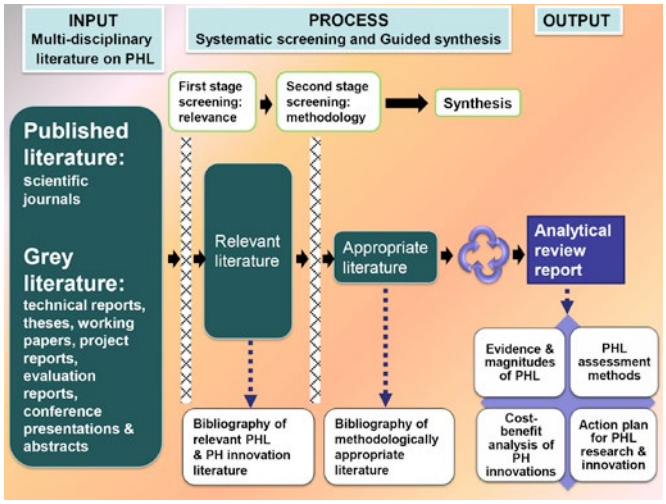

Fig. 2: Methodological framework of the review

Out of 73 relevant documentation, only 7 (2 published, 5 unpublished) articles were suitable for review. Of the 7, 5 reported on maize, 1 on fish and 1 on sweetpotato. The articles reported losses or innovations at single-level points of value chains, mainly storage. For maize, all 5 articles were in-farm storage. Three articles disclosed data on losses (to insects and rodents) whereas 2 reported cost–benefit analysis and impact of improved storage. Storage losses range between 3.3–62% (average 29% during a storage period of 7 months on average) but without adjustment for store emptying either for consumption or sale. Based on this limited disclosure, it is not possible to ascertain, in its entirety, the magnitude of losses in the maize value chain. Adoption of storage innovations by farmers is deterred by high cost, the failure of innovations to fit within the context of local practices and inability of innovations to generate attractive economic returns.

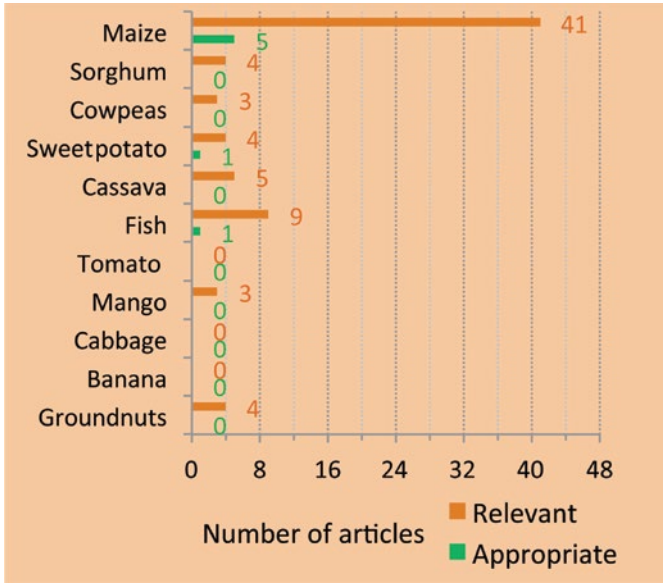

Fig. 3: Distribution of articles retrieved and articles found appropriate for review

For fish, PH losses amount to 39 – 58%. This figure, however, is a guesstimate, given by value chain actors for the entire chain, from capture to sale, without specific reference to the causes or chain levels where the losses occur. The article on sweetpotato disclosed vitamin A loss during drying of potato chips and storage of the dried chips.

Estimates of losses in stored maize due to insect attack (data 2005–2007)

Region	Province (Location)	Weight losses (%)	Storage period (months)
Central Mozambique	Manica (Vanduzi)	46.4	8
	Manica (Pangue Sul)	45.9	8
	Manica (Cruz. Tete)	45.8	8
	Manica (Nhazonia)	55.9	8
	Manica (Honde)	61.5	8
	Tete (Moatize)	25.5	8
	Tete (Chiuta)	50.8	8
	Tete (Changara)	44.7	8
	Tete (Mutarara)	5.3	2
	Tete (Moatize)	14.3	3
	Sofala (Chibabava)	25.6	4
	Zambezia (Morrumbala)	7.7	3
Southern Mozambique	Maputo (Marracuene)	3.3	9
	Maputo (Moamba)	10.5	12
	Gaza (Massingir)	9.8	11
	Gaza (Chókwe)	12.0	8

Overriding PH issues in value chains of important food commodities in Mozambique

Cereals, pulses, root and tuber crops, fruits, vegetables, oil crops and fish are important food commodities in Mozambique. For the majority of these commodities, value chains are shallow. Farmers are responsible for most functions including production, processing and marketing. Cleaning, sorting and bulking are the dominant value addition activities. Markets are largely informal, often localised or village based, with numerous constraints to accessing markets, and losses can occur at several levels of value chains.

