Food Loss and Waste Value Chain Selection Guide Pilot in the Huetar Caribbean Region, Costa Rica

AUGUST 2022
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Acknowledgements

From the Government of Costa Rica’s Ministry of Agriculture and Livestock (MAG), this pilot benefited greatly from the continued efforts of the core working team - Regional Director of the Caribbean Huetar Yendri Delgado and Executive Secretariat of Agricultural Sector Planning Analyst Francini Araya Molina. A special thanks to the Extension Agents from the Caribbean Region that provided valuable contributions to the pilot: Brayan Sánchez Ureña, Cristian Rodriguez Artavia, Jeannethe Aguilar Salad, Fabián Vindas Cubillo, Erika Valverde Ortiz, Alfredo López, Allan Villegas Loaiza, Keneth Bolivar Quiel, Delfin Rojas, and Alberto Rojas. This pilot benefited from the contributions from EARTH University Agroindustrial Cluster staff Gabriel Mora, Luis Valenciano and Ana Laura Jiménez. Special contributions came from: MAG Coordinator of the Research and Technology Transference Program for Tomato and Pepper, National Tomato and Pepper Programs Ligia Mayela López Marín, Walter Picado with the Rural Development Institute (INDER) of Costa Rica, and Mauricio Barrientos with the National Production Council (CNP), Costa Rica.

This work would not have been possible without the support of former MAG National Director of Extension Nils Solorzano, former Executive Director of Executive Secretariat of Planning (SEPSA) Jorge Cruz Hernández, and current Executive Director of SEPSA Lorena Jiménez Carvajal, SEPSA Coordinator of the Economic Studies and Information Area Sandra Mora Ramírez.

Lastly, we’d like to thank USDA Costa Rica team and USDA DC FAS team for their unflagging support and encouragement throughout the pilot.

USDA Foreign Agricultural Service (FAS) in Washington D.C., specifically program managers Paige Cowie, Andre Ntamack, Thomas Poole, and Branch Director Bruce Crossan.

USDA FAS Regional Office in San Jose, Costa Rica Post country facilitators Evan Mangino and Victor Gonzales.

Gurbinder Gill and Mandeep Sharma of Agribusiness Associates Inc. for guidance and support throughout the development of the guide and the pilot.

Any remaining errors and omissions are the responsibility of the contributors of the report.
Executive Summary

Food Loss and Waste (FLW) is a severe problem affecting the functionality of food systems; however, its approach is not always systematic and orderly. Hence, the FLW Value Chain Selection Guide helps identify and evaluate where in value chains interventions can reduce the problem. The Food Loss and Waste Value Chain Selection Guide was developed as part of the International Food Loss and Waste Hotspots and Business Models Project, funded by the United States Agency for International Development (USAID) and implemented by Agribusiness Associates Inc. (ABA) with technical support from the United States Department of Agriculture (USDA). Piloting of this guide was funded by the USDA Foreign Agricultural Service.

With the support of USDA Costa Rica and The Ministry of Agriculture and Livestock (MAG), it was decided that the guide will be piloted in the Huetar Caribbean region.

With limited data on regional FLW, the Core Team formulated the pilot objective: "To prioritize the value chains of the Huetar Caribbean Region by exploring food losses and waste and the main factors that affect this phenomenon, to inform future reduction strategies that improve the economic and environmental conditions of the area." The criteria selected to prioritize value chains included: economic outcomes, food security, investment opportunities, climatic events, agricultural producer population, availability of data and information, water footprint, MAG-producer accessibility, soil management, carbon footprint and food safety.

The resulting systematic prioritization supported by national, sectoral and/or regional data, literature, field observation and expert opinion, ranked the identified value chains in the following order of importance (highest to lowest): plantain, papaya, cassava, banana-criollo and baby banana-datil.

Banana-General information

Bananas are very important for the Costa Rican economy, and are one of the most consumed fruits nationally and worldwide. There are many different types of bananas, such as the ones studied in this Pilot: “banano criollo”, “baby-banana” and plantains. The fruits can be obtained from different levels of technology and management, either from commercial farms or indigenous territories. where they are harvested when physiologically ripe; then the fruits are sorted, and finally directed (with possible intermediation) either to the national or international markets to be consumed fresh or processed. These are some highlights:

Plantain

The plantain value chain ranked as the highest priority crop from the study. MAG is very interested in plantain as 3,254 producers grow the product on 4,956 ha in the region. Demand was considered high with an estimated price of ₡180/unit. Plantain has a much larger size than the other two Musaceae (bananas) studied and has different government prioritization policies. The main insights are:

→ At the packhouse - 5% of the produce was observed to be rejected at reception. Another 1% was lost during unloading of product and 4% lost during peeling (excessive trimming).
→ Once the product arrives at the collection center, it is placed in an unloading area and, depending on its ripeness, it is peeled and/or packed in high-density bags for other types of industry. Usually, plantain is ripened in chambers through a controlled process, but even if different maturity is present in a received load, it can be sorted and directed to different commercial destinations.
→ Depending on the type of customer, the plantain goes through specific processes: peeled or not, more mature, or green.
→ Washing, selection, peeling and processing operations are commonly carried out by female workers.
→ Finally, depending on the type of client, the presentation and packaging will also depend on the client’s request. Sometimes products have been returned due to packaging or labeling issues, without resulting in losses, according to the managers consulted.
→ Value chain actors should anticipate an influx in plantain supply approximately 1 year after severe climatic events such as floods since a new harvest can be expected around that time and most farmers tend to re-plant at the same time after these events; leading to potentially high levels of food loss and lower profits for producers. Finally, depending on the type of client, the presentation and packaging will also depend on the client’s request. Sometimes products have been returned due to packaging or labeling issues, without resulting in losses, according to the managers consulted.

Papaya

Papaya is a fruit usually consumed fresh. It is of high-middle importance in the region, recognized as a hotspot of papaya production at national level. At the same time the fruit is popular in the Costa Rican diet and is characterized as a “typical” tropical fruit. It is a priority in public sector policies, as there are 1,089 ha under 397 farms and it has a price of ₡250/kg at the date of study, with a medium but stable demand throughout the year in the Costa Rican market. The main insights are:

→ At the farm, 9% of fruit was discarded or left in the field if they are affected by pests or diseases or are fruits from female flowering plants, resulting in a different shape not always accepted by the market (rounder than oval).
→ Papayas are harvested at their optimum ripening point. Here new defects not previously seen can be detected, could represent about 6% loss, which may not be redirected to another market or for animal feed.
→ 1% of papayas are discarded at the packhouse mostly because of pathological damage.
→ There are two imminent risks to the crop:
  o The prohibition of the use of styrofoam could result in greater damage to the harvested fruits, since it has not yet been possible to find a material that effectively replaces it - cardboard deteriorates quickly, is not reusable and is currently very expensive; fabrics could both accumulate more pathogens and become stiff when filled with the latex that exudes from the recently harvested fruit stalk, further damaging the papaya peel).
  o A possible increase in the disease "bunchy top". The disease is transmitted by an insect, *Empoasca papayae*, and once the plant is infected with this bacterium there is no known treatment. In some cases, growers manage to get the tree to harvest and try to make the most of it, but at other times the fruits are affected due to vascular damage to the plant and are discarded, finally in other cases the tree is cut down even when it already has fruit as an effort to control the spread of the disease.
→ The papaya association in this study interestingly facilitates and improves commercial and trading processes, including capturing certain types of fruit for processing, thus avoiding loss.

Cassava/Yuca

Cassava is of high priority in sectoral policies with high domestic and international consumption rates. There are 2,079 ha, with 1,661 farmers and yields varying, but around 15 tons/ha. The price was
determined at the pilot dates at ₡350/kg. Approximately 17% of national cassava farmers are located in this Region. The crop is considered of high priority in sectoral policies, with high domestic and international consumption rates. The farmer manages the primary production and harvest, then cassava arrives at the packhouse (often with intermediaries), and different operations could take place to ensure longer shelf life. Other industrial actors will process fresh-cut frozen yuca, and finally, the cassava is taken directly or through an intermediary to the national and international markets. Paraffined cassava, a mechanism for extending shelf-life, is restricted from the EU market, causing a growth in value adding options, including peeled and frozen (known as fourth range or minimally processed products according to Codex Alimentarius). The main insights are:

- Once harvested, cassava must be transported to be conditioned within one day, because several oxidation processes begin.
- At the farm, Cassava is separated by grade (first grade for export and second for local market or industry, including cassavas too large to fit in an export box) with the remaining being discarded. An estimated 12% loss occurs and would be difficult to use even for animal feed due to the small size of the product and lack of economic value.
- At the packhouse 3% of the damaged cassava is discarded. Some discards may be sent to the local market if basic requirements are met.
- The cassava leftovers are used for animal feed; however, they do not generate any economic benefit at the moment and no by-products are sold, even with the potential it has.
- It was expressed that the Huetar Caribbean Region is the location with the highest yield per area of cassava in the country, so there are important initiatives to promote value addition in the locality, with the possibility of greater proximity to export ports, unlike the usual route that has consisted of intermediaries buying cassava in the Huetar Caribbean Region to take it to the Huetar North to industrialize it, and then bring it again through to the Caribbean for export. However, reconfiguring the supply chain has significant challenges due to the lack of associations and the usual practice of purchasing by middlemen without major contracts or commitments.

**Banana-criollo**

During the prioritization matrix exercise, banana-criollo was classified as medium importance but of interest in the Region because of its high commercialization as fresh produce with high perishability, high consumer demand, but unfortunately with little prioritization by state policies. This type of banana is believed to be preferred by national consumers with an accessible price of ₡301/unit.

- A loss of 1.05% was observed at the farm level during separation of bunches and discarding damaged produce.
- Loss of .73% was observed while transporting bananas on the river from the boat to the truck.
- At the packhouse, 1.19% of the bananas were discarded for not meeting specifications.
- Banana-criollo is not exported as fresh fruit (unless there is value addition) but is marketed fresh domestically.
- Most of this crop production is concentrated in indigenous areas, where it must be harvested from different farms and transported in a vehicle until it reaches a boat; the product is transported by this means to cross a river and then take the crop to the loading truck. From this point on, it enters either the national or export commercialization channels.
- In the case of export, there is interest from foreign buyers who value the product coming from indigenous territory and have established special contracts where a percentage of the payment is reserved for a type of "bonus or saving" at the end of the year for the farmers. This product is

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1 The exchange rate was 565₡: 1$ approximately by the time of the Pilot.
processed in Costa Rica into puree then sent to the destination country where it is used as an additive into a final product. In these cases of processing, the safety precautions are rigorous as a key use for the puree is baby food.

**Baby banana-datil**

Baby Banana (datil) is marketed fresh, with low priority for government policies and moderate levels of national consumption, although with growing economic value as it is marketed as a "delicacy."

→ Loss of 0.58% was observed at the packhouse for bananas that were discarded as they did not meet market specifications.

→ Leaving the two smaller “spur fingers” at the end of each bunch helps avoid rot issues. The spur fingers may be discarded or packaged for national retail.

→ One case of loss due to food safety risk, according to the FSMA "Produce Safety Standards," is that all fruit from any banana plant where a bird's nest is found must be discarded, even though the banana fruit is protected by the bag.

Additionally, learning about FLW, reviewing value chain structures, and the guide’s process and tools were considered useful activities. The pilot generated knowledge and motivation to begin considering interventions to reduce FLW.
Background

FUNDATEC served as a local consultant, adapting the guide for the Costa Rican context and facilitating the pilot. The Ministry of Agriculture and Livestock (MAG) authorities selected the coastal Huetar Caribbean Region to pilot the guide.

The MAG Huetar Caribbean Regional Director, Yendri Delgado, and the Executive Secretariat for Agricultural Sector Planning (SEPSA), Francini Araya, were delegated as national counterparts, serving as the pilot’s FLW Core Team. The pilot included planning and induction activities, fieldwork, workshops, and a Collaboration, Learning and Adaptation (CLA) wrap up session. The working methodologies included participatory methods, collection of information and secondary data, and field observation together with applied tools for interviews, focus groups and data collection in the field under a case study approach. Using a FLW lens, this report includes a background of the Huetar Caribbean Region, processes for defining a pilot objective, prioritization of selection criteria and indicators, and findings from field research used to rank value chains for intervention.

The FLW Value Chain Selection Guide was piloted April 25 - May 6, 2022, with additional planning and introduction activities in April. Fieldwork, workshops, and report preparation and feedback took place through June, with a final Collaboration, Learning and Adaptation (CLA) session taking place in July. The pilot was adapted to the Huetar Caribbean Region of the country, with the FLW Core Team spearheaded by Francini Araya, data analyst of SEPSA, and Yendri Delgado, Director of the Huetar Caribbean MAG Region. They were supported by the Consultant Team- from FUNDATEC and ABA- and the MAG Team - composed of extension agents2 from the respective local Agricultural Extension Agencies (AEA).

FLW Context in Costa Rica

As UN member country, the Republic of Costa Rica was the first country in the world to sign a National Pact for the Advancement of the Sustainable Development Goals (SDGs) in September 2016. SDG 12 on sustainable production and consumption has been of interest, including target 12.3 reducing food loss and waste. This led to its inclusion in the National Policy on Sustainable Production and Consumption, which identifies the Costa Rican FLW Network as a national initiative coordinated by the Tecnológico de Costa Rica (TEC, 2022) (MINAE-DIGECA, 2019).

Currently, this Network has about 30 members from the public, private, academic, and organized citizen sectors and has initiated FLW awareness raising, research and governance actions (Bolaños-Palmieri, 2021). Among the members of this Network, SEPSA has been working with several Network actors and FAO to strengthen the measurement of post-harvest losses and compile the Food Loss Index (FLI) for SDG 12.3.1a. This project is in progress as of August 2022. In 2017, SEPSA, FAO, TEC and the FLW Network established the 10 priority food basket products for monitoring the FLI and began identifying existing sources of information in the country. Data included: research conducted by TEC on food losses in the tomato value chain (Brenes-Peralta, Jiménez-Morales, & Gamboa-Murillo, 2015), initial estimates for potato and milk, and rice in 2020 from loss indicators in the National Agricultural Survey. Other members of the Network such as University of Costa Rica and Universidad Técnica Nacional (National Technical University) are also initiating case studies of loss quantification in some agro-chain sections (SEPSA, 2021).

