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WHERE TO FOCUS POST-HARVEST LOSS EFFORTS?

A review of recent evidence, with application to Ghana

VIVIAN HOFFMANN, CARLOTTA RIDOLFI, AND MANSON NWAFOR

Food loss constitutes a significant and complex problem around the world. FAO estimates place the amount of food lost and wasted globally each year at about 1.3 billion tonnes – one-third of all food produced for human consumption. While much of this food loss in developed countries occurs at the consumer stage, in Africa south of the Sahara and other developing regions, the majority of this food loss occurs during the production, handling, and storage stages of the food value chain. Perishable crops suffer disproportionate losses.

Reducing food loss and waste can help improve food security by increasing the amount of food available for consumption. Accurately measuring and understanding the relative magnitude of food loss across types of crops and at different stages in the value chain is critical for identifying the most cost-effective interventions. However, terms like "food loss", "food waste", "post-harvest loss", and "food loss and waste" are often used interchangeably in the literature, causing confusion as to what actually is being measured. Further, measurement methodologies used across studies are often inconsistent and the precise causes of food loss are often not described. As a result of this confusion, data on food loss remain inconsistent, leaving open questions about the most effective targeting of resources to combat this problem. In this note, we summarize new evidence from a recent IFPRI study that documents the relative importance of losses in value chains for staple foods in six countries, review the evidence on which crops are most affected by losses, and outline ways to mitigate PHL.

LOSSES HIGHEST AT PRODUCER LEVEL

In a new study undertaken by the CGIAR Research Program on Policies, Institutions, and Markets (PIM)[1], researchers tested several new methodologies to measure food loss at various points in the value chain. These new methodologies account for the important component of pre-harvest loss and include measures of quality deterioration and quantity loss, thus providing a more robust look at the true measure of food loss in seven staple food value chains in developing countries. While the study does not look specifically at Ghana, it covers several of Ghana's major staple food crops, including maize and beans, in economies similarly dominated by smallholder agricultural production. The findings are thus highly relevant to Ghana.[2]

In the first methodology (the self-reported method), the research team designed a set of surveys to capture detailed data regarding farmers', middlemen's, and processors' different activities and to collect self-reported measures of the volumes and values of food lost during each of these activities in order to quantify loss along each node of the value chain. The second methodology (the category method) collected data from each value chain actor regarding the quality of agricultural commodities that they use as inputs and outputs, allowing the researchers to estimate losses based on the reduction of value by stage of production. Finally, the research team captured information regarding different types of commodity attributes (size, broken grain, impurities, etc.) and determined the price penalty that these types of crop damage cause, allowing them to quantify food quality loss based on market conditions (the attribute method and price method). While these methodologies were tailored to specific countries and commodities and commodity varieties, consistent findings across settings mean the results may be generalized to other similar settings. Further, the study provides a set of consistent approaches that may be adapted to assess losses in other commodities and regions.

The study finds that across all of the studied value chains, losses were systematically lower when measured in aggregate through a single survey as is typical than losses estimated using the three more detailed methodologies. Aggregate self-reported losses range from 6.26 percent to 13.2 percent, while estimates using the

[1] Delgado et al, 2017.

[2] The value chains included in this study were: maize and beans in Guatemala and Honduras, potatoes in Peru and Ecuador, and teff in Ethiopia.

other methodologies, which relied on highly specific questions about losses at each stage from harvest to distribution, range from 8.69 percent to 25.97 percent across the various crops and countries studied.

Looking at all of the studied value chains, losses are consistently largest at the producer level (between 60 and 80 percent of total value chain loss) and smallest at the middleman level (around 7 percent). For maize and beans, two crops of particular importance for Ghana, both pre-harvest and post-harvest losses play a role at the producer level. The paper points out that estimates for pre-harvest losses do not include yield gaps (the extent to which yield is below agricultural potential), which could vary between 50 percent and 80 percent.

For maize and beans, the most common self-reported causes for pre-harvest loss at the farmer level were pests, crop disease, and low or excessive rainfall. Post-harvest, damage due to laborers during crop selection and crop harvest and damage from animals and disease were reported as causing the most loss.

The study finds that in some cases, as the cost of reaching markets increases, so do losses, indicating that access to improved roads plays an important role for farmers. Access to and use of improved technologies and seeds also appear to matter in a variety of ways. In several of the studied maize and bean value chains, the use of improved seed varieties is associated with a decrease in losses. In addition, in some bean value chains, the use of mechanical harvesting techniques is positively correlated with an increase in loss; the authors suggest that these techniques appear more likely to damage the bean crop or result in beans being left in the field due to the use of older or poorer quality machines and poorly trained laborers.

Storage by producers significantly increased loss for both beans and maize, although the use of improved storage facilities, such as silos, and fumigation and ventilation mitigated those losses.

When extrapolated to the Ghanaian context, these findings highlight the need to address food loss at the producer level. Improving rural infrastructure such as roads and storage facilities can play an important role in reducing food loss at earlier stages of the maize and bean value chain. In addition, there is a clear need for improved training of farmers and agricultural laborers in terms of proper crop selection and harvesting techniques, as well as for increased support for farmers to enable them to use improved agricultural inputs. Such inputs could increase their resilience to shocks like pests or disease infestation or low rainfall, mitigating losses due to such occurrences.