Key review findings

1. **Evidence of PH losses that is based on credible loss assessment is scanty.**
2. **Magnitudes of losses along value chains of major food commodities are unknown. Where available, quality of data is poor and numerous gaps exist.**
3. **There is a clear pointer to lack of capacity for PH loss assessment and management in the country.**

Cereals: Maize is the main cereal crop. Smallholder farmers control over 95% of total production. Maize production is more intense in the northern and central parts. Poor roads and high transport costs, however, limit spatial trade with the deficit southern region; the deficit in the south is covered by imports from South Africa. Long-term storage, as a means for smoothening supply, is discouraged by heavy storage losses under traditional technologies. At processing level, large industrial millers are involved, particularly in the south, where they

Spillage losses during bagging

process imported maize. Hammer mills and small-scale millers also play important roles, especially in the central and northern regions. Generally, the maize value chain is skewed toward transportation and milling services. Sorghum is another important cereal crop in Mozambique. It is mainly produced for household subsistence and only about 24% is marketed. About 23% of the total produce is used for brewing alcoholic beverages, particularly in the northern and central regions of Mozambique.

Pulses: Common beans are produced by small-scale and some commercial farmers for subsistence and income generation. The production mainly takes place in Niassa, Tete, Gaza and Zambézia provinces. Cowpea is also cultivated but largely for household subsistence.

Root and tuber crops: Cassava is the second most important food crop after maize. Over 70% of smallholder farmers (generally in Cabo Delgado, Nampula, Zambézia and Inhambane) cultivate cassava for household subsistence. About 30% of cassava is processed into flour and roasted grits (*rale*). Almost all processing is done at farm level. Processing tools are quite basic. Improved processing technologies such as chippers and grating machines were introduced, but adoption was low because of high costs of acquisition and maintenance, and the local perception of the resultant product did not match local preferences. Sweetpotato is produced in almost all regions for subsistence. Only minimal processing (at household level) is done.

Sun-drying of sweetpotato chips

Fruits and vegetables: Bananas and mangoes are among the most important fruits. Their production is mainly by smallholder farmers, but some commercial producers for urban and export markets are found in Maputo, Manica and Nampula provinces. The advent of the fruit fly in Mozambique forced a ban on banana and mango to export markets. Postharvest value addition activities are quite minimal. Cabbage and tomato are important vegetables. They are produced by both subsistence and commercial farms. Mozambique is, however, a net importer of tomato and cabbage. Value addition for these commodities is minimal. Lack of consistency in quality and supply, inadequate PH extension on handling, poor linkage to markets, high transaction costs and poor quality are main factors that constrain access to markets for fruits and vegetables.

Roadside markets for fruits are common

Oil crops: Groundnuts are grown in almost all regions of Mozambique exclusively by the smallholder farmers for subsistence and income. Major producing provinces are Nampula and Inhambane. Value addition is limited to domestic activities such as roasting, boiling, and pounding for home consumption, or sale in street markets and kiosks. Bulking for oil extraction or export is also undertaken. Whereas potential for export (to Europe and the Middle East) exists access to this export market is limited by quality issues related to aflatoxin contamination and the size of nuts.

Aspergillus flavus *infected groundnuts. Aflatoxin contamination is a key PH issue*

Fish: Fishing is important as a source of food and income. Chain actors include industrial, semi-industrial, artisanal and small-scale players. Markets for fish products depend on commercial value, quality and region. Industrial and semi-industrial actors dominate export markets (Europe, Asia). Demand in these markets constitutes high quality shrimp, *gamba* and lobster. Downgraded products are sold locally. Small-scale and artisanal fishermen, who account for about 80% of the total catch, supply the local market. The small-scale and artisanal fishermen operate either as individuals or in small organised groups but generally, their economic and input capability is weak. Sun-drying, smoking and salting are the commonest processing methods especially in northern and central parts of Mozambique, where local market for such processed products is more expanded. The national distribution system for fish is poorly developed. Inadequate handling, poor transportation and storage infrastructure are among the constraints.

Dried fish products in the market

Future PH research and innovation needs

Limitations of past approaches for PH loss assessment and mitigation

Very few studies were conducted to assess extent of postharvest losses in Mozambique. With the exception of maize, data on losses are completely missing for all important food commodities. Furthermore, only physical storage losses have been estimated thus, magnitude of losses along the entire maize value chain is unknown. There is need to conduct systematic assessments to ascertain magnitudes of both the physical and economic losses, along value chains of food commodities. Such systematic data will help identify critical hotspots for PH losses and also inform the types of innovations that could be needed to halt the losses. It will further provide a tool for evaluating impact of innovations by providing precise baselines.