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2 Brayan Snchez Ureña, Cristian Rodriguez Artavia, Jeannethe Aguilar Salon, Fabián Vindas Cabillo, Ericka Valverde Ortiz, Allan Villegas Loaiza, Keneth Bolívar Quiel, Delfín Rojas, Alberto Rojas, Alfredo López (in the field visits) Christian Rodriguez (regional Chief of Extension)
Although interest has been shown by different sectors to fulfill the SDGs, there are structural and statistical challenges to monitor such progress. According to the Second Voluntary Report on the SDGs issued by the Technical Secretariat of the SDGs in Costa Rica, only 55% of the total SDG monitoring indicators in the country are currently available, and 16% are not produced at all - including those related to SDG target 12.3 (Technical Secretariat of the SDGs in Costa Rica, 2020), which indicates the need to strengthen system actions addressing FLW.

**Geographic Overview**

**Huetar Caribbean Region**

The Huetar Caribbean Region is located mainly in Limón Province (Figure 1) and includes the cantons of Talamanca (2,809.93 km²), Pococí (2,403.49 km²), Limón (1,765.79 km²), Siquirres (860.19 km²), Matina (772.64 km²) and Guácimo (576.48 km²); it represents 18% of Costa Rica’s territory (Mora Calvo, 2020).

![Figure 1 Map of the Huetar Caribbean Region of Costa Rica (INDER, 2022)](image)

The region’s altitude ranges from 0 and 3,820 masl; however, most of the territory is between 0 and 300 masl. Slopes range from less than 8% in the fluvial and coastal areas to more than 30% in mountainous areas. Soils in the Huetar Caribbean Region are classified as ultisols in the foothills of the Talamanca Mountain Range, inceptisols in the flat or nearly flat alluvial areas from Tortuguero to northeast of Sixaola,
entisols in mountainous areas, low and swampy areas, beach bars and river meadows, as well as inceptisols/ultisols, histosols and inceptisols/entisols (Mora Calvo, 2020) (InfoAgro, 2022) (Annex 1).

According to the COSAR Regional Agricultural Sector Committee (2015), the annual relative humidity in the Huetar Caribbean zone ranges between 82-92% due to rainfall. March, April, September, and October are the driest months of the year, and June, July, November, and December are the rainiest. Temperatures in the region range between 21°C and 32°C. The climate is predominantly humid tropical. Ecosystems or “Holdridge Life zones” are identified as Very Humid Tropical Forest (bmh-T), Premontane Rainforest (bp-P) and Very Humid Premontane Forest (bmh-P) (INDER, 2020) (Annex 1). Table 1 presents a summary of some of the socioeconomic conditions of the population in this region.

Table 1: Descriptive variables of the population served by the Agricultural Extension Service of MAG in the Huetar Caribbean Region.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Male 55.2; Female, 52.2 (Head of the household 48.3 years old)</td>
</tr>
<tr>
<td>Literacy Rate</td>
<td>92.2% (CR 96.8%, Rural areas 92.1%)</td>
</tr>
<tr>
<td>Multidimensional Poverty Index (INEC, 2017) adjusted to agriculture</td>
<td>Poor households 48.5% (69.7% of which are led by women)</td>
</tr>
<tr>
<td>Senior citizens with income (pension)</td>
<td>21%</td>
</tr>
<tr>
<td>Low/Mild Food Insecurity</td>
<td>16.7% of households</td>
</tr>
<tr>
<td>Severe Food insecurity</td>
<td>6.7% of households</td>
</tr>
<tr>
<td>Food production for the family diet³</td>
<td>27%</td>
</tr>
</tbody>
</table>

Source: (Mora Calvo, 2020)

Agricultural Production of the Huetar Caribbean Region

The National Institute of Statistics and Census (INEC) reported in the National Agricultural Survey of 2017 to 2020 the extent and production of the main crops of Costa Rica. Within those, yam (Discorea spp), taro (Colocasia sculenta), potato (Solanum tuberosum), cocoyam (Xanthosoma sagittifolium), cassava (Manihot esculenta) and permanent crops such as oil palm (Elaeis guineensis), heart of palm (Chamaerops humilis), plantain (triploid hybrid of Musa acuminata and Musa balbisiana), and banana (Musa × paradisiaca). Previously, the Agricultural Survey of 2014 (INEC, 2014), identified 9,008 farms in the region, representing 259,334.6 ha, and 8,152 jobs, of which 20.06% belonged to women. Exports from the Huetar Caribbean Region correspond mostly (81.8%) to fresh fruits such as bananas, pineapple, and cassava (Table 2); there are no recent significant records for the main imports in the Region (COSAR, 2015).

Table 2: Exports in thousands in US$ of relevant crops in the Huetar Atlántica Region from 2016 to 2021.

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Palm heart</td>
<td>9,000.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

³ "Defined from six basic food groups, according to FAO, it shows that farming families produce around 1 out of every 4 foods necessary for a healthy diet and nutrition, which ultimately compromises the resilience of farming systems, especially after extreme agroclimatic events"
Organization Overview

The Regional Directorate of MAG in the Huetar Caribbean zone has six Agricultural Extension Agencies dedicated to producers in the area.

The MAG’s mission is to:

“Promote the dignity of rural families of small and medium-sized producers in rural territories, promoting the development of technical and business management skills in production systems and agricultural organizations that promote competitiveness, equity and social, economic and environmental sustainability of agricultural activities.” (MAG, 2022).

In terms of FLW, MAG considers as potential allies the National Production Council (CNP), the Integral Agricultural Marketing Program (PIMA, which manages the country’s Wholesale Market infrastructure CENADA), INDER, various producer groups, sector chambers (such as exporters), the Academy (academic research institutions), and the National Institute of Statistics and Census (INEC; although it does not collect FLW data yet).

Related Policies

The FLW Core Team, supported by the process and tools in the FLW Selection Guide, stated that the MAG was motivated and interested in this pilot due to the following main reasons:

- Value chains have significant losses, although this is not quantified, so this Pilot will help to understand FLW in greater depth and inform decisions for the future.
- Evidence-based investments need to be more focused, effective, and efficient (including identifying low cost/high impact human capital investments such as awareness raising and training instead of equipment focused physical capital investments).
- Policies intended to improve productive yields could benefit from a FLW focus.

In addition, it was considered that a validated guide would help determine the FLW in value chains of interest, to better guide the processes for reducing FLW and their implications (i.e., quality, income, waste, etc.). While there are national policies and projects that address FLW, including the SEPSA/FAO\(^4\) cooperation, there has not been a regional approach, which became a key motivation for this pilot.

In terms of relevant institutional guidelines, the 2019-2022 Policy for the Agricultural, Fisheries and Rural Sector consists of four priority policy axes with their respective strategic lines and three cross-cutting axes.

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\(^4\) The selection of a basic food basket of 10 products has been selected for the report of the FLI (Target 12.3.1 of the SDGs) and it was based in the importance of these products in terms of economic importance, food security according to the caloric value and the availability of data in related institutions (SEPSA, 2021)
axes. The priority policy Resilient Agribusiness Management Axis contains two strategic lines related to FLW:

a) Good production and manufacturing practices - increasing sustainable production through the coordinated actions of institutions related to good agricultural, livestock and manufacturing practices.

b) Value Addition - increasing production linkages that: encourage agribusinesses to add value to their products, improve their access to markets, and improve their level of competitiveness.

The Climate Actions cross-cutting axis includes the strategic line of actions for agricultural adaptations, so farms are profitable, efficient and generate social benefit, through extension services in the use of sustainable agro-industrial production and transformation technologies. This may be enhanced or improved by addressing FLW issues.

The Institutional Strategic Plan and the Strategic Interventions Plan 2019-2022 of the Ministry of Agriculture and Livestock empowers MAG to develop specific Huetar Caribbean Region goals in 2022 that increase the number of farmers engaged in:

- Sustainable production, with the objective of increasing the number of farmers that apply Good Agricultural Practices to promote sustainable production adapted to climate change.

- Risk Management, Prevention and Climate Change Program, with the objective of increasing prevention, mitigation, and adaptation practices to climate change in production systems.

In MAG’s Institutional Operational Plan 2022, each Region has actions consistent with the sectoral plan, indicating room to work in FLW. The Huetar Caribbean Development Region is executing Agricultural Extension Management activities to promote new farms using practices and technologies for sustainable production on farms.

Policy guidelines reflected in this Pilot include: Climate change, Sustainable development, family agriculture, Food and nutritional security, National market, and Decarbonization Plan.

Per SEPSA’s Institutional Operational Plan 2022, on- and off-farm postharvest loss data is being collected and analyzed within the framework of the FAO Technical Assistance Project to measure and report on SDG indicator 12.3.1 Sustainable Production and Consumption.

FLW Strengths and Alignment

MAG’s FLW strengths include the knowledge its agents have of the territory, a team of professionals and technicians trained to address productive aspects of the agricultural value chains of interest, and its local and national institutional coverage. The pilot also clarified that the AEAs (Agricultural Extension Agencies) can support collaborative extension processes in groups, seminars, trainings, and/or farm diagnoses - with the latter leading to individual producer assistance through Farm Plans. Regional problems to be addressed include a) agricultural product quality and the process involved in accessing markets (i.e. quality standards, criteria for determining that quality in industry and harvesters, criteria highly related to product esthetics, reasons for rejection, etc.), b) pests and diseases management and the effect they have on possible post-harvest losses, and c) aspects related to marketing, mainly intermediation.

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5 A new Central Government went into effect May 8, 2022. Transitioning policy priorities need to be updated accordingly.
One competitive advantage of the region is transportation since Limón Province has one of the nation’s most important ports for exporting to the USA and the EU. Considering this, it was determined that priorities at the regional level could focus on:

- Value addition of products and by-products, including those with high FLW potential due to quality non-compliances while maintaining food safety requirements.
- Increased production yield and efficiency.
- Environmental aspects.

Key sources of FLW information related to MAG and/or its institutions include: Regional characteristics and their respective AEAs available on the MAG web page; SEPSA’s annual Agricultural Sector Bulletins, national and sectoral or regional value chain studies, MAG projects in alliance with IICA, CATIE and academic institutions, among others, and the Territorial Development Plans of INDER.

**FLW value chain selection process**

As part of the Pilot, multiple planning meetings were held between the Consultant Team and the Central Team. The first session (February 25, 2022) introduced the Guide, outlined generalities of the Pilot, and started planning for field work. A second session (March 18, 2022) began shaping the execution of the field work and organizing the MAG Team. A third session (April 4, 2022) introduced the MAG team - primarily extension agents - to the general aspects of the Pilot, including addressing operational aspects and defining the purpose of the activity. The Framing a FLW Objective session (April 18, 2022), facilitated by the local Consultant Team, was a collaborative effort by the Central Team (Figure 2). After the session, a few days were given to receive additional feedback from the Core Team to arrive at the final refinement of the Pilot objective.

1. **Framing a FLW Objective**

Different exercises and questions helped facilitate Defining a FLW Objective.

Relevant priorities, opportunities and/or strengths relevant to the FLW perspective

- Regional potential to use and transform unutilized and/or discarded products.
- The strong interest in improving yields; in this sense, by addressing aspects generating loss.
- Improved yields, a component of productive efficiency, also means better management and less environmental impact, a cross-cutting issue in MAG’s work (state and regional).

**FLW Objective**

The following FLW objective was drafted to execute the Pilot and guided the work of the Central, Consultant and MAG Teams in the following days:
Selected criteria, reasons and definition

As a last step of the Framing a FLW Objective stage, potential prioritization criteria to guide the process were reviewed. The importance of each suggested criterion was preliminarily rated using MentiMeter\(^6\) and then adapted to the regional context of interest, as shown in Figure 3.

![Figure 3 Evaluation of possible criteria, given by the Core Team according to their relevance to the context under study (Spanish- original from the exercise with the Central Team)](image)

*Translation: Left axis: not relevant, right axis: very relevant*

Potential prioritization criteria from top to bottom: food loss, food waste, economic results, food security, climatic events, land footprint, wildlife and biodiversity, women and youth, investment opportunities, availability of data/information, number of producers and/or area, accessibility MAG has to producers.

Figure 3 illustrates that preliminarily, the aspects related to Wildlife and Biodiversity, Climate Events, and Gender and Youth were of low relevance for the Core Team. Food Waste and Land Footprint, Food Security, Investment Opportunities and Data-Information Availability were more important. On the other hand, the criteria of Food Losses, Economic Performance and Number of farmers/Area were the most relevant for the Central Team. These rankings were determined by considering MAG guidelines and policies as well as regional needs and opportunities.

However, differences of opinions or interpretations for each criterion persisted. As a result, once the Pilot was launched during the week of April 25, 2022, two days of initial sessions were held with the MAG Team and the Core Team, together with other sectoral experts (from INTA-Ing. Ligia López, INDER-Walter Picado, CNP-Mauricio Barrientos and the Agroindustrial Cluster led by EARTH University-Gabriel)

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\(^6\) A [https://www.mentimeter.com](https://www.mentimeter.com) educational subscription was used, although the free version would be sufficient.
Mora, Luis Valenciano and Ana Laura Jiménez, to enter the stage of defining Prioritization Criteria and possible value chains Annex 4 and Annex 5.

The criteria selection process was gradual and involved three stages of the process that led to refining the selection as shown in Figure 4.

The starting point was 16 possible criteria at the beginning of the April 25 session with the Central Team. Next, participants were given a worksheet with possible criteria and short description to rank individually before discussing in small groups of 3-4 people (Figure 5). Lastly, a multivote dot voting exercise helped finalize selected criteria, with each participant receiving dots (Figure 6). Criteria were grouped based on definitions, applicability and relevance; a cut-off rule of 5% was applied (those below this value at the beginning were not considered as criteria for the Pilot).

