INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI

SFS4YOUTH RESEARCH NOTE #1 DECEMBER 2025

Synopsis: Quantifying Food Losses in the Beans Value Chain in Rwanda

Results from a Baseline Survey

Fantu Bachewe, Luciana Delgado, and Josue Niyonsingiza

Reducing food loss has become important, particularly in Sub-Saharan Africa, due to its direct impact on food security. Food loss also reduces producer incomes, increases food prices, and wastes natural resources, resulting in unnecessary greenhouse gas emissions. Most estimates of food loss have been heavily criticized for lacking sound methodological basis. This study uses a novel methodology to measure food loss and identify where it occurs along the beans value chain in Rwanda. Key findings of the study are:

- Significant losses occur along the beans value chain, with producers bearing the largest share, highlighting major inefficiencies at the farm level.
- Most losses in quantity arise before harvest due to pests, diseases, and unfavorable weather, though the value of postharvest losses remains significant.
- Women and youth producers are more affected by losses, reflecting unequal access to resources and technologies.
- Traditional methods dominate bean production as well as postharvest handling (threshing, drying, and storage), while adoption of modern inputs and technologies remains low.
- Aggregators and processors also face quality and handling losses from spillage, spoilage, and poor storage or transport conditions.
- Reducing losses requires improved pest management, better postharvest tools, and inclusive capacity building, especially for youth and women.

Introduction

Awareness about food loss has grown significantly over the past decade, particularly in sub-Saharan Africa (SSA). This has prompted several initiatives to address the problem, including the establishment of the African Postharvest Losses Information System (APHLIS) in 2009, the inclusion of postharvest loss (PHL) targets in the Malabo Declaration under the Comprehensive African Agricultural Development Program in 2014, and a commitment to reduce food waste as part of the Sustainable Development Goals (SDG target 12.3) in 2015. The focus on food loss reflects its direct impact on the food availability dimension of food security, a critical problem in SSA. Food loss reduces producer income, increases food prices, and wastes natural resources, resulting in unnecessary greenhouse gas emissions.

Annually, up to 30 percent of total global food production for human consumption may be lost or wasted. However, this and other widely cited estimates, most of which rely on aggregate/macro methods, have been heavily criticized for lacking sound methodological bases. FAO (2019) updated these estimates based on an improved micro-data methodology that highlights the Food Loss Index. This study implements Delgado et al.'s (2021) approach, which is consistent with FAO (2019), to measure food loss and identify where it occurs along the value chain.

This study measures the magnitude of losses in Rwanda's beans value chain and their socioeconomic impacts, especially on youth and women. This data is key to better informing the design of targeted policies and effective programs in Rwanda, where food insecurity concerns are frequently cited by policymakers. The Government of Rwanda, led by its Ministry of Agriculture (MINAGRI), prioritizes beans among the country's six main agricultural value chains; beans are grown by 81 percent of farmers (predominantly women) and are an important cash crop. However, postharvest bean handling still faces significant challenges. Government plans, including the Second National Strategy for Transformation (NST 2) and the Fifth Strategic Plan for Agriculture Transformation (PSTA-5), underscore the need to address food loss and invest in postharvest infrastructure to modernize the agriculture sector.

This research project is part of the collaboration between IFPRI, the Mastercard Foundation, and its implementing partner in the Strengthening Food Systems to Promote Increased Value Chain Employment Opportunities for Youth project. Its overall objective is to provide tested options for creating innovative, digitally savvy livelihood opportunities for youth, especially young women, while reducing postharvest losses across agrifood systems.

The study aims at characterizing food losses at different stages of the value chain for beans, a crop important in terms of income and food security in Rwanda. Specifically, it identifies several production stages and processes during which bean losses occur; it also measures the extent of losses along the value chain, thereby pinpointing the relative importance of the locations where these losses occur. As part of this description, the study also characterizes bean production, aggregation, and processing activities, as well as spatial and demographic aspects of value chain agents. By collecting data and measuring losses at production, postharvest production, aggregation, and processor levels, the study provides a broad view of the value chain for beans, thereby helping to fill the gap in micro-level knowledge about food losses in SSA.

Methodology

The study applies the "attributes" method for measuring food losses, developed by Delgado et al. (2021). This methodology quantifies losses at different stages of the value chain and is applicable across crops

and regions. Specifically, the method evaluates crops based on visual, tactile, and olfactory characteristics, using 10 to 14 attributes depending on the commodity and country. Data are collected through representative surveys of producers, who report, among other things, the share of production affected by inferior attributes after production and postharvest, and of aggregators and processors, who follow equivalent procedures but also report associated price penalties.