Past PH loss interventions focused mainly on improvement of storage. The interventions involved transfer of storage technologies, particularly for maize, to small-scale farmers. Examples include promotion of improved granaries, communal silos and warehouses (most of these were destroyed during the 1977–

1992 civil war but there have been new initiatives to reconstruct them), chemical insecticides (Actellic Super®), and metal silos. Some of these strategies have not been successful. For example, dissemination of the metal silo failed due to inadequate capacity for local fabrication. Notably, very few studies assessed success or failure of PH innovations. There is also paucity of information regarding cost–benefit analysis, among other factors. Nevertheless, from the few available studies, there is evidence that technologies intended for dissemination need to be assessed for cost-effectiveness, socio-cultural acceptability and sustainability under local capacity. Furthermore, innovations could be more promising if dissemination is anchored on models that integrate chain actor interaction, capacity building and coherent platforms for learning, knowledge sharing and resource mobilisation. Such models include organised farmer groups as well as small and medium agro-enterprises operating in postharvest segments of value chains. Within these models, technology adoption is inspired by a business perspective, economies of scale, access to credit services and markets, shared risk and stronger negotiating power.

PH research & innovation pointers

1. **Capacity building and training**
2. **PH Loss assessment and innovations along commodity value chains**
3. **Appropriate innovation identification and transfer**
4. **Strengthening national policy and legislation**

Capacity building and training for effective PH losses mitigation

Government capacity in the field of postharvest is weak in Mozambique. The focus on postharvest issues is made worse by poor representation in curricula for agricultural education at universities, training colleges and farmer-extension schools. Standards and exchange of information are also low and need to be raised. This can be done by including postharvest modules in the curriculum of agricultural colleges and building farmer and private sector capacity through diverse training channels, so as to foster efficiency in loss assessment and innovation delivery systems.

Local knowledge of value chains

Building local knowledge of value chains is needed for systematic assessment of losses and identification of appropriate innovations. Apart from establishing commodity paths, understanding the volumes moved, processes involved, the people/groups/organisations involved and their activities, goals, motivations, and behaviours will be of essence. This will also reveal factors that influence the decisions taken at production, distribution, marketing, processing, etc. This detailed analysis of value chains will help to assess loss magnitudes accurately, and to identify interventions that are problem-centered and socio-economically appealing using participatory means. The participatory component would, therefore, need to feature at three levels: (i) participatory diagnosis of key PH problems and constraints at different levels of commodity value chains; (ii) participatory inventory of existing strategies to mitigate identified problems and constraints, including baseline information on their uptake; and (iii) participatory development of loss mitigation strategies for specific commodities.

Women undertake most activities in PH chains

Appropriate innovations identification and transfer

Whereas not many technologies were transferred to deal with PH losses in Mozambique, many PH technologies have been promoted in SSA and other comparable parts of the world such as Asia. These technologies can be accessed. What is required, for Mozambique, is knowledge management and application, leading to the appropriate innovation along commodity value chains. Adaptive research and technology transfer should thus be the basis of innovations. However, to ensure that technologies fit within the local socio-economic, technological and policy environments, some key research (to be able to make modifications if necessary) will need to focus on: (i) analysis of costs and benefits of technologies; (ii) assessment of policy context that may influence adoption and continued technology utilisation; (iii) testing and evaluating the innovations in selected pilot sites; (iv) optimising innovations for wider dissemination; (v) training to build the necessary capacity; (vi) assessing preliminary impacts of developed innovations on stakeholders' behaviour leading to technologies uptake; (vii) up-scaling; and (viii) assessing impact.

Strengthening national policy and legislation

At the national level some policy and legislation actions will certainly help to mitigate PH losses in Mozambique. Examples include:

1. Postharvest training extension policy to promote capacity in postharvest at institutional and chain actor levels;
2. Formal–informal sector gap bridging policy to promote participation in PH entrepreneurships;
3. Rural infrastructure development policy; and
4. Government structured policies for facilitating access to financing and markets.

Conclusion

Evidence of PH losses that is based on credible loss assessment is scanty, and points to lack of capacity. Nevertheless, in past years, some PH loss intervention work has been conducted in Mozambique but success stories are difficult to find. Interventions to halt PH losses will need to start with building capacity for comprehensive assessment of losses. Interventions will require focusing on holistic innovations along commodity value chains, based on detailed understanding of the chains. Innovations will most likely involve adaptive research, and transfer of those technologies that fit within the local socio-economic, technological and policy environment. Modalities for engaging socio-cultural diversity in mechanisms for disseminating the technologies, and the integration of structures for learning and knowledge sharing, will be necessary for effective mitigation of PH losses.

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