**Figure 4 Evolution of Accessibility MAG the selection of criteria for the prioritization of value chains under a PDA approach (Spanish- original from the exercise)**

<table>
<thead>
<tr>
<th>Initial Suggested Criteria</th>
<th>Central Team Selected Criteria</th>
<th>Individual Ranking Criteria</th>
<th>Final Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Results</td>
<td>Economic Results</td>
<td>Economic Results</td>
<td>Economic Results</td>
</tr>
<tr>
<td>Agricultural Planning</td>
<td>Agricultural Planning</td>
<td>Agricultural Planning</td>
<td>Agricultural Planning</td>
</tr>
<tr>
<td>Food Loss</td>
<td>Food Loss</td>
<td>Food Loss</td>
<td>Food Loss</td>
</tr>
<tr>
<td>Food Security</td>
<td>Investment Opportunities</td>
<td>Investment Opportunities</td>
<td>Investment Opportunities</td>
</tr>
<tr>
<td>Food Waste</td>
<td>Climatic Events</td>
<td>Climatic Events</td>
<td>Climatic Events</td>
</tr>
<tr>
<td>Investment Opportunities</td>
<td>Number of producers/area</td>
<td>Number of producers/area</td>
<td>Number of producers/area</td>
</tr>
<tr>
<td>Climatic Events</td>
<td>Availability of data/information</td>
<td>Availability of data/information</td>
<td>Water Footprint</td>
</tr>
<tr>
<td>Number of producers/area</td>
<td>Water Footprint</td>
<td>Water Footprint</td>
<td>MAG-Producer accessibility</td>
</tr>
<tr>
<td>Availability of data/information</td>
<td>MAG-Producer accessibility</td>
<td>MAG-Producer accessibility</td>
<td>Land Footprint</td>
</tr>
<tr>
<td>Water Footprint</td>
<td>Land Footprint</td>
<td>Land Footprint</td>
<td>Land Footprint</td>
</tr>
<tr>
<td>MAG-Producer accessibility</td>
<td>Carbon Footprint</td>
<td>Carbon Footprint</td>
<td>Carbon Footprint</td>
</tr>
<tr>
<td>Land Footprint</td>
<td>Food Safety</td>
<td>Food Safety</td>
<td>Food Safety</td>
</tr>
<tr>
<td>Carbon Footprint</td>
<td>Wildlife and Biodiversity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Safety</td>
<td>Gender/Youth/Minority</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wildlife and Biodiversity</td>
<td>groups</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 5** Individual exercises for the selection of the prioritization criteria

**Figure 6** Participatory exercises for the selection of prioritization criteria (a and b are images of the working subgroups giving their multivote to prioritize criteria)
By the end of the second day, 11 prioritization criteria were selected via participant vote (Figure 7) for the Pilot according to the Central and MAG Teams, and the regional context in which it would be developed.

**Figure 7 Prioritization of criteria by multivote (Spanish- original from the exercise)**

### 2. Prioritizing promising value chains

**Selected indicators and definition**

For each of the 11 selected prioritization criteria, participants individually brainstormed and wrote possible indicators on sticky notes they added under the relevant criteria (Figure 8). The sticky notes were organized into clusters and participants discussed the options as a group.

**Figure 8 Participatory exercises for the identification and selection of indicators for each criterion (a and b are images of the working subgroups giving their suggestions for indicators)**
Table 3 summarizes the criteria definitions and indicators. Minor criteria definition and indicators were adjustments while searching for data during the data analysis phase of data collection.

### Table 3 Definitions of the criteria selected to prioritize the value chains

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic results</td>
<td>Amount of money that is no longer received due to FLW</td>
<td>Value of loss ($ or colones)</td>
</tr>
<tr>
<td>Food Security &amp; Nutrition</td>
<td>How many people would no longer have access to food or the availability and access to food</td>
<td>How many people lack access or availability to food</td>
</tr>
<tr>
<td>Investment Opportunities</td>
<td>Available projects aimed at reducing FLW</td>
<td>Number of current FLW projects</td>
</tr>
<tr>
<td>Climate Events</td>
<td>Events that harm the food supply-chain (how they affect production)</td>
<td>Quantity of loss per area per event, along the food supply-chain</td>
</tr>
<tr>
<td>Value Chain actors</td>
<td>Estimate of the people dedicated to cultivation within the producing population of the Region</td>
<td>Number of producers/crop (in the Huetar Caribbean Region)</td>
</tr>
</tbody>
</table>
Available Data | Availability of data from the value-chain to the public (information generated on FLW, up-to-date data bases, available technical services) | Reports
---|---|---
Water Footprint | amount of water used by quantity of product | L water/kg product
MAG FLW Capacity | Strength of addressing FLW issue in department Number of extension agents trained in FLW (department, unit, AEA or working group focused on FLW) according to the value chain | Number of extension agents trained in FLW for each value chain
Soil Management | Soil management as an enabling practice to achieve a basic input for production | Area (ha) planted
Carbon Footprint | GHG emitted per production unit | kg CO2/unit of loss
Food safety | Product contamination caused by mismanagement of product safety management resulting in FLW | kg of contaminated product

At the April 26 session, participants self-selected, based on their expertise and interest, into small groups of 2-3 people to evaluate their value chain of interest according to the defined indicators. Subsequently, the groups were redistributed into two larger groups to evaluate each value chain (Figure 10).

Figure 10 Preliminary value chain prioritization matrix (end of session on April 26, 2022) (Spanish- original from the exercise)

Table 4 shows, for visual ease, the transcript of Figure 10.
Table 4 Rating of group 1 and group 2 on the economically important crops in the region
(Spanish- original from the exercise)

<table>
<thead>
<tr>
<th>CRITERIOS</th>
<th>PONDERACIÓN</th>
<th>PLATANO</th>
<th>DÁTIL</th>
<th>BANANO CRIOLLO</th>
<th>AYOTE</th>
<th>ELOTE</th>
<th>PAPAYA</th>
<th>CACAO</th>
<th>YUCA</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resultados Económicos</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>10</td>
<td>14</td>
<td>10</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Seguridad Alimentaria</td>
<td>13</td>
<td>11</td>
<td>8</td>
<td>11</td>
<td>10</td>
<td>13</td>
<td>8</td>
<td>4</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Oportunidad de Inversión</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Eventos Climáticos</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>4</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Número de productores y/o área</td>
<td>9</td>
<td>9</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>9</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Disponibilidad de Datos e Información</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Huella de Agua</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Accesibilidad MAG-Produtor</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Huella de Tierra</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Huella de Carbono</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Incertidad</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>86</strong></td>
<td><strong>85</strong></td>
<td><strong>59</strong></td>
<td><strong>65</strong></td>
<td><strong>69</strong></td>
<td><strong>82</strong></td>
<td><strong>63</strong></td>
<td><strong>82</strong></td>
<td><strong>68</strong></td>
<td></td>
</tr>
</tbody>
</table>

Value Chain Translation: Plantain, Baby Banana (Dátil), Banana Criollo, Squash (ayote), Corn (elote), papaya, cacao, cassava, yam

Why were the value chains classified in this way?
The above exercise was carried out on a large flipchart on the wall to discuss the similarities and differences in the valuation of each criterion and its indicator. The exercise highlighted ambiguous indicators and lack of existing quantitative data. Participants assessed the reliability and certainty of the scores they gave to value chains; those marked as: green assumed good data sources, yellow had some difficulties in obtaining data, and red lacked reliable data (Figure 10, top row).

Top-ranking crops
In addition, pre-existing data known to the MAG Team were used in the sessions. An overall scale of importance for the value chains was established (high, medium, or low, according to Table 5).

Table 5 Rating scale for the identification of promising value chains

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High:</td>
<td>very relevant in terms of number of producers, area, value, or it is in the sectoral policy</td>
</tr>
<tr>
<td>Medium:</td>
<td>intermediate importance in terms of number of producers, area, value, although it may not be in the policy.</td>
</tr>
</tbody>
</table>
Based on the 1) FLW Prioritization Criteria indicators and their weighting, 2) discussions about each criterion on the crops considered of local importance, and 3) the availability and ease of access to indicator data, the average value and selection of value chains for the pilot was determined prior to data collection in the field, as showed in Table 6.

**Table 6 Crops selected for the pilot**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plantain</td>
<td>86.5</td>
</tr>
<tr>
<td>Papaya</td>
<td>81.5</td>
</tr>
<tr>
<td>Cassava</td>
<td>81.5</td>
</tr>
<tr>
<td>Baby Banana</td>
<td>81</td>
</tr>
<tr>
<td>Corn</td>
<td>75.5</td>
</tr>
<tr>
<td>Yam</td>
<td>72</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>72</td>
</tr>
<tr>
<td>Cocoa</td>
<td>67.5</td>
</tr>
<tr>
<td>Banana-criollo</td>
<td>56.5</td>
</tr>
</tbody>
</table>

The highlighted crops were selected for the validation exercise according to the harvest season, physical accessibility, and contacts. For example, corn and pumpkin are short-cycle crops that were not available at the time of the pilot; although they are relevant to study in the future because they are crops that add positively to the household cashflow. In summary, after a final refinement by the Central Team and the Consultant Team, considering the components, assessments and discussions of the MAG Team and participating experts, the final value chain prioritization matrix is shown in Table 7.

**Table 7 Final matrix for prioritizing value chains after field work and verification of information sources**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Food Loss %</th>
<th>Food Security and Nutrition</th>
<th>Investment Opportunities</th>
<th>Climate Events</th>
<th>VC actors</th>
<th>Available Data</th>
<th>Water Footprint</th>
<th>MAG FLW Capacity</th>
<th>Soil Management</th>
<th>Carbon Footprint</th>
<th>Food Safety</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator</td>
<td>Food Loss %</td>
<td>Economic Results</td>
<td>FL value ($)</td>
<td>Availability and access</td>
<td>FLW projects</td>
<td>Effect of climate on FLW</td>
<td>Farmers per crop</td>
<td>Tools, databases, registers</td>
<td>Amount of water per lost product (L/kg)</td>
<td>Number of extension agents proficient in FLW</td>
<td>sustainable soil management practices</td>
<td>GHG emissions per lost product (kg CO₂ eq/kg)</td>
</tr>
<tr>
<td>weight</td>
<td>18%</td>
<td>13%</td>
<td>10%</td>
<td>10%</td>
<td>9%</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>6%</td>
<td>5%</td>
<td>5%</td>
<td>100%</td>
</tr>
</tbody>
</table>

In this case, the final matrix resulted with the respective weightings for each indicator established according to the criteria defined by the group. The following explains how the calculation and source for each indicator was determined, also considering the weighting percentage.
% Food loss\(^7\): this criterion was used to calculate some indicators; it was estimated from field findings when monitoring batches and interviewing stakeholders during visits to farms and packing or processing plants.

Economic outcome: this criterion had a weight of 18% and the indicator was the ‘value of lost food’, expressed in a currency (\$ or ₡). Data sources relied on SEPSA, MAG, CATIE, PIMA and INEC among others.

\[
\text{Value of lost food} = \text{cultivated area (ha)} \times \text{yield (ton/ha)} \times \text{farm-gate price ($ or ₡)} \times \text{estimated loss (%)}
\]

Food security: the criterion was given a weight of 13%, and it was decided that the most feasible, realistic, and accessible indicator to calculate it would be the ‘nutritional value of the product’. basket. For this purpose, official information on the basic food basket (INEC, MinSalud, PIMA reports) would be used. During the sessions, other possible formulas were considered that would be worth exploring, such as the profitability of production and the % of family income generated by the product that is used to buy food; however, the complexity and robustness of current data on profitability and the effect of socioeconomic variables by family strata made this calculation difficult at the moment of the Pilot.

\[
\text{Food security} = \text{caloric contribution (% to the Costa Rican basic food basket}
\]

Investment opportunities: a weight of 10% was determined for this criterion, with the indicator of ‘projects identified for FLW reduction’ effective in the Region. It was discussed in the future to consider the monetary value of the projects as well as more detail regarding level or type of projects, direct focus towards value adding that prevents FLW, among others.

\[
\text{Investment opportunities} = \text{number of value chain specific FLW projects in the Region}
\]

Climatic events: this criterion also had a weight of 10% and it was determined that the indicator would be the ‘impact of climate on the FLW’ with severe weather events detected according to reports from the National Meteorological Institute (IMN). In this case, a low risk would be 1 (minimal quantities lost), a moderate risk 2 (some losses) and a high risk 3 (significant losses).

\[
\text{Climatic events} = \text{number of severe weather events} \times \text{value of risk}
\]

Agricultural value chain actors (population): in this criterion, the weight was 9% and the indicator was the ‘number of farmers per crop’, based on existing data from official national or regional sources, the Agricultural Survey or the Roots and Tubers survey being carried out in the Region at the time of the Pilot.

Availability of data and information: this criterion was not originally included in the Guide, but it was important for both the Central Team and the MAG Team, resulting in a final weighting of 9% and a qualititative indicator on the ‘quality of existing tools or records’. In this sense, the criteria of experts and stakeholders such as SEPSA would be considered.

Water footprint: the criterion was given a weight of 8%, because although water is a critical factor for production, the Region does not have an actual deficit to date. Official quantification of the water footprint of crops in the region or Costa Rica is unknown so international publications were used.

\[
\text{Water footprint} = \text{quantity of water L/kg of product}
\]

MAG-Producer accessibility: this was not suggested by the Guide, but it had value for the Central and MAG Teams, it was given a weight of 6%, and assigned the indicator ‘number of extensionist agents trained in FLW by value chain’, which would result from inventories or information available

\(^7\) Food waste: this criterion was not calculated because the data from interviews with vendors, food services and consumers were not conclusive or of the expected quality to estimate a value.

\(^8\) Annex 3: Wholesale and fair prices according to PIMA’s information system
from the MAG and its AEAs (e.g. training events on this topic that support their ability to address the issue).

MAG-Producer accessibility = number of extensionist agents trained in FLW by value chain

- **Soil management**: with a weight of 6%, the criterion evolved from the one suggested by the Guide called Land Footprint, since there was no information for this and that it was important to have data on sustainable soil management practices on farms. At the time of the assessments, this inventory of practices was not known, so the starting point was the basic indicator of 'effective crop area' for each crop, in the hope that it would later evolve to include aspects such as management. The sources of information would focus on the agricultural census and official national or regional data.