The survey data enable us to characterize production, storage, handling, and processing practices and corresponding estimations of losses in quantity, quality, and value along the value chain. At the producer level, losses are measured from pre-harvest to postharvest sale, and for aggregators and processors, from purchase to sale over a one-month period within the same season.[1]

Data

This study uses primary data collected from a baseline survey of the beans value chain in Rwanda. The data was collected using a structured questionnaire and involved three main agents: producers, aggregators, and processors. Three distinct questionnaires were designed and administered to each group.

In the producers' survey, information was obtained from farmers who cultivated beans and sold all or part of their harvest during Season A 2023. Data collected included farmer and household demographics, farm characteristics, beans varieties cultivated, production volume and value, pest and disease management, pre-harvest losses, and harvest and post-harvest handling practices and losses. Aggregators were those who purchased beans from producers for resale in larger markets or to processors during the same season. The processors' survey covered those who acquired beans either from aggregators or directly from producers during Season A 2023.

In total, the dataset comprises of 686 producers, 139 aggregators, and 28 processors.

Results

Characteristics of value chain agents

Producers: The data show that nearly 60 percent of bean producers in Rwanda are male. The average producer is 48.4 years old and has 20 years of experience cultivating beans. In terms of education, 13 percent are illiterate, and 71 percent have completed primary education.

On average, producers cultivated 0.36 hectares of beans during Season A 2023, producing 193 kg, with an average yield of 910.5 kg/ha. This is comparable to the national average bean yield of 708.4 kg/ha reported in 2021 (FAOSTAT 2023).

Only 4.1 percent of producers used improved seeds, while over 95 percent applied fertilizer at least once. However, relatively few used other modern inputs.

More than 85 percent of producers prepared their storage sites, and virtually all (98 percent) stored their harvest an average of 2.5 months, usually at their dwellings (99.7 percent). About 12 percent used modern storage methods, most commonly PICS bags (used by 90 percent of those using modern storage).

[1] Details of this methodology and the results are available in Delgado, L., Niyonsingiza, J., and Bachewe, F. 2024. *Quantifying Food Losses in the Beans Value Chain in Rwanda: Analysis and Results from a Baseline Survey*. SFS4YOUTH Working Paper #2. Washington, DC: International Food Policy research institute. https://hdl.handle.net/10568/152031

On average, producers sold about 32 percent of their harvest, primarily to aggregators (56 percent). As expected, these numbers vary across provinces, between control and treatment areas, and by producer characteristics such as gender and age.

Aggregators: Nearly three-quarters of the aggregators in the sample are male. Aggregators are, on average, 42 years old and have 9 years of experience aggregating beans, although most operate as informal businesses. Most (84 percent) source beans directly from producers, while 36% acquire beans from other aggregators.

Over three-quarters (77 percent) of aggregators sell beans directly to final consumers, while a smaller share sell to processors (18 percent) and retailers (13 percent). Aggregators also engage in various postharvest handling activities, including drying (39 percent), cleaning and packaging (31 percent), and storage (91 percent). Additionally, 22 percent are engaged in transportation, collectively contributing to the quality and accessibility of beans in the market.

Processors: About 43% of processors are male. The average age of processors is 39 years old, with three years of experience in bean processing. Only 21 percent of processing businesses are formal. All processors rely on aggregators as their primary source of raw beans. All processors in the sample cook beans as part of the processing activities intended for sale to the public, either in restaurants or markets.

Estimated food losses

Figure 1 depicts the volume and value of bean losses across the three stages of the beans value chain covered in the Rwanda baseline bean PHL survey. Losses at each stage include both quantity degradation, where the product completely disappears from the value chain, and quality degradation, where the product is affected by quality deterioration but remains usable for other purposes.

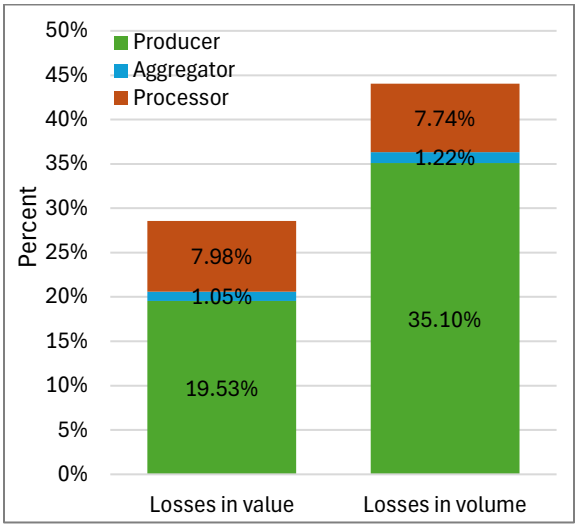
Total losses within the beans value chain in terms of volume averaged 44 percent of production, comprising losses by producers (35 percent), aggregators (1.2 percent), and processors (7.7 percent). In terms of value, total losses averaged 28.5 percent of the production value, with 19.5 percent of the value lost at the producer level, 1 percent at the aggregator level, and 8 percent at the processor level.

