



Food loss analysis: causes and solutions

Maize supply chain in Malawi

Maize (*Zea mays L.*) is the main staple food crop in Malawi and is largely cultivated by smallholder farmers. Aside from its strategic importance to the economy and food security, it also plays an important role in the livestock industry as an ingredient in feed formulations. Maize is a major source of carbohydrates, protein and fibre, and has high content of minerals such as potassium, phosphorous, magnesium and calcium. Over 1.6 million smallholder and subsistence farmers depend on maize production for their livelihoods.

Critical loss points in the supply chain

Post-harvest begins where production ends, that is at harvest. High quantitative and qualitative loss of 58 percent and 22 percent, respectively, occur in the production chain where harvesting and subsequent on-farm operations are done. Stooking, picking of maize ears, shelling and farm storage are the critical loss points of the supply chain which occur at the production stage (Table 1). Stooking, where cut maize stalks are stacked in an upright position and left to dry in the field, is done manually with quantity and quality losses of 10 percent and 6 percent, respectively (Table 1) due to attack by insects and rodents as well as mould growth. Losses of 14 percent occur during picking of maize ears due to the practice of children performing this task or of hired labourers who deliberately leave maize ears that they will collect later for their own use. Shelling is done by beating maize cobs in a polypropylene bag or by the use of inefficient motorized shellers which result in quantity (14 percent) and quality (5 percent) losses due to spillage and

The maize supply chain

The supply chain that was assessed in Naming'ongo EPA (Extension Planning Area) villages of Chamoto, Matunduluzi and Mbuto, Lilongwe district in Malawi represents the dry maize supply chain which includes farmers, traders, wholesalers, retailers and millers/processors. The supply chain draws much support from the government to ensure adequate availability of and access to quality maize that is affordable to consumers. Observations, direct interaction with stakeholders and actual load tracking were done to provide estimates of the quantitative and qualitative losses, and to identify the critical loss points in the chain.

Maize production is dominated by smallholder farmers who, on the average, cultivate 0.4 hectare per household with an average yield of 1 tonne/hectare. After harvesting, stooking/drying, dehusking and shelling, farmers sell the maize grains to small-scale traders who in turn supply the medium-scale traders, large-scale traders, or market institutions. Retailers and small-scale millers source the grain from the small-scale traders and sell it to consumers (Table 1). Industrial processors source the grains from medium and large-scale traders as well as market institutions and sell the processed products to retailers.

TABLE 1
The maize supply chain, stakeholders, operations and loss points

Supply chain level	Production	→ Rural market	→ Wholesale market	→ Retail market	→ Consumption
Stakeholders	Farmer Input suppliers	Small-scale traders	Medium and large-scale traders Market institutions Industrial processors	Retailers Millers	Rural and urban consumers
Operations	Harvesting Stooking Picking/Dehusking Shelling Packaging Farm storage	Transport	Transport Storage	Transport Milling Retailing	Buying Consumption
Loss (%)					
Quantitative:	57.8				
Qualitative:		21.5			
Loss Points (%)	Stooking: 10 Picking: 13.5 Shelling: 14 Storage: 20.3	6 1.5 5 9			

broken grains. Quantity and quality losses of 20 percent and 9 percent, respectively, occur during storage caused by insects and rodents, and mould contamination due to the use of traditional granaries for storage of maize cobs and grains (Table 1).

Impact of post-harvest losses

Losses that occur at the farmer's level have a negative impact on the livelihood of many smallholder farmers who live on the margin of food insecurity. Maize losses reduce food availability at the household level where about 86 percent of the produce is retained for consumption. Reduction in volume that can be sold due to losses translates to reduced income. Losses also mean wastage in labour and inputs utilized in maize production that significantly impact the resource-poor farmers.

The importance of good post-harvest handling practices

Traditional practices in harvesting, stooking, shelling, and homestead storage result in high levels of post-harvest losses in maize due to spoilage and grain quality deterioration caused by unfavourable weather conditions, pest infestation and mould contamination. Maize grains are susceptible to attack by rodents, insects, and moulds due to poor

packaging and inadequate storage conditions. The lack of appropriate and feasible technologies is the main constraint in the reduction of post-harvest losses in the maize supply chain. Food loss reduction measures should therefore be given high priority to raise incomes of smallholder maize farmers and improve food and nutrition security in Malawi.

Recommendations to reduce losses and the economic benefits

Stooking is one of the critical loss points at the farmer's level. This traditional practice contributes to quantity and quality losses which translate to an economic loss of 427USD/year. Loss reduction of 75 percent can be achieved with the use of biological control measures such as natural predators against the insect pests. The use of biological control agents will be beneficial if farmer groups or cooperatives will adopt it with a profitability of 50 USD/year as shown in Table 2. Losses in picking of maize ears can be reduced with the use of a community-based mechanical harvester operated to provide harvesting rental services to individual or groups of farmers. With loss reduction of 75 percent, savings of 427 USD/year can be realized with the use of harvester with a profitability of 87USD/year. In the case of shelling, losses can

be reduced with the adoption of community-based modern mechanical shellers providing shelling rental services to individuals or groups of farmers. If operated properly, loss reduction of 75 percent can be achieved with mechanical sheller equivalent to a savings of 480 USD/year and a profitability of 100 USD/year. Metal silos, if properly managed, effectively protect stored grains from rodents, birds and moisture migration that results in growth of moulds in the grains. Since an individual smallholder farmer cannot afford the cost of buying and operating the metal silo, adoption of metal silos will be profitable if operated as community-based facilities providing storage rental services to individuals or groups of farmers. With loss reduction of 75 percent, savings of 747 USD/year can be realized with the use of metal silo with a profitability of 137USD/year (Table 2). Introduction of the various loss reducing interventions will require training of farmers on proper operation, maintenance and management of the facilities to ensure effectiveness of the interventions in reducing the losses. Smallholder farmers will reap significant benefits with the use of the various recommended interventions in terms of higher grains output and improved product quality.

TABLE 2
Costs and returns for the various interventions

Item	Biological control agents	Mechanical harvester (10 tpd capacity)	Mechanical sheller (50 tpd capacity)	Metal silo (800-1800 kg capacity)
	Value	Value	Value	Value
Product quantity, tonnes/yr	23.94	23.94	23.94	23.94
Product value, USD/tonne	297.30	297.30	297.30	297.30
Loss rate, %	6	8	9	14
Food loss, tonnes/yr	1.43	1.92	2.15	3.35
Economic loss, USD/yr	427.04	569.39	640.56	996.43
Total cost of intervention, USD/yr	270	340	380	610
Client cost of intervention, USD/tonne	11.28	14.20	15.87	25.48
Anticipated loss reduction, %	75	75	75	75
Volume of loss reduction, tonnes/yr	1.08	1.44	1.62	2.51
Loss reduction savings, USD/yr	320.38	427.04	480.42	747.32
Profitability of the intervention, USD/yr	50.38	87.04	100.42	137.32

Note: tpd= tonnes per day

This information sheet summarizes the results of the study on Food Loss Analysis: Causes and Solutions, Case Studies in Small-scale Agriculture and Fisheries Subsectors of the Food and Agriculture Organization (FAO) of the United Nations. *For more information:* Global Initiative on Food Loss and Waste Reduction (www.fao.org/save-food).



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