Soil management = area (ha) planted

- **Carbon footprint**: this indicator was weighted at 5% and was assigned the indicator 'GHG emitted per lost product'. Although this is a priority issue for Costa Rica, there is no formal determination of product carbon footprints either through Life Cycle Assessment or environmental product declarations (at least for these value chains). For this reason, we worked with scientific literature sources. In the future, more reliable data for FLW of each value chain can be incorporated into this formula.

Carbon footprint = kg of CO₂ eq/kg of product

- **Food safety**: the last indicator added by the team, with a weight of 5%. Different food safety standards and the absence of food safety assurance in some cases, can have a strong impact on FLW. The indicator, defined as the 'risk of FLW due to food contamination', was based on expert estimates according to the risk or documentation of product rejection events according to USDA or other sources in regard to commercial destinations.

Food safety = quantity (ton) of product rejected (but still safe to eat)

Once each indicator was scored, values were normalized and weighted for each case to compare and prioritize the agro-chains among themselves, according to the following equation:

\[NPP = \frac{(AIP \times % \ Pn)}{\sum AI}\]

Where NPP is the value of the normalized and weighted indicator for a product, AIP is the absolute value of the indicator for a product, % Pn is the value of the weighting given to the criterion to which that indicator belongs, and \(\Sigma AI\) is the sum of the absolute values of the products for the indicator.

Finally, the adjusted values were summed for a total product score, then compared across products to establish rankings with higher values receiving greater prioritization.

### 3. Data collection

**Data collection plan**

Data collection occurred in sessions with the Central and MAG Teams and in the field. Based on the availability of resources, time and accessibility to producers and other value chain actors, field visits were scheduled for observation, measurement, interviews and focus groups.

Table 8 shows the data collection plan that was established among the Core Team, Consultant and MAG, and the producers and organizations providing support.
### Table 8 Field schedule proposed for data collection in the Pilot

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>27-4-22</td>
<td>Cassava - Rio Jiménez Ana Laura</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Processing plant toured and semi-structured interview</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Food Waste</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• EARTH - campus food waste key informant semi-structured interview</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Banana</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Semi-structured key informant interview</td>
</tr>
<tr>
<td>4</td>
<td>28-4-22</td>
<td>Papaya- Ericka and Jeannette, Pococí</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Farm and plant toured, semi-structured interviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Value chain mapping focus group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Baby banana - Alberto/Delfín/Angello/Brayan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Farm and plant toured, semi-structured interviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Key informant interviews for banana-criollo and plantain</td>
</tr>
<tr>
<td>5</td>
<td>29-4-22</td>
<td>Cassava - Fabian, Allan, Jeannette, Pococí</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Farm measurements and semi-structured interview</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Packhouse toured, semi-structured interviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Value Chain map focus group</td>
</tr>
<tr>
<td>7</td>
<td>2-5-22</td>
<td>CENADA, government wholesale market</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Food waste observations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Semi-structured interview with Miguel Monterrey (manager)</td>
</tr>
<tr>
<td>8</td>
<td>3-5-22</td>
<td>Banana-criollo / Talamanca</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Observation, counting and interviews in “Playón de Suretka” (Telire´s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>riverside)</td>
</tr>
<tr>
<td>9</td>
<td>4-5-22</td>
<td>Banana-criollo / Talamanca</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Banana observation and interviews in Cahuita</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Value chain mapping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semi-structured interviews and whether there were focus groups or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>measurements still pending.</td>
</tr>
<tr>
<td>10</td>
<td>5-5-22</td>
<td>Data analysis and preparation for validation workshop (consultants, SEPSA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>specialist)</td>
</tr>
<tr>
<td>11</td>
<td>6-5-22</td>
<td>Validation Workshop - included producers and intervention of the DNEA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and USDA</td>
</tr>
</tbody>
</table>

**Data collection instruments**

Annex 2 contains the data collection instruments used. Some instruments originated from the toolkit
drafted to accompany the Guide, others came from exercises carried out in Costa Rica, and others were
adapted from different instruments. In general, they were:

- Food Waste Survey of Market Vendors
- Consumer Food Waste Survey
- Producer Food Loss Survey
- Packer food loss survey
- On-Farm Data Collection Tool
Packing Plant Data Collection Tool

Note: when possible, a count and/or weighing of boxes or units (fruits, tubers) was used to estimate quantities of initial and final product, or of discarded product and its causes. In other cases, visited organizations shared information on the volumes that usually entered per batch, the resulting quantities of boxes, mass or units rejected from the initial market, and where it was redirected to - other markets, animal feed or discarded (loss). The data obtained was converted into tons to compare across value chains during the Validation Workshop and in this report.

Map of Visited Areas

Figure 11 shows the different sites visited by the Consultant Team accompanied by MAG Team of extension agents for each crop. In some cases, more than one site was visited per value chain, resulting in visiting the farm and the packing plant, or, in the case of bananas, both commercial and indigenous territory loading operations were observed on the shores of the Telire River (Suretka). Due to time limitation the data presented in this report for food loss is based on one or two observations at farm and packhouse level.

Figure 11 Locations visited during project development and data collection
4. Findings

Plantain (*Musa sp*\(^9\))

The census conducted by INEC (2014) reports that, out of 17,487 plantain farmers in Costa Rica, 18.61% correspond to the Huetar Caribbean Region. Figure 12 shows that for plantain, the extension of sowed and harvested hectares remained constant with slight decreases from 2017 to 2020.

![Figure 12 Extent in hectares of plantain crop planted and harvested in Costa Rica according to INEC data 2017-2020](image)

In Figure 13, plantain production is observed as decreasing from 2017 to 2018, and constant from 2018 to 2019, while there was an increase in production in 2020.

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\(^9\) Note that the plantain, the banana-criollo and the baby-banana belong to the Musaceae family and the currently marketed materials will come in general from the species *Musa paradisiaca*, being able to have hybrids and subvarieties from selections of *Musa balbisiana* or *Musa acuminata* (in the case of plantain) and with materials such as Gros Michel (banana-criollo), the Cavendish (clone usually used for international markets), ant the Great Nain or the baby banana (which belongs to the AA group). (CATIE, 2017 [http://www.mag.go.cr/bibliotecavirtual/F01-8205.pdf](http://www.mag.go.cr/bibliotecavirtual/F01-8205.pdf))
Figure 13 Production in metric tons of plantain crop in Costa Rica according to INEC data 2017-2020

Table 9 shows different uses and potential postharvest losses reported.

Table 9 Distribution of production in metric tons of plantain in Costa Rica according to INEC data 2017-2020

<table>
<thead>
<tr>
<th>Plantain (MT)</th>
<th>Sold amount (MT)</th>
<th>Self consumption (MT)</th>
<th>Self-input (MT)</th>
<th>Seed (MT)</th>
<th>Inventory (MT)</th>
<th>Other (MT)</th>
<th>Postharvest loss (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2017</strong></td>
<td>8,654,888</td>
<td>519,602</td>
<td>103,713</td>
<td>-</td>
<td>142</td>
<td>194,759</td>
<td>31,646</td>
</tr>
<tr>
<td><strong>2018</strong></td>
<td>5,781,748</td>
<td>539,720</td>
<td>209,944</td>
<td>-</td>
<td>-</td>
<td>132,908</td>
<td>35,518</td>
</tr>
<tr>
<td><strong>2019</strong></td>
<td>5,906,861</td>
<td>491,876</td>
<td>172,969</td>
<td>-</td>
<td>-</td>
<td>130,301</td>
<td>16,874</td>
</tr>
<tr>
<td><strong>2020</strong></td>
<td>6,846,953</td>
<td>978,702</td>
<td>159,757</td>
<td>-</td>
<td>-</td>
<td>310,489</td>
<td>145,375</td>
</tr>
</tbody>
</table>

Source: (INEC, 2020)

Plantain Overview (scale of importance)

MAG was very interested in plantain as 3,254 producers grow the product on 4,956 ha. Demand was considered high with an estimated price of ₡180/unit. Plantain has a much larger size than the other two Musaceae (bananas) studied and has different government prioritization policies.
Figure 14 shows the value chain map, although in some cases there may be additional actors or linkages. The farmer oversees managing harvest and selection, selling the product directly or through an intermediary. Sometimes farmer organizations are responsible for transportation. The fruit may reach the packhouse or industrial food processor. Value added activities, more common for national consumption, of green to ripe plantains include pre-fried frozen “patacones,” chopped, or fried plantains as in chips. The product obtained is transferred either directly or through an intermediary to the national and international markets.
Like the case of banana criollo, plantains may come from commercial plantations or from indigenous territories, so there could be an intermediate transport by boat across the Telire River. Government wholesale marketing at CENADA was observed for fresh green or ripe plantains as they are consumed both ways in the Costa Rican diet.
Figure 16 Loss diagram of the banana value chain in Costa Rica

Farmer:

→ **Selection (1):** With the physiological age, it is decided which plantain bunch is suitable for harvesting. Plantains can be harvested at different stages of maturity, reducing instances of loss due to harvest timing.

→ **Harvesting:** Plantain bunches are harvested using a spear with a machete or blade then piled together in the field until the arrival of the transport truck.
Selection (2): In the field after harvest, plantains that present unacceptable physical damage, red stains, rubbing between fingers or rubbing of leaves may be discarded or redirected to other clients who will collect the product later.

Classification (2): The plantains are classified as first quality or second quality; third quality is used for animal feed.

Transportation (3): Depending on the area, plantains are transported by boat to be loaded into a truck.

Loading: The plantains are loaded onto trucks to be taken to either a packhouse or an industrial food processor.

Packhouse:

- Receiving: The product is unloaded at the packing plant. Preselection determines if the plantain enters the plant. A 5% rejection is possible.
- Separation of the bunch: The hands are separated from the plantain bunch.
- Washing: The plantain is washed to remove dirt.
- Selection (4): Plantains are discarded due to physical damage, which usually occurs during transport and unloading of the product. This can be up to a 1% loss.
- Sorting/Classification (4): The plantains are sorted according to size and quality, depending on the market and the destination client.
- Peeling (5): Some clients purchase the product peeled, with a 3% loss according to the facility records, due to excessive trimming or human error when manually peeling.
- Packaging: The product is placed in bags when it is peeled or in boxes when not peeled; the quantity and quality of plantains is defined by the client.
- Packing: The plantain is placed in boxes and pallets, where it is ready to be loaded.
- Transportation: The plantain is transported either to the national or international market.

Food processor:

- Receiving: The product is unloaded, and similar as in the packing house case, has up to 5% being rejected.
- Separation of the bunch: The hands are separated from the plantain bunch.
- Washing: The plantain is washed to remove dirt.
- Selection and Sorting: Product discarded due to physical damage, usually occurring during transport and unloading; was reported as 1% loss (rejection).
- Ripening (6): For fried ripe plantains, the product is destined for ripening in ethylene chambers.
- Processing: Preparation of fried snacks or chips, sliced plantain and frozen plantain.
- Packaging: The finished product is packaged according to the client's request and the presentations offered by the manufacturer.
- Secondary Packing: The packed product is placed in boxes and pallets to be loaded.
- Loading: The product is ready for distribution, either for national or international markets.

In the international market there will usually be an intermediary that distributes the product either in frozen chunks (chopped plantain) or fried chips to different types of institutional clients, wholesalers, or retailers. In the national market the product may go to a retailer (to be sold in supermarkets or convenience stores, greengrocers, and restaurants), industry (the product is fried and presented as snacks or frozen slices) or the CENADA market which is a wholesaler. Additionally, there may be a
marketing channel such as the PAI to supply the institutional markets in the country (i.e., schools, prisons, etc.)

Criteria specific results
Bananas were the top-ranked product in the prioritization of the pilot’s value chains. This was due to the estimated value of food loss, both in terms of the amount of production and the higher loss percentage compared to the other banana value chains mentioned in previous paragraphs. Of the Pilot crops, plantain contributes most to the Costa Rican basic food basket, scoring high in the food security criterion. In terms of investment opportunities, as for all the value chains in the study, only one project has been detected so far (this Pilot), so this criterion does not really influence its prioritization. However, in terms of climatic events, it was considered as a highly affected crop due to the edaphoclimatic (soil and climate) conditions where it is grown; last year’s flood practically wiped out the crop areas. This has a subsequent positive effect in terms of sedimentation with high nutritional value for the soils, but results in producers replanting at the same time which will consequently causing a drop in prices due to oversupply. As a result, there could be a higher product discard (a market where there is "much to choose from" becomes “pickier”) and a very low price will be paid to the producer (the locals refer to this as times where plantain is sold 3x1). On the other hand, there are many producers and a significant effective planting area compared to the rest of the chains studied, which enhances the importance of the crop locally. There seems to be a relatively greater and better availability of information on this crop compared to the previous, and, although the risks of food safety losses are not high, the water and carbon footprint was considered to be the highest in the group according to scientific sources, resulting in a double environmental effect to be addressed when talking about food losses, given the waste of productive resources such as water or the increase in emissions into the atmosphere.

Summary of key findings/highlights

→ At the packhouse - 5% of the produce was observed to be rejected at reception. Another 1% was lost during unloading of product and 4% lost during peeling (excessive trimming).

→ Once the product arrives at the collection center, it is placed in an unloading area and, depending on its ripeness, it is peeled and/or packed in high-density bags for other types of industry. Usually, plantain is ripened in chambers through a controlled process, but even if different maturity is present in a received load, it can be sorted and directed to different commercial destinies.

→ Depending on the type of customer, the plantain goes through specific processes: peeled or not, more mature, or green.

→ Washing, selection, peeling and processing operations are commonly carried out by female workers.

→ Finally, depending on the type of client, the presentation and packaging will also depend on the client’s request. Sometimes products have been returned due to packaging or labeling issues, without resulting in losses, according to the managers consulted.

→ Value chain actors should anticipate an influx in plantain supply approximately 1 year after severe climatic events such as floods since a new harvest can be expected around that time and most farmers tend to re-plant at the same time after these events; leading to potentially high levels of food loss and lower profits for producers. Finally, depending on the type of client, the presentation and packaging will also depend on the client’s request. Sometimes products have been returned due to packaging or labeling issues, without resulting in losses, according to the managers consulted.
General Banana (*Musa* sp) Background

An INEC (2014) survey found that of 15,924 banana producers in Costa Rica, 14.67% were in the Huetar Caribbean Region. Figure 17 shows the sowed and harvested area which remained constant with slight decreases from 2018 to 2019. Banana production had a significant decrease from 2018 to 2019, with increased production in 2020. Table 10 shows the distribution of banana production in metric tons in Costa Rica according to INEC data 2017-2020.