This means that 79.6 percent of the total volume of losses and 68.4 percent of the total value of losses occurred at the producer level, while processors accounted for 17.6 percent of volume and 28 percent of value losses. The value of postharvest losses is more important because the value of beans increases as they move along the value chain, highlighting the critical points where interventions to reduce losses could have the greatest economic impact.

Figure 2 further disaggregates the sources of bean losses, with production being the most significant node in our study. The data show that, of the total volume of producers' losses, 72.7 percent occurred before harvest. This is followed by postharvest losses (26 percent). In terms of value, pre-harvest losses accounted for 19.5 percent of producers' total value of losses, while postharvest losses were more significant, accounting for 58 percent of the total.

Female producers experienced higher losses on average: their volume of losses averaged 38 percent, and value of their losses averaged 22 percent. Among youth producers (15–35 years old), the volume of losses was similar to the overall sample (35.3 percent), with an average value loss of 17.5 percent. Despite these variations, pre-harvest losses contributed the largest share of total volume losses, while postharvest losses accounted for the largest share of total value losses among youth and female producers.

Figure 1. Estimated food losses along the beans value chain in Rwanda: Season A 2023



Source: Authors' calculation using PHL baseline survey (2023).

Causes of food Losses: Producers

Pre-harvest losses: Three-quarters of producers cited pests and diseases as the primary reason for pre-harvest bean losses. However, only about one-third practiced pest management, and most of those still reported losses despite doing so. Weeds were also reported as a contributing factor, although none of the producers used herbicides. Weather-related factors were another major cause of losses: 39 percent of producers reported losses due to excessive rainfall, while 57 percent cited insufficient rainfall as a contributing factor.

Left in the field: Producers reported leaving good-quality beans unharvested in the field, primary due to the unavailability of affordable labor. However, this affected less than ten producers.

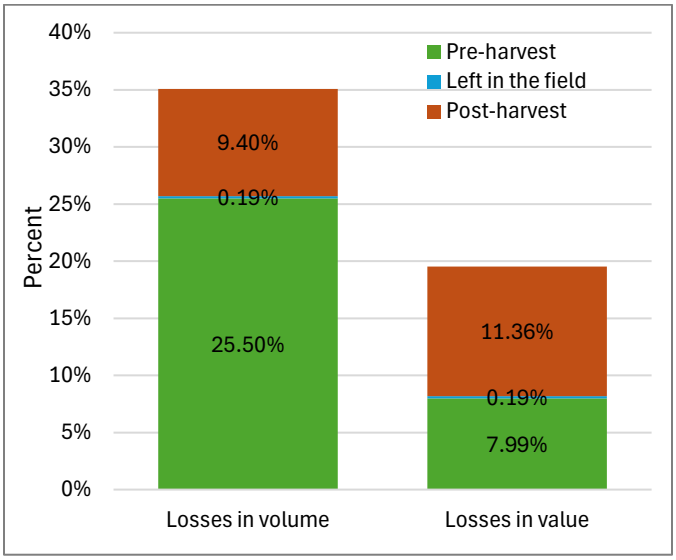
Post-harvest: Producers experienced significant losses during threshing, drying, winnowing, sorting, storing, and transportation, driven by a range of factors.

- **Threshing:** Almost all producers thresh their beans manually, and 92 percent reported losses during this process.
- **Drying:** About 98 percent of producers dry their beans, nearly all (99 percent) use traditional floor drying rather than hanging and nearly half of the producers reported losses during drying.
- **Shelling:** Almost all producers shell beans, with 96 percent using manual shellers. Of the 63 percent who experienced losses during shelling, 97 percent used manual shellers, while only 3 percent used mechanical ones.
- **Storage:** Nearly all producers store their beans, typically for two months, and entirely at home. About 88% use traditional storage methods. Among those who stored beans, 38 percent reported losses, with 91 percent using traditional storage (sacks, uncovered platforms, underground pits) and 9% using modern storage (PICS bags, SuperGrain bags, or silos).
- **Transportation:** Almost all producers transport their beans, and 57 percent reported losses during transport. Most (96 percent) carried the harvest physically, while 13 percent used bicycles. Among those reporting losses, 95 percent transported beans manually

Overall, the limited adoption of modern tools and the poor quality or unsuitability of traditional tools were major contributors to post-harvest losses. Losses during threshing and winnowing stages were also associated with insufficient training and experience among workers. Additional causes included blown away

by wind, spillage, and pest infestations. Although storage-related losses were relatively minor, they underscored the complexity of post-harvest challenges in Rwanda's beans value chain.