FRUIT AND VEGETABLES MOST AFFECTED

The production of horticultural commodities has been identified as a promising channel through which to increase and diversify farm incomes and reduce poverty in Ghana.[3] However, horticultural commodities are more perishable than staple crops like maize or beans and are thus more vulnerable to loss. While estimates of the precise size and value of horticultural crop losses vary significantly in the literature, there is a consensus that these losses are far higher than losses for storable staples.[4]

In developed countries, much of the loss in perishable products occurs at the consumer level, but in developing regions like Africa south of the Sahara, most perishable products are lost post-harvest before reaching consumers.[5] Inadequate infrastructure and transportation facilities combined with hot and humid weather conditions can result in post-harvest spoiling and loss of perishable products of up to 40-50 percent[6]. In Africa south of the Sahara, such post-harvest losses have been estimated to reduce the income of farmers and downstream value chain actors by an average of 15 percent.[7]

The tomato value chain is particularly important to both diets and incomes in Ghana, and is highly vulnerable to post-harvest losses. Handling, transportation, and storage conditions pose the largest challenges for tomato producers and marketers. One study estimates total tomato losses in Ghana to be between 13.1 and 35.3 percent, with the majority of losses occurring during harvest, grading, and storage.[8] This is far higher than estimated tomato losses for the region as a whole, estimated by others to be around 10 percent, and suggests significant room for improvement in Ghana.[9] One study points to the potential for cooling technologies to reduce these losses.[10]

APPROACHES TO ADDRESING LOSSES

PHL can be best tackled with a multipronged approach that recognizes and addresses impediments at each stage in the value chain, and takes into account both individual constraints and the institutional context. In the case of individual farmers, various low-cost and cost-effective technological interventions are available. Technologies such as field packing stations with concrete flooring, fiber-board lined crates for fruits, and simple cooling technologies

[3] World Bank, 2011.
[4] Gustavvson *et all*, 2011; FAO 2013; Affognon *et al*, 2015
[5] Ridolfi and Hoffman, 2017.
[6] Ridolfi and Hoffman, 2017.
[7] Gustavsson *et al.*, 2011
[8] Addo, Osei, Mochiah, Bonsu, Choi, and Kim. 2015.
[9] Sibomana, Workneh, and Audain. 2016.
[10] Sibomana, Workneh, and Audain. 2016.

have been shown to be cost-effective and feasible to adopt in similar contexts.[11] There are, however, multiple material and behavioral bottlenecks to adoption, such as lack of knowledge and information about such technologies, credit constraints to acquire them, and farmers prioritizing present consumption over future income.[12] Interventions should be designed keeping in mind both material and behavioral constraints. Furthermore, some technologies and interventions may only be cost-effective at scale or when used collectively rather than by individual farmers; achieving such scale or coordination requires active collaboration and investment by public and/or private institutions.

There is great potential for the private sector to invest in making value chains more efficient, particularly when production is highly concentrated so that the firms are able to capture a return on such investments. Such private sector initiative should be encouraged by the policy makers. However, public sector will need to take active leadership for crops grown by a large number of geographically dispersed farmers, for which the incentives for private sector investment in value chains are weaker. Furthermore, investments outside of the agri-food sector, including transportation infrastructure, rural electrification, and the development of rural financial markets are key to reducing PHL and providing broader socio-economic benefits.

CONCLUSIONS AND RECOMMENDATIONS

- Food losses in developing countries appear are consistently highest at the producer level; this is a key node at which interventions are needed
- Specific and detailed data collection methods are required to generate reliable evidence on food loss; common survey approaches tend to underestimate the extent of loss.
- The main drivers of food loss in maize and bean value chains are pests and disease, too much or too little rainfall, and poor harvest and post-harvest techniques. Approaches to addressing these challenges include improved extension services to educate farmers about pest management and harvesting techniques and financial services to improve farmers' resilience to rainfall shocks.
- Horticulture is an important sub-sector of Ghana's agricultural economy with great potential for growth due to a strong export market as well as growing domestic demand. Given that PHL in horticultural crops is particularly acute, returns to PHL prevention in horticulture are expected to be high.
- Numerous low-cost and cost-effective postharvest technologies to prevent PHL exist. There are, however, multiple material and behavioral bottlenecks to adoption, such as lack of knowledge and information about such technologies, credit constraints to acquire them, and farmers prioritizing present consumption over future income. Interventions should be designed keeping in mind both material and behavioral constraints.
- Some technologies and interventions may only be cost-effective at scale or when used collectively rather than by individual farmers; achieving such scale or coordination requires active collaboration and investment by public and/or private institutions.
- Efforts to address PHL must consider the entire value chain rather than focus on losses at a single stage.
- The private sector should be encouraged to invest in making value chains more efficient, particularly when production is highly concentrated so that firms are able to capture a return on these investments.
- Ghana should study instances of regional successes and create enabling conditions for partnerships across the private and non-profit or public sector, such as that between Coca Cola and the Gates Foundation in the mango value chain in Kenya.
- For crops grown by many, geographically dispersed farmers, reducing PHL will require leadership by the public sector.
- Investments outside of the agri-food sector, including transportation infrastructure, rural electrification, and the development of rural financial markets can reduce PHL while providing broader socio-economic benefits. All of these benefits should be taken in to account when considering such investments.

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[11] Kitinoja, 2013.

[12] Daminger, Datta, and Guichon, 2016.

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
A world free of hunger and malnutrition
1201 Eye Street, NW | Washington, DC 20005-1002 USA
T: +1.202.862.5600 | F: +1.202.467.4439
Email: ifpri@cgiar.org | www.ifpri.org