![Figure 17 Extent in hectares of banana crop planted and harvested in Costa Rica according to INEC data 2017-2020](image)

*Blue is hectares planted; orange is hectares harvested*

![Figure 18 Production in metric tons of banana crop in Costa Rica according to INEC data 2017-2020](image)

*Table 10 Distribution of banana production in metric tons in Costa Rica according to INEC data 2017-2020*

<table>
<thead>
<tr>
<th>Banana (Year)</th>
<th>Sold amount (MT)</th>
<th>Self-consumption (MT)</th>
<th>Self-input (MT)</th>
<th>Seed (MT)</th>
<th>Inventory (MT)</th>
<th>Other (MT)</th>
<th>Postharvest loss (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Papaya (Carica papaya)

Costa Rica has 3,264 papaya farmers; 12.16% are located in the Huetar Caribbean Region (INEC, 2014). Figure 19 shows that for papaya in 2019, planted hectares is significantly higher than harvested hectares (further analysis is required to understand if there were problems with yield or plantations were abandoned). Between 2017 to 2018, production was reported as 33,459.94 metric tons (INEC, 2020).

<table>
<thead>
<tr>
<th>Year</th>
<th>Planted Hectares</th>
<th>Harvested Hectares</th>
<th>Hectares Abandoned</th>
<th>Postharvest Loss (MT)</th>
<th>Inventory (MT)</th>
<th>Other (MT)</th>
<th>Postharvest Loss (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>221,420,604</td>
<td>2,835,102</td>
<td>0</td>
<td>128,448</td>
<td>9,333</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>247,467,664</td>
<td>4,711,670</td>
<td>-</td>
<td>-</td>
<td>80,843</td>
<td>137,360</td>
<td></td>
</tr>
</tbody>
</table>

Source: (INEC, 2020)

Table 11 shows the distribution of papaya production in metric tons in Costa Rica according to INEC data for the 2019 harvest.

Table 11 Distribution of papaya production in metric tons in Costa Rica according to INEC data 2017-2020

<table>
<thead>
<tr>
<th>Papaya</th>
<th>Sold amount (MT)</th>
<th>Self-consumption (MT)</th>
<th>Self-input (MT)</th>
<th>Seed (MT)</th>
<th>Inventory (MT)</th>
<th>Other (MT)</th>
<th>Postharvest loss (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>3,080,880</td>
<td>17,060</td>
<td>6,484</td>
<td>0</td>
<td>-</td>
<td>55,480</td>
<td>186,090</td>
</tr>
</tbody>
</table>

Overview (scale of importance)

Papaya is a fruit usually consumed fresh. It is of high-middle importance in the region, recognized as a hotspot of papaya production at national level. At the same time the fruit is popular in the Costa Rican diet and is characterized as a “typical” tropical fruit. It is a priority in public sector policies, as there are
1,089 ha under 397 farms and it has a price of ₡250/kg at the date of study, with a medium but stable demand throughout the year in the Costa Rican market.

Value chain map

Figure 20 Map of the papaya chain in Costa Rica

Figure 20 shows the typical value chain where the farmer oversees managing harvest and transportation to a packer, usually in a vehicle owned or rented by a local actor. The packer (sometimes an association or cooperative) prepares the product for market. The papaya is then taken either directly or through an intermediary to the national and international markets.
The research team observed 15% loss at a farm and 1% loss at a packhouse. According to the above diagram, the unit operations for each stage of the value chain are presented:

**Farmer:**

- **Selection (1):** in this operation, papayas are checked to see which are ready to be harvested, some should be left to continue growing, others (about 9%) was discarded or left in the field if they are affected by pests or diseases or are fruits from female flowering plants, resulting in
a different shape not always accepted by the market (more round than oval). When the market price is high, the female fruit or "bomba" is sold to industry, but if the price is low it will remain in the field as loss.

→ **Harvesting**: Papayas are harvested at their optimum ripening point. Here new defects not previously seen can be detected, could represent about 6% loss, which may not be redirected to another market or for animal feed.

→ **Sleeving**: The harvested papaya is placed in a sleeve to protect it from rubbing against other papayas and prevent damage during transport. The practice avoids considerable damage from rubbing; however, Costa Rican legislation currently prohibits the use of styrofoam, which risks an increase in damage in the future.

→ **Weighing (2)**: The product is weighed in boxes to record the amount harvested.

→ **Loading**: The product is loaded onto a truck for transport to the packer.

**Packer:**

→ **Receiving**: The product is unloaded at the packer’s reception area.

→ **Grading, Washing and Disinfection**: These activities occur in an assembly line. The product will be classified for export or national market - the latter accepting minor defects of shape, size, or over ripeness, but without pathological damage. About 1% of papaya may be discarded. The papaya is immersed in a pool to be washed, dirt is removed, and disinfected.

→ **Drying**: The papaya is dried with conventional fans.

→ **Labeling**: The client’s labels are added.

→ **Packing**: The papaya is placed in protective covers to avoid physical damage.

→ **Secondary Packing**: The papayas are placed in boxes to meet the client’s requirements for both quantity of fruits and average weight per box. In this Pilot, the packing house was working with 16 kg boxes; therefore, each box could have 9, 10 or 11 papayas. Sometimes, boxes are loaded with additional 250-500g of product to compensate for the dehydration loss that could occur during transport.

→ **Loading**: The packed product is placed on trucks, ready for shipment.

Papaya going to the international market will usually go through an intermediary who oversees the distribution of the papaya as fresh fruit, candied, frozen, and pureed fruit abroad. In the national market these channels may exist:

→ **Retail**: Sales in supermarkets or convenience stores, greengrocers, and restaurants.

→ **Industry**: Value-added processes are carried out, such as purees, frozen products, and candied products.

→ **Wholesaler**: Papaya that does not meet the characteristics for the international market is transferred to a wholesale market.

→ **Public Supply programs**: Some of the production is destined to these public programs (jails, hospitals, schools etc.)

For more details, the following image summarizes the map of the value chain and its operations with photographs taken on site.
Figure 22 Photo history of the papaya value-chain
Criteria specific results
This was prioritized as the second product of importance within the studied crops in this Pilot, particularly criteria related to economic results. Availability of data-information and safety risks obtained the highest scores. Papaya had the highest loss percentage of the studied crops, and there have been reports of rejections of this fruit, for example when entering the U.S. market. In addition, the product could potentially contain phytosanitary barriers that, if not satisfactorily overcome, would also result in the discard of exported batches, although this was not quantified. Finally, the handling of this product is quite delicate due to its fragility and its climatic condition, as well as the socioeconomic impact on the area. Although it is not the crop with the largest area or number of farmers in the group, it does have a significant number of people who depend on the activity.

Summary of key findings/highlights
→ At the farm, 9% of fruit was discarded or left in the field if they are affected by pests or diseases or are fruits from female flowering plants, resulting in a different shape not always accepted by the market (rounder than oval).
→ Papayas are harvested at their optimum ripening point. Here new defects not previously seen can be detected, could represent about 6% loss, which may not be redirected to another market or for animal feed.
→ 1% of papayas are discarded at the packhouse mostly because of pathological damage.
→ There are two imminent risks to the crop:
  o The prohibition of the use of styrofoam could result in greater damage to the harvested fruits, since it has not yet been possible to find a material that effectively replaces it - cardboard deteriorates quickly, is not reusable and is currently very expensive; fabrics could both accumulate more pathogens and become stiff when filled with the latex that exudes from the recently harvested fruit stalk, further damaging the papaya peel).
  o A possible increase in the disease "bunchy top". The disease is transmitted by an insect, *Empoasca papayae*, and once the plant is infected with this bacterium there is no known treatment. In some cases, growers manage to get the tree to harvest and try to make the most of it, but at other times the fruits are affected due to vascular damage to the plant and are discarded, finally in other cases the tree is cut down even when it already has fruit as an effort to control the spread of the disease.
→ The papaya association in this study interestingly facilitates and improves commercial and trading processes, including capturing certain types of fruit for processing, thus avoiding loss.

*Figure 23 Papaya "bomb" on the right*
Cassava (*Manihot esculenta*)

The INEC survey (2014) reports 9,506 cassava producers in Costa Rica, with 17.47% located in the Huetar Caribbean Region. The planted and harvested area remained relatively constant from 2017 to 2019, increasing in 2020 (Figure 24). Figure 25 shows that from 2017 to 2018 cassava production grew significantly, from 2018 to 2020 there was a slight annual decrease.

![Figure 24 Extent in hectares of cassava crop planted and harvested in Costa Rica according to INEC data 2017-2020](image)

*Blue = hectares planted; orange = hectares harvested*

![Figure 25 Production in metric tons of cassava crop in Costa Rica according to INEC data 2017-2020](image)

In addition, Table 12 shows different uses for this product, its destination (i.e., self-consumption, self-consumption, seed, inventory, other uses), and reported post-harvest losses.
Table 12 Distribution of production in metric tons of cassava in Costa Rica according to INEC data 2017-2020

<table>
<thead>
<tr>
<th>Cassava (Year)</th>
<th>Sold amount (MT)</th>
<th>Self-consumption (MT)</th>
<th>Self-input (MT)</th>
<th>Seed (MT)</th>
<th>Inventory (MT)</th>
<th>Other (MT)</th>
<th>Postharvest loss (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>7,786,154</td>
<td>93,700</td>
<td>367,958</td>
<td>-</td>
<td>-</td>
<td>65,003</td>
<td>435,398</td>
</tr>
<tr>
<td>2018</td>
<td>9,301,138</td>
<td>103,742</td>
<td>414,738</td>
<td>-</td>
<td>-</td>
<td>3,461</td>
<td>217,012</td>
</tr>
<tr>
<td>2019</td>
<td>8,114,259</td>
<td>131,012</td>
<td>1,425,899</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>253,954</td>
</tr>
<tr>
<td>2020</td>
<td>7,790,554</td>
<td>69,234</td>
<td>1,150,261</td>
<td>-</td>
<td>-</td>
<td>20,725</td>
<td>689,325</td>
</tr>
</tbody>
</table>

Source: (INEC, 2020)

Overview (scale of importance)
Cassava is of high priority in sectoral policies with high domestic and international consumption rates. There are 2,079 ha, with 1,661 farmers and yields varying, but around 15 tons/ha. The price was determined at the pilot dates at ₡350/kg. Paraffined cassava, a mechanism for extending shelf-life, is restricted from the EU market, causing a growth in value adding options, including peeled and frozen (known as fourth range or minimally processed products according to Codex Alimentarius).

Value chain map
The following figure shows the simplified outline of the cassava value chain in the Huetar Caribbean Region of Costa Rica, according to field findings, interviews and focus groups.

![Figure 26 Map of the cassava value chain in Costa Rica](image)

The farmer oversees managing harvest, typically hired labor, and sometimes transporting directly to the packhouse or industry.
The **packhouse** processes the product to ensure its shelf life after harvesting; the industry conducts a value-added process to make it ready for market. The cassava is taken either directly or through an intermediation to the **national and international markets**.

**Value Chain Food Loss diagram**

The following figure details the unit operations for each stage of the cassava value chain mapped in the Pilot. It should be noted that surveys, observations, and direct passages were applied to determine the loss points presented below, exploring a visual method for the case of product left and lost in the field. It is commonly said in forums of this chain that large quantities are left in the field, but usually this is not quantified, so on this occasion we proceeded to take 10 photographs of an area of 1m² in the field that had already been harvested and collected, then the remaining cassava was counted. Classifying and weighing small (discard), medium (grade 2), and large cassava (grade 1) was used to estimate how much was left in the field. The amount of cassava left in the field per square meter (m²) was scaled to the harvested area to estimate the percentage of loss at the farm.
Figure 27 Loss diagram of the cassava value chain in Costa Rica
Farmer:

- **Foliage cutting (1):** The above ground foliage of the cassava plant is cut down some days before harvest, thickening the tuber peel to improve postharvest quality.
- **Harvesting (2):** The cassava root is extracted manually. Extraction using a tractor is possible but is not economical and increases loss as some cassava remains in the soil.
- **Destemming:** Each tuber is separated from the main root of the cassava plant using large trimmers.
- **Destemming:** Minor structures (extensions) or "hairs" that protrude from the root are cut, as well as from the distal part of the tuber using small hand trimmers.
- **Selection/Sorting:** Cassava is separated by grade (first grade for export and second for local market or industry, including cassavas too large to fit in an export box) with the remaining being discarded. An estimated 12% loss occurs and would be difficult to use even for animal feed due to the small size of the product and lack of economic value.
- **Packing:** The first quality (export) is placed in boxes and the second quality (domestic) in sacks.
- **Loading:** The product is transferred from the harvesting area to a truck to be taken to the packer or industrial plant.

Packer:

- **Reception:** The product is unloaded in the reception area.
- **Washing/cleaning:** If the product arrives dry, it is brushed; if it was harvested on a rainy day and arrives wet, it is washed to remove any dirt or mud.
- **Drying:** The washed cassava is oven dried to avoid moisture damage.
- **Selection (3):** The product is selected so that it is not scratched or wet, or with damage to the peel or ends, because this increases the instances of pathogens that affect the shelf life of the product.
- **Destemming (3):** Tails or “hairs” are removed from the tuber.
- **Sorting:** Damaged cassava is discarded. Between this and the previous steps, about 3% loss can be detected. Some discards may be sent to the local market if basic requirements are met.
- **Paraffin coating:** The cassava is immersed in paraffin, which ensures a long shelf life of the product. Cassava with a thin peel may rupture due to temperature changes. This has about 3% loss. Once the cassava is covered in paraffin wax, it cannot be fed to animals.
- **Selection:** The cassava that was not well paraffined will be re-processed and passed again to the paraffine coating. Cassava is selected according to client requirements, with those not meeting specifications are separated for the national market.
- **Packing:** The cassava meeting client requirements are packed in boxes.
- **Weighing:** The packed boxes are weighed as they must meet client weight specifications.
- **Packing:** The packed boxes are placed on pallets.
- **Loading:** The pallets are loaded and taken to their destination.