Figure 2. Food losses among bean producers in Rwanda: Season A 2023



Source: Authors' calculation using PHL baseline survey (2023).

Causes of food losses: Aggregators and processors

Aggregators: Losses among aggregators were mainly from spillage blown away during drying, cleaning and packaging, storage, distribution, and transportation. Other key factors include pest and disease infestations during drying and storage, adverse weather during drying and transport, insufficient worker experience, and the use of suboptimal tools across handling processes.

Processors: Processing losses primarily stemmed from human and operational factors, including damage during transport, theft linked to inaccurate weighing scales, and bean spoilage due to fluctuating storage temperatures or related issues.

Conclusions

In sum, this study finds substantial losses in Rwanda's beans value chain amounting to an average loss of 44 percent in volume and 28.5 percent loss in total value. Producers bear the highest share of these losses, followed by processors. Most of the volume losses occur at the pre-harvest stage, indicating that reducing losses during production could significantly improve rural incomes and livelihoods. Postharvest losses among producers account for over one-fifth of total losses, exceeding those experienced by processors. In terms of value, postharvest losses are more significant, though producers still bear the largest share overall.

The data identify critical points along the value chain where significant losses occur during both pre- and postharvest stages, as well as the specific value chain actors involved. While this analysis does not prescribe specific interventions, several inferences can be drawn. For instance, pre-harvest losses could be reduced through timely and adequate application of agrochemicals and the use of high-quality seeds, while postharvest losses could be mitigated through access to modern tools and storage materials and through relevant capacity building for value chain participants. The dissemination of modern production and postharvest practices remains essential across all stages of the value chain.

In the context of the project for which this research was conducted, the findings provide valuable insights for stakeholders designing interventions to reduce food losses. In particular, the results highlight the potential of youth engagement, especially young women, as change agents in reducing food losses and creating employment opportunities across the agrifood systems.

Overall, this study sheds light on the challenges and losses within Rwanda's beans value chain and underscores the urgent need for targeted interventions and innovations to address the root causes of these losses. The findings, as well as the underlying methodology, not only offer evidence to guide efforts within Rwanda but also provide lessons and strategies applicable to other agrifood systems across sub-Saharan Africa.

ABOUT THE AUTHORS

Fantu Bachewe, Research Coordinator, Development Strategies and Governance Unit, International Food Policy Research Institute (IFPRI)

Luciana Delgado Otero, Technical Adviser, Food and Agriculture Organization of the United Nations. (FAO)

Josue Niyonsingiza, Senior Research Analyst, Development Strategies and Governance Unit, IFPRI

ACKNOWLEDGMENTS

The authors would like to thank Samuel Benin and Kalyani Raghunathan for their valuable feedback and comments on the full report. Additionally, the authors would like to extend its thanks to Pamela Stedman-Edwards and other members of IFPRI's Communications and Public Affairs Division for copyediting and related publication services.

REFERENCES

FAO. 2019. *The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction*. Rome. Licence: CC BY-NC-SA 3.0 IGO

Delgado, Luciana; Schuster, Monica; and Torero, Maximo. 2021. Quantity and quality food losses across the value Chain: A Comparative analysis, *Food Policy*,101958, ISSN 0306-9192, https://doi.org/10.1016/j.foodpol.2020.101958.

This publication has been prepared in the context of the Strengthening Food Systems to Promote Increased Value Chain Employment Opportunities for Youth partnership with the Mastercard Foundation. It is a five-year initiative running between 2022 and 2027 to gain insight into the latest trends and challenges in agrifood systems, and how addressing market inclusion and post-harvest losses can enable dignified and fulfilling livelihoods for young women and men. The views expressed do not necessarily represent those of the Foundation, its staff, or its Board of Directors. This publication has not been independently peer reviewed. Any opinions expressed here belong to the author(s) and are not necessarily representative of or endorsed by IFPRI.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

A world free of hunger and malnutrition

IFPRI is a CGIAR Research Center

1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info