Industrial:

- **Reception:** The product is unloaded in the reception area.
- **Washing:** All received cassava is passed through a washing tunnel to remove dirt.
- **Peeling:** The peel is removed from the cassava.
- **Cutting:** Cassava is peeled and cut into pieces.
- **Selection:** Pieces with damage, whether it is striped cassava or blue spot, are rejected.
- **Immersion:** The accepted pieces are placed in a solution of acetic acid.
- **Weighing:** The cassava is placed in boxes and weighed to record the processed product.
- **Immersion:** After weighing, the cassava pieces are immersed in a peracetic acid solution.
→ **Freezing:** The cassava enters a cold chain to ensure its shelf life.
→ **Packing:** The cassava pieces are packed according to the client’s request.
→ **Packing:** The bags are placed in boxes, ready for shipment.
→ **Loading:** The finished product is loaded into containers for shipment.

In the case of the international market (6), it is usual for an intermediary to oversee the distribution of the sliced and frozen product, and paraffined if the market allows it. As for the national market, there are these potential channels:

→ **Retail:** Sales in supermarkets or convenience stores, greengrocers, and restaurants.
→ **Industry:** Value-added processes are carried out, such as frying, frozen pieces or flour processing.
→ **Wholesaler:** cassava that does not meet international market standards is transferred to a wholesale market.
→ **PAI:** eventually can go to government schools, prisons, etc.
peeled during cleaning
(might come from the field but it is observed here or the operation caused it)

peeled after paraffin (temperature changes can increase it)

broken tip and “rayado” (dark stripes)

Figure 28 Photos of Damage in Cassava
The following is a photo story of the value-chain to illustrate the steps observed during the field visits.

Figure 29 Photo history of the cassava value chain
Criteria specific results
Cassava turned out to be the third product in the priority ranking of the Pilot. It was the value-chain with the highest economic value of the loss. It is the second most important crop in terms of food security due to the caloric contribution it provides in the basic food basket of national consumers. It has a medium impact in terms of climatic events and has the third most relevant value of farmers in the region. Its water and carbon footprint are not considered particularly high, but there is an important productive area dedicated to the crop in the Huetar Caribbean Region.

Summary of key findings/highlights
→ Once harvested, cassava must be transported to be conditioned within one day, because several oxidation processes begin.
→ At the farm, Cassava is separated by grade (first grade for export and second for local market or industry, including cassavas too large to fit in an export box) with the remaining being discarded. An estimated 12% loss occurs and would be unlikely to be used even for animal feed due to the small size of the product and lack of economic value.
→ At the packhouse 3% of the damaged cassava is discarded. Some discards may be sent to the local market if basic requirements are met.
→ The cassava leftovers are used for animal feed; however, they do not generate any economic benefit at the moment and no by-products are sold, even with the potential it has.
→ It was expressed that the Huetar Caribbean Region is the location with the highest yield per area of cassava in the country, so there are important initiatives to promote value addition in the locality, with the possibility of greater proximity to export ports, unlike the usual route that has consisted of intermediaries buying cassava in the Huetar Caribbean Region to take it to the Huetar North to industrialize it, and then bring it again through to the Caribbean for export. However, reconfiguring the supply chain has significant challenges due to the lack of associations and the usual practice of purchasing by middlemen without major contracts or commitments.

Banana-Criollo

Overview (scale of importance)
During the prioritization matrix exercise, banana-criollo was classified as medium importance but of interest in the Region because of its high commercialization as fresh produce with high perishability, high consumer demand, but unfortunately with little prioritization by state policies. This type of banana is believed to be preferred by national consumers with an accessible price of ₡30¹⁰/unit (see Annex 3 for screenshots of price received via SMS from the official system of farmer markets and wholesale prices). Granted, there is a lack of specific data on area planted, number of producers and total yields. One publication estimated 258 ha planted with a yield of 10.2 ton/ha, although the national statistics only contain aggregate data for "bananas," only referring to export varieties (Araya, 2022).

Banana-Criollo value chain map
The following is a map of the banana criollo value chain. This is the result of field observations, interviews, focus groups (Annex 4), and adjustments subsequent to the validation with key actors in the pilot. Note,

¹⁰ The exchange rate was 565₡ : 1$ approximately by the time of the Pilot
these are the main value chain postharvest stakeholders and more complex interconnections in the supply chain flow may exist.

Figure 30 Map of the criollo banana value chain in Costa Rica

The farmers oversee crop management, its harvest and selling the product directly or through an intermediary. Sometimes the product reaches the packer or industrialist who sometimes adds value to the product with this final product either transferred directly or through an intermediary to the national and international markets.

Banana-Criollo Value Chain Food Loss diagram
Based on the value chain map, the operations or activities that occur in the main links of the supply-chain were diagrammed, and monitoring loads and interviews helped determine in which operations losses were observed in the case study, as well as the percentage of estimated loss.
Figure 31 shows that in the case of the link related to the producer, the following operations were observed:

→ **Harvesting (1):** The banana is harvested according to its physiological age and the quantity requested by the client (in indigenous territory, the harvest is done more by observation, while in commercial plantations they use colored ribbons to indicate days after flowering and therefore harvest).

→ **Transport:** The banana is moved from the field to a specific area for conditioning.

→ **Banana bunch separation and Selection (2):** these operations are simultaneous and consist of separating the hands of the rachis (or shaft) of the banana bunch while discarding damaged product (due to rubbing between the fingers of the banana bunches, by red stain...
from leaked sap, or transportation damage affecting product quality). Observation and interviews found a 1.05% loss.

→ **Immersion:** The selected bananas are immersed in an alum solution\(^{11}\), then in a disinfectant solution, then pass to the packaging and loading operations, and from there are transported to the next link in the chain.

→ **Transport (3):** In the case of bananas coming from indigenous territory, the harvested and selected product is taken by boat across the Telire River to load trucks on the other side. At this point there can be a 0.73% loss during river transport and transferring into the truck (bananas fell in the river, damage detection). Bananas from a commercial plantation are loaded directly from the farm to the truck.

→ **Packaging:** Depending on the buyer’s request, 50 or 100 bananas are placed per box or up to 7 tons can be loaded in bulk onto a truck or vehicle (according to its capacity).

→ **Loading:** The banana boxes are placed in a vehicle for the respective transport to the *packer* and/or *industrial processor*.

At the *Packhouse*, operations include:

→ **Reception:** The banana is received at the reception center.

→ **Selection:** Any non-compliant bananas are discarded, this study found a 1.19% loss

→ **Finger separation:** If requested by the client, fingers are separated from the hand

→ **Immersion:** The banana goes to a solution containing alum and a bactericide

→ **Selection:** The banana is sorted according to its destination.

→ **Classification:** The selected banana is divided into the qualities requested by the customer.

→ **Disinfection:** A chlorine bath is applied to the banana.

→ **Labeling:** Depending on the destination of the product, a label is placed in the banana fingers.

→ **Packaging:** The banana is packaged for presentation as requested by the client.

→ **Loading:** The banana is moved to a distribution center for the *domestic (national)* market.

The *Industrial* actor is mostly the distribution channel for international markets, since usually fresh banana-criollo are not exported, at least among the actors observed or visited during the Pilot.

→ **Reception:** The banana is unloaded in the reception area of the purchasing company.

→ **Washing:** The banana is washed to remove dirt and disinfected.

→ **Selection:** Bananas with peel or pulp damage are discarded, about 1.19% loss.

→ **Ripening (4):** The product is placed in chambers with ethylene gas, to ensure the optimal degree of ripeness for its process.

→ **Processing (5):** Once the product meets the time in the ripening chambers, it goes under different food processing operations (for example, banana puree)

→ **Loading:** The product is loaded and taken to its distributor for *international markets*.

\(^{11}\) Potassium alum is an organic substance that promotes the scarring of the tissue to prevent crown rot, which reduces latex stains which can seep from banana fingers attached to the bunch thereby helping reduce FLW.
In the case of the **International Market**, banana puree is commonly sent to a food processor, and more industrial processes are applied, for example, to obtain in nectars or in baby food. In the case of the **National Market**, the product will go to other possible links according to its quality or use:

→ **Retailer**: sold in supermarkets or convenience stores, fruit stands and restaurants.
→ **Industry**: to be fried into chips or other snacks.
→ **Wholesaler**: The banana is moved through a wholesale market towards a retailer, restaurant, hotel, or industrial buyer.

*Note: an alternative market that is observed in some cases for the value chains under study is the **PAI** (Institutional Supply Program) managed by the National Production Council, that would take the product and direct it to public institutions with food services such as schools, hospitals or the penitentiary system.*
Visually, the photo story of the value chain observed in the field visits is presented below.

Figure 32 Photo story of the criollo banana value chain

Note: (the upper flow of operations is usual in the commercial chain, while the lower flow is usual in the value chain originating in indigenous territory).
Criteria specific results

When calculating the indicators, banana criollo ranked 4th in the Pilot. It should be noted that the data for the criterion of number of producers had a value of zero because no information was available, which could change the final prioritization result. The rest of the data were taken from existing information sources or experts. Particularly, banana-criollo had the greatest risk of climatic events since the main productive zones near the southern Caribbean have a greater possibility of flooding. On the other hand, data availability had one of the lowest scores of the value chains. Banana-criollo are seen to have a low risk of losses due to food safety (the crop is not usually exported fresh) and there is a significant number (5) of extensionists prepared to deal with FLW in the crop.

Summary of key findings/highlights

→ A loss of 1.05% was observed at the farm level during separation of bunches and discarding damaged produce
→ Loss of .73% was observed while transporting bananas on the river from the boat to the truck
→ At the packhouse, 1.19% of the bananas were discarded for not meeting specifications.
→ Banana-criollo is not exported as fresh fruit (unless there is value addition) but is marketed fresh domestically.
→ Most of this crop production is concentrated in indigenous areas, where it must be harvested from different farms and transported in a vehicle until it reaches a boat; the product is transported by this means to cross a river and then take the crop to the loading truck. From this point on, it enters either the national or export commercialization channels.
→ In the case of export, there is interest from foreign buyers who value the product coming from indigenous territory and have established special contracts where a percentage of the payment is reserved for a type of "bonus or saving" at the end of the year for the farmers. This product is processed in Costa Rica into puree then sent to the destination country where it is used as an additive into a final product. In these cases of processing, the safety precautions are rigorous as a key use for the puree is baby food.
Baby Banana (datil)

Baby Banana Overview (scale of importance)
Baby Banana (datil) is marketed fresh, with low priority for government policies and moderate levels of national consumption, although with growing economic value as it is marketed as a "delicacy." There is little data on yields, cultivated area, or farmers dedicated to the crop. Like banana criollo, national statistics aggregate data for "bananas" or only refer to conventional banana varieties (cavendish) for export (Araya, 2022). Based on field visits and interviews, the value chain was mapped, unit operations identified with loss and other indicators estimated.

Baby Banana value chain map
The baby banana value chain map is presented in Figure 33, and the photo story in Figure 34. These were drawn up based on field observations, interviews and validation by the Central and MAG Team and external stakeholders. There may be more complex interconnections in the product flow.

![Figure 33 Map of the baby banana value chain in Costa Rica](image)

The **producer** manages the cultivation, harvest, and conditioning of the baby bananas, which can be taken to a packhouse or directly to a trader for export. The **packhouse** is commonly operated by the same farmer groups in this crop; however, there are also independent packhouses. Finally, the baby bananas are taken directly or through an intermediary to the national and international markets.
Figure 34 Photo-story of the banana value chain of the baby banana"
Figure 35 Loss diagram of the date banana value chain in Costa Rica
Farmer:

→ **Selection (1):** Bananas are selected for harvesting according to their physiological age. Age is monitored by tying colored ribbons to the baby banana bunch according to the week of flowering (or birth, as commonly referred in the sector) and will be harvested in the respective week according to the destination market.

→ **Harvesting:** The banana is cut and placed on an overhead rail for on-farm transport.

→ **Transport:** The bananas are carefully transported via rail to the plant to be conditioned. To decrease instances of damage, bunches are often left in the blue bags that were applied to prevent pests and disease during production, attention is paid for bananas to not fall off the rail or rub between fingers or bunches.

Packhouse:

→ **Reception:** Once the bananas enter the packhouse, the blue bags are removed and sent to be recycled into packaging material.

→ **Banana bunch separation:** The hands are separated from the banana bunch. The bunch is usually composted and is not considered food loss since it is inedible.

→ **Immersion:** The hands are immersed in a solution with alum (to prevent latex stains) and then in a solution with a bactericide.

→ **Selection:** The bananas are selected according to the client, i.e., requiring a uniform size. The food loss here was estimated at 0.58% depending on the case, since a finger may not qualify for a client, but could be redirected to another client. However, in some cases bananas at the end of the bunch do not qualify for some clients because they are too small and are thrown away; in other cases, they are packed as individual fingers for certain markets.

→ **Grading:** The banana is graded according to the size of the fingers and is directed to the client of interest according to their standards.

→ **Disinfection:** A chlorine solution bath is applied.

→ **Labeling:** The bananas are labeled with the client's labels.

→ **Unit Packing:** The banana is placed in a plastic sleeve for protection.

→ **Packing:** The bananas are placed in boxes according to their classification and destination.

→ **Loading:** The bananas are transported to the buyer client.

From here, the baby bananas can go to the international market, usually via an intermediary who oversees distributing the fresh bananas to wholesalers, retailers, and other markets. Alternatively, product not qualifying for export goes to the national market, either through a wholesaler to retailers (supermarkets or convenience stores, greengrocers and restaurants) or industrial processors outside the Huetar Caribbean Region. The product can go straight to retail, without a wholesaler.

Criteria specific results

There was a significant lack of data for this value chain, so the criteria of economic performance, number of farmers and soil management could not be estimated, although it was considered a product of high vulnerability due to climatic events. This highlights the need to address the crop because its importance could be underestimated, but within the group it was the last priority. The ranking of 5th place is reinforced as tape indicators assist with timely harvesting, handling causes little damage or safety risk, and
alternative distributions options (redirection of small fingers to certain customers or to the national market) means low levels of losses compared with other value chains.

Summary of key findings/highlights

→ Loss of 0.58% was observed at the packhouse for bananas that were discarded as they did not meet market specifications.
→ Leaving the two smaller “spur fingers” at the end of each bunch helps avoid rot issues. The spur fingers may be discarded or packaged for national retail.
→ One case of loss due to food safety risk, according to the FSMA "Produce Safety Standards," is that all fruit from any banana plant where a bird’s nest is found must be discarded, even though the banana fruit is protected by the bag.

![Figure 36 Finger "spur" in banana tree](image)
Matrix Updates

As a result of the sessions held on April 25 and 26, as well as the field visits, external bibliographic sources, expert sources and the review of data availability with the support of the SEPSA Data Analyst who was part of the Central Team, the prioritization matrix was refined in terms of the name of the criteria, indicators and their units. Therefore, we went from the preliminary matrix (a) to the final matrix (b) as shown in the following Table. Slight changes in the name of the indicator or criterion will be noted to ensure consistency.

Table 13 Updating of the value chain prioritization matrix

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Food loss</th>
<th>Economic Results</th>
<th>Food Security and Nutrition</th>
<th>Investment Opportunities</th>
<th>Climate Events</th>
<th>VC actors</th>
<th>Available Data</th>
<th>Water Footprint</th>
<th>MAG FLW Capacity</th>
<th>Soil Management</th>
<th>Carbon Footprint</th>
<th>Food Safety</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>weight</td>
<td></td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
</tbody>
</table>

(a)

(b)

Final FLW Value Chain Prioritization

The following shows value chains prioritized based on FLW reduction interventions in the Huetar-Caribbean Region.
## Table 14 Final value chain prioritization matrix for selection and intervention under a FLW approach

<table>
<thead>
<tr>
<th>Indicador</th>
<th>% pérdida de alimentos</th>
<th>Resulats Económicos</th>
<th>Seguridad Alimentaria</th>
<th>Oportunidad de inversión</th>
<th>Eventos climáticos</th>
<th>Potencia Productiva y Agropecuaria</th>
<th>Sostenibilidad del PDA y la información</th>
<th>Habilidad de acceso a agua y otros servicios</th>
<th>Habilidad de gestión de Productos y mercados</th>
<th>Manifestación de fragmentación de PDA, productos y mercados</th>
<th>Resultados</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yuca</td>
<td>14,67%</td>
<td>289,21</td>
<td>0,64</td>
<td>1</td>
<td>1,2</td>
<td>1661</td>
<td>3</td>
<td>207</td>
<td>3</td>
<td>207,3</td>
<td>100%</td>
</tr>
<tr>
<td>Plátano (plantain)</td>
<td>9,00%</td>
<td>17,66</td>
<td>1,23</td>
<td>1</td>
<td>1,8</td>
<td>3254</td>
<td>3</td>
<td>1602</td>
<td>5</td>
<td>4956</td>
<td>100%</td>
</tr>
<tr>
<td>Coto (banana)</td>
<td>0,58%</td>
<td>0,41</td>
<td>0,41</td>
<td>1</td>
<td>1,8</td>
<td>790</td>
<td>3</td>
<td>256</td>
<td>1</td>
<td>256</td>
<td>100%</td>
</tr>
<tr>
<td>Papaya</td>
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<td>606,85</td>
<td>0,10</td>
<td>1</td>
<td>1,2</td>
<td>397</td>
<td>3</td>
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<td>5,00</td>
<td>4056</td>
<td>3,00</td>
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</tr>
</tbody>
</table>

## Matriz de valores normalizados y ponderados

<table>
<thead>
<tr>
<th>Indicador</th>
<th>% pérdida de alimentos</th>
<th>Resulats Económicos</th>
<th>Seguridad Alimentaria</th>
<th>Oportunidad de inversión</th>
<th>Eventos climáticos</th>
<th>Potencia Productiva y Agropecuaria</th>
<th>Sostenibilidad del PDA y la información</th>
<th>Habilidad de acceso a agua y otros servicios</th>
<th>Habilidad de gestión de Productos y mercados</th>
<th>Manifestación de fragmentación de PDA, productos y mercados</th>
<th>Resultados</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yuca</td>
<td>14,67%</td>
<td>0,0053</td>
<td>0,0076</td>
<td>0,0106</td>
<td>0,0684</td>
<td>0,0458</td>
<td>0,0097</td>
<td>0,0138</td>
<td>0,0353</td>
<td>0,0269</td>
<td>0,0113</td>
</tr>
<tr>
<td>Plátano (plantain)</td>
<td>9,00%</td>
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<td>0,1282</td>
<td>0,1266</td>
<td>0,0897</td>
<td>0,0089</td>
<td>0,0097</td>
<td>0,0136</td>
<td>0,0461</td>
<td>0,0461</td>
<td>0,0091</td>
</tr>
<tr>
<td>Coto (banana)</td>
<td>0,58%</td>
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<td>0,0379</td>
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<td>0,0233</td>
<td>0,0233</td>
<td>0,0233</td>
<td>0,0233</td>
</tr>
<tr>
<td>Papaya</td>
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<td>0,0188</td>
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<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ponderación</th>
<th>15%</th>
<th>13%</th>
<th>10%</th>
<th>10%</th>
<th>9%</th>
<th>9%</th>
<th>8%</th>
<th>6%</th>
<th>6%</th>
<th>5%</th>
<th>5%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yuca</td>
<td>14,67%</td>
<td>0,0053</td>
<td>0,0076</td>
<td>0,0106</td>
<td>0,0684</td>
<td>0,0458</td>
<td>0,0097</td>
<td>0,0138</td>
<td>0,0353</td>
<td>0,0269</td>
<td>0,0113</td>
<td>0,0171</td>
</tr>
<tr>
<td>Plátano (plantain)</td>
<td>9,00%</td>
<td>0,0052</td>
<td>0,1282</td>
<td>0,1266</td>
<td>0,0897</td>
<td>0,0089</td>
<td>0,0097</td>
<td>0,0136</td>
<td>0,0461</td>
<td>0,0461</td>
<td>0,0091</td>
<td>0,0171</td>
</tr>
<tr>
<td>Coto (banana)</td>
<td>0,58%</td>
<td>0,0000</td>
<td>0,0427</td>
<td>0,1026</td>
<td>0,0299</td>
<td>0,0379</td>
<td>0,0221</td>
<td>0,0233</td>
<td>0,0233</td>
<td>0,0233</td>
<td>0,0233</td>
<td>0,0513</td>
</tr>
<tr>
<td>Papaya</td>
<td>14,86%</td>
<td>0,1796</td>
<td>0,0188</td>
<td>0,1126</td>
<td>0,0688</td>
<td>0,0189</td>
<td>0,0097</td>
<td>0,0064</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0001</td>
</tr>
<tr>
<td>Cálculo del indicador max value</td>
<td>1,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
<td>0,0000</td>
</tr>
</tbody>
</table>
5. Validation Workshop

Objective
This workshop was held on May 6 for half a day, plus a 1-hour feedback activity with the MAG team and the Central Team. The objective of the workshop was to validate the findings of the field work carried out during the Pilot of the Value Chain Selection Guide under the PDA approach, thus fulfilling the FLW Objective developed by the Central Team at the beginning of the Pilot. The agenda is shown below:

Table 15 Validation Workshop Agenda for the Value Chain Selection Pilot under the PDA approach

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30 a.m.</td>
<td>Welcome messages</td>
<td>Evan Mangino, Agricultural Counselor for Costa Rica &amp; Nicaragua. U.S. Embassy to Costa Rica</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Julia Shuck, FLW Expert for ABA Inc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nils Solórzano Director DNEA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jorge Cruz, Director SEPSA</td>
</tr>
<tr>
<td>08:40 a.m.</td>
<td>Short round of introduction</td>
<td></td>
</tr>
<tr>
<td>09:00 a.m.</td>
<td>Presentation of results obtained in the field</td>
<td>Laura Brenes &amp; Eva Vargas, Local Consultants with the support of Julia Shuck, FLW Expert for ABA Inc.</td>
</tr>
<tr>
<td>09:35 a.m.</td>
<td>Round of validation of field results</td>
<td></td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>Prioritization Matrix: preliminary vs updated</td>
<td></td>
</tr>
<tr>
<td>10:15 a.m.</td>
<td>Round of validation of updated Matrix</td>
<td></td>
</tr>
<tr>
<td>10:30 a.m.</td>
<td>Specific data consultation for selected criteria</td>
<td></td>
</tr>
<tr>
<td>11:00 a.m.</td>
<td>How to scale up the process?</td>
<td></td>
</tr>
<tr>
<td>11:45 a.m.</td>
<td>Closing remarks</td>
<td>Yendri Delgado, Head of the MAG Regional Office; Región Huetar Caribbean</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Francini Araya, Data Analyst, SEPSA</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>01:00 p.m.</td>
<td>Closing session with Extension agents</td>
<td>Central Team, MAG Team and Consultants</td>
</tr>
<tr>
<td>02:00 p.m.</td>
<td>Closing session with Central Team</td>
<td>Central Team, and Consultants</td>
</tr>
</tbody>
</table>

Participants
Both members of the Central Team and the MAG Team were invited to this activity from the beginning of the Pilot. In addition, it was extended to producers who were visited during the weeks of field work, so papaya producers participated. Local stakeholders were also invited to participate in the initial sessions, and the Agroindustrial Cluster group led by EARTH University was able to attend. This is shown in Figure 37 and in Annex 5.

It was possible to manage a hybrid format with the participation of Mr. Evan Magino from USDA, Mr. Nils Solorzano Arroyo Director of MAG Extension and Mr. Jorge Cruz Hernández Director of SEPSA.
In addition, Mrs. Ligia López of MAG participated in the meeting because of her previous work on FLW.

Results
Participants were presented the updated matrix criteria and indicators made during data analysis (see Table 5).

A participatory review activity encouraged participants to walk around the room, discussing and commenting on value chain maps. In some cases, they added or pointed out possible adjustments that were considered for the presentation of the maps in findings section of this report. The following images show part of the exercise.
The participants had the opportunity to see in detail the values of the prioritization matrix, comparing it with the preliminary one that had been made, and agreeing that the current valuations seemed more accurate.

An anonymous final evaluation with the Central and MAG Teams using Mentimeter, obtained the following feedback:

- The Pilot's exercise seemed to them (open ended description): Accurate, easy to use, possible to do, and enriching, interesting, necessary, very good for making decisions and having a baseline, valuable for the importance it has for the producer, relevant.
- The Guide seemed to them: Suitable for the products under study, specific, organized and logical; flexible, fundamental, objective, excellent, improvable after the pilot's experience, practical and easy to apply.
- The information shared, according to the scale of importance given for certain criteria, was considered useful and necessary in the first place, relevant, practical and not very repetitive (all exercises were necessary).
- The facilitating team was above all organized, respectful and gave clear instructions, and were attentive to suggestions and comments, and with varied capacities in the subject and products under study.
- The extension agents mentioned among their preferred sections during the Pilot: the results and different points of view. Field work was a preferred aspect because it verified what was planned in the first sessions with what was actually done in the field, the feedback received with the visits to producers and the practical understanding of the objectives sought. Other agents were inclined to the process of building the tool and the prioritization process itself.
- Regarding changing any section of the Pilot, the greatest response was regarding available time, since they said that if replicated in a future it will be better to dedicate more time. Also, it will be important to have more information prior to the Pilot, more coordination with the farms, and
involve more extensionists; but several pointed out that they would not change anything and that
the Pilot was clear. (note: the pilot was executed in 2 weeks)

- Finally, data collection tools were generally regarded as useful, easy to use, important, necessary
  and accessible, valuable and improvable especially in terms of digitalization in the future.

Collaborating, Learning, Adapting
To close the process, on July 13 a Collaboration, Learning and Adaptation (CLA) Session was held with
new authorities in both SEPSA and MAG and extension agents participating in the Pilot.

Next steps
Based on the strategic approach proposed by the Central Team at the beginning of the project and
recognizing the interest in the results obtained, it was perceived that in addition to the next steps to close
the activity (review of the final report, experience sharing exercise, etc.), the MAG Team is interested in
taking the findings and visualizing interventions.

The participants also indicated that the data collection tools and FLW quantification protocols seemed
feasible to apply, provided that the digitization of the processes is ideally considered in the future to
facilitate subsequent documentation.

They mentioned that resources, as always, are a constraint, but stressed that the review of the condition
of the value chains, the FLW concepts and the findings of the field work would motivate them to make
further progress in this regard.

The core team also stated that:

“This process allowed us to validate a tool (Guide) that helped to select VCs where we wanted to identify,
measure, and generally understand the PDA occurring along the supply chain, including the actors involved.
In the future, it allows us to think about possible solutions and to prioritize VC products and sections where
we can target investments.” (Francini Araya and Yendri Delgado. 6 mayo 2022)

Potentially, the proposed approach presents the following figure:

*Figure 39 Proposed FLW approach by the Core Team (Spanish original version)*
During the prioritization matrix exercise, gaps in data were identified that can be further addressed for a more refined ranking of value chains. Specifically, the Land Footprint, with the indicator soil management, can be updated by creating a list of priority soil management best practices, then surveying producers on practices implemented as a proxy for soil health. The gold standard would be actual on-farm soil sample tests, but this approach is often too expensive and time consuming to scale.

Collaboration, Learning and Adaptation Session (CLA)

The objective of this reflection session was to exchange, update and obtain information to help edit the Country Report, comment on the updated Guide (individual comments due July 26), and assess past and future Collaborating, Learning and Adapting (CLA) opportunities.

The CLA Presentation Tool was used to facilitate a group discussion, reaching the following conclusions:

**Collaboration**

It was estimated that the MAG-Extension Program will be key as an actor, but that it should consider joining efforts and interaction with other institutions within the Agriculture Sector. Among these, SEPSA, SFE, SENASA, INTA (which has developed studies in flours for example), CNP, PIMA were mentioned. Since food interventions influence emissions, food safety, competitiveness, and efficiency, it is important more actors participate. Outside the Agriculture Sector, Universities (CITA, TEC, EARTH) and other related ministries were cited, such as INEC. It was also noted that the OECD takes the reduction of FLW as a strategic route to manage the current food crises/war, which should motivate the work in the future.

Concern in terms of available time and resources included the budget to carry out a deeper process in FLW. However, acknowledging the FLW loss data represents a huge responsibility that should be a call to action, justifying the search and use of resources.

**Learning**

In terms of technical evidence, in addition to what was shared in the Validation Workshop and the results presented of this Pilot as part of the actions in the route of reducing food losses, it was mentioned that:

✔ Future studies should consider bioeconomy, circular economy, and sustainable food systems. Participants considered all three to be large and complex topics but are part of the development model supported by Costa Rica.

✔ In addition, there are markets that have not been developed and that should be considered in the fight against FLW. The current conditions set by clients in the external markets and the value chains are

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*Figure 40 Proposed FLW approach by the Core Team (English translation version)*
generators of a greater potential incidence of FLW (rigorous quality conditions). Seasonality also plays an important role.

✔ Associations must be explored to address the FLW issue, since it is easier to have data from a consolidated organization than from highly disaggregated individual producers.

✔ Consider the following elements to help expand and improve existing technical evidence:
  - Linking to organizations, programs or applications that facilitate data or information collection. Consider access to that information.
  - Use of Agricultural and Regional Surveys (e.g., roots and tubers)* These are still "momentary" so there could be opportunities to continue information
  - Consideration of other sources and studies (CATIE for example) and publications that can serve as a reference
  - Take advantage of experiences from other areas such as NAMAs (livestock, coffee) that have the sources for the emission criterion, for example for bananas, considering the lessons learned and practical issues applied

By definition, the theory of change is a visual representation of how a program, or an intervention works, its components and the link between them to capture the outcome we want to achieve. For this reason, once the proposal to approach FLW according to the Pilot was presented to the participants, they generally agreed. These elements were mentioned to arrive at a theory of change of higher quality and challenge:

- Search for alternatives and financial aids
- Reinforcement of the fact that waste has a strong link to the issue of added value, so we must work on the relationship to the consumer as well: advertising, communication, evaluation of tastes and preferences/needs can affect the opening of possible markets and products that are accepted by the consumer. For example, it is commonly said that making flour from some by-products has great potential, but this will be realized as long as it has a market (otherwise it is still a wasted product later in the supply chain).
- Strategies should be used to publicize product alternatives through showcases so that these products are displayed, for example, existing activities such as the “Feria del Gustico”
- Consider experiences in the country (e.g. South/North Regions) where farmers experiment with added value and manage to enter the market (even not saturating the demand for certain products in their markets, denoting that there is a market opportunity)
- Articulation with existing policies-programs-experiences of the subject. There is potential but we must decide to explore, investigate and generate a model for FLW management.

In terms of Monitoring and Evaluation, it was concluded in the session that:

- M&E experiences are relatively limited in the organization and industry. Some time ago there was an evaluation exercise with the support of the United Nations, but with limited data that did not include these crops.
- It would be necessary to see more studies to offer concrete data and to visualize the use of these to move forward.
- In addition, there was agreement among participants on the limitation of data particularly those that include cost estimates.

**Adaptation**
As part of the adaptation process, pause and reflection are a vital element. For example, during the Pilot it was possible to generate regular/daily conversations of consultants with the extension agents both formally and informally, there was space for comments after the field research with extensionists such as those of Talamanca, who were not able to attend the workshops so the ability and need to make adaptations in the pilot processes is observed. On the other hand, the anonymous survey and group discussions were applied after the validation workshop with the Central team and the MAG Team (extension agents) that facilitated important results.

Among the comments in the CLA session for the element of pause and reflection, the following were cited:

- There is an opportunity to share experiences with more MAG actors in other regions because there are value chain studies in other regions that have experiences or that can be supported by sharing the Pilot experience.
- For this, today there are activities that allow sharing between regions, which is also viable and necessary.
- This exchange process will make it possible to turn on and rethink, if necessary, some criteria, existing sources of information, etc.
- There are also spaces for interaction between instances of the public and private sector, for example, there is a Sustainable Production and Consumption policy that involves all agriculture as well as other sectors including (economy, environment) and the FLW is inserted in this broader policy.

In order to propose the adaptation of this experience to be eventually adopted, it was indicated that the region could:

- Share their experience in a forum with other Regional Directors.
- Personnel who were involved in this Pilot to support other areas by sharing the experience or in a more practical way (in the field).

The session closed with comments such as the following:

- Today more than ever, given that some families do not have on their tables enough food in variety and quantity, and agriculture is called to reduce its environmental impacts, we are called upon as professionals and institutions in the agricultural sector to contribute so that the food that is being lost is used for human consumption.
- There is the strength of making visible possible resources so that organizations benefit, from a perspective that can indirectly be related to FLW, with initiatives in topics such as: differentiated markets, associations, diversification of income and added value.
- Costa Rica as a signatory of the SDGs, is obligated to collection and monitoring data.
References

Araya, F. (5 de Mayo de 2022). Disponibilidad de datos según análisis de SEPSA. (L. Breunes-Peralta, & E. Vargas-Solís, Entrevistadores)


INDER. (2020). PLAN DE DESARROLLO RURAL TERRITORIAL DE POCOCI. San José: INDER.


INEC. (2014). Censos Agropecuarios: Actividad Agrícola. Instituto Nacional de Estadística y Censos. Obtenido de https://www.inec.cr/agropecuario/actividad-agricola?keys=finca&shs_term_node_tid_depth=All&field_periodo_tid=All&field_anio_documento_value%5Bvalue%5D%5Bdate%5D=


SEPSA. (2021). Nota conceptual del Proyecto de Asistencia Técnica “Medición del Indicador del ODS 12.3.1 de Pérdidas Post-Cosecha en Costa Rica”. San José : SEPSA.


Annexes

Annex 1: Soil, life zones and topographic features maps of Costa Rica

Soils

https://www.ucr.ac.cr/noticias/2016/08/04/cia-actualiza-mapa-digital-de-suelos-de-costa-rica.html

Life zones

Topography

Annex 2: Field Data Collection Tools

Market vendors' food waste survey

Market:

Age:

How many years have you been a salesperson?

Answer for each case:

<table>
<thead>
<tr>
<th>Product</th>
<th>1. What are you looking for when you buy this product to sell?</th>
<th>2. Do you perform any sorting, sizing, grading or inspection?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana Date</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creole banana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cocoa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. How do you store the products? (Observe visually)

<table>
<thead>
<tr>
<th>Seller's response</th>
<th>Observation of the person who applies the questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. How are they transported?

5. Do you do anything to try to keep them fresh? (observation)
6. Which of the foods you market are the most thrown away (thrown away) before being sold?

7. Why are they thrown away?

<table>
<thead>
<tr>
<th>LAST WEEK</th>
<th>Banana Date</th>
<th>Creole banana</th>
<th>Cocoa</th>
<th>Product 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>How many times a week do you buy to sell?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>How much do they buy in a week to sell?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>How much money does it cost per kg of what you bought?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Who did you buy it from?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>How many km did you transport?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>At what price per kg do you sell it?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>How many days does it stay in good condition?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
16. Do you process/add value (juice, etc.)?  

17. Did you throw away/discard anything?  

18. How much was thrown away/discarded?  

<table>
<thead>
<tr>
<th>Banana Date</th>
<th>Creole banana</th>
<th>Cocoa</th>
<th>Product 4</th>
</tr>
</thead>
</table>

19. Why was it thrown away/discarded?

20. What is done with unsold products?

21. How do you try to reduce the amount of food that spoils before it can be sold?

Consumer food waste survey

1^2 Market:

Age:

1. Are you the primary food preparer at home?

2. How many adults do you buy food for?

3. How many children do you buy food for?

---

4. Thinking back over the last month, what foods are discarded at home most often?

5. Why do these foods end up in the trash?

6. What is done with the food that is thrown away?

<table>
<thead>
<tr>
<th>IN THE LAST • MONTH • WEEK:</th>
<th>(Product 1)</th>
<th>(Product 2)</th>
<th>(Product 3)</th>
<th>(Product 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. You bought...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. How many days a week do you buy?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. How much did you buy this week?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. How many days does it keep well?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Did you throw away/discard any?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If thrown away, how much (how many pieces) were:

| 12. Completely unused |             |             |             |             |
| 13. Partially used in food preparation |             |             |             |             |
| 14. Leftovers (prepared, but not consumed) |             |             |             |             |

15. Why was it thrown away/discarded?

<table>
<thead>
<tr>
<th>(Product 1)</th>
<th>(Product 2)</th>
<th>(Product 3)</th>
<th>(Product 4)</th>
</tr>
</thead>
</table>

16. How often do you think about food waste (food that is thrown away), when you encounter it:

<table>
<thead>
<tr>
<th>Always</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grocery shopping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eating at home</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
17. Why are you concerned about food waste?

18. How do you try to reduce the amount of food waste in your home?
On-Farm FLW Survey

**Product:** ________________ Variety (if known) ________________

Date ______ Location ________________ Surveyor ________________

Production ______ □ kg/ha □ ton/ha □ unit (indicate any other unit) _______

Operations developed by you:

□ Crop □ Selection/classification □ Transportation □ Conditioning

□ Packing □ Distribution

1. Is there seasonality? □ No (pass to 2) □ Yes, when? ____________

2. General description of its production system and the operations it performs (process, type of family-corporate organization).

CROP

3. How is harvesting done? Indicate schedule, type of containers, equipment or machinery, harvest indicator (maturity), how many people/ha, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspects.

4. Are there any losses at this stage?

□ No (pass to 6) □ Yes
5. Tell us about these losses: why does it happen, what causes them, what kind, what amount, or volume is lost here, what do you do with them?

SELECTION AND CLASSIFICATION

6. Where and how is the selection and sorting done? (Indicate schedule, type of containers, equipment or machinery, quality indicators and selection criteria, how many people are involved, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspects).

7. Tell us more about the usual quality classifications in the marketing of this product. Write them down and know if it is a standard of your customer, of the market, is there any national regulation or standard?

8. Are there any losses at this stage?
   □ No (pass to 10) □ Yes

9. Tell us about these losses: why does it happen, what causes them, what kind, what amount or volume is lost here, what do you do with them?
POST-HARVEST CONDITIONING

10. What conditioning operations are performed?

11. How are these conditioning processes carried out? Indicate timetable, type of containers, equipment or machinery, products or treatments used, how many people participate, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspect.

12. Are there any losses at this stage?
   □ No (pass to 14) □ Yes

13. Tell us about these losses: why do they occur, what causes them, what type, what amount or volume is lost here, what do you do with them?
TRANSPORT

14. How is the transportation process carried out? (Indicate schedule, type of containers, vehicle, equipment or machinery, how many people are involved, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspects).

15. Are there any losses at this stage?
   □ No (pass to 17) □ Yes

16. Tell us about these losses: why do they occur, what causes them, what type, what amount or volume is lost here, what do you do with them?

MARKETING / SALES

17. Main destination market:
   □ national □ export

18. Location of the target market: _______________
19. Main type of customer
- □ direct on-farm sales
- □ intermediary
- □ local market
- □ CENADA
- □ farmer's fair
- □ supermarkets
- □ hotels restaurants
- □ industry

20. Reference price per kg/ton/Unit: ______________

21. By whom or based on what is this price given? _______________

22. Indicate if there are price differences by size, maturity, etc.

23. Process carried out? (Indicate schedule, type of containers, vehicle, equipment or machinery, how many people are involved, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspects).

24. Are there any losses at this stage?
- □ No (pass to 16)  □ Yes

25. Tell us about these losses: why does it happen, what causes them, what type, what amount or volume is lost here, what do you do with them?

26. Total % of products not reaching the market: ______________
(no sales, shrinkage, discards)
27. Reasons for failure to sell

28. Other destinations or uses given to unsold product

PACKAGING

29. What type of packaging does the product come in?

30. Characterize the degree of protection of the packaging:

- □ 5 (strong, protects a lot)  □ 4 (strong, moderate protection)
- □ 3 (relatively strong, protects to some extent)
- □ 2 (weak, does not protect much)  □ 1 (without packaging) intermediary
Packhouse FLW Survey

**Product:** _______________________________ Variety _______________________________

Date ______________________ Location ______________________ Data collector______________

Production ______ □ kg/ha □ ton/ha □ unit (indicate any other unit) ______

Operations developed by you:

- □ Crop  □ Selection/classification  □ Transportation  □ Conditioning
- □ Packing  □ Distribution/sales

1. Is there seasonality? □ No (pass to 2) □ Yes, when? ____________

2. General description of its production system and the operations it performs (process, type of family-corporate organization).

---

**PRODUCT RECEPTION**

3. How is the product received? Indicate schedule, type of containers, equipment or machinery, harvest indicator (maturity), how many people/ha, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspects.

---

4. Are there any losses at this stage?
   □ No (pass to 6) □ Yes
5. Tell us about these losses: why does it happen, what causes them, what kind, what amount or volume is lost here, what do you do with them?

SELECTION AND CLASSIFICATION

6. Where and how is the selection and sorting done? (Indicate schedule, type of containers, equipment or machinery, quality indicators and selection criteria, how many people are involved, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspects).

7. Tell us more about the usual quality classifications in the marketing of this product. Write them down and know if it is a standard of your customer, of the market, is there any national regulation or standard?

8. Are there any losses at this stage?
   □ No (pass to 10)  □ Yes
9. Tell us about these losses: why does it happen, what causes them, what kind, what amount or volume is lost here, what do you do with them?

POST-HARVEST CONDITIONING

10. What conditioning operations are performed?

11. How are these conditioning processes carried out? (Indicate timetable, type of containers, equipment or machinery, products or treatments used, how many people participate, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspect).

12. Are there any losses at this stage?
   □ No (pass to 14) □ Yes
13. Tell us about these losses: why does it happen, what causes them, what kind, what amount or volume is lost here, what do you do with them?

TRANSPORT

14. How is the transportation process carried out? (Indicate timetable, type of containers, vehicle, equipment or machinery, how many people are involved, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspect).

15. Are there any losses at this stage?  
   □ No (pass to 17)  □ Yes

16. Tell us about these losses: why does it happen, what causes them, what kind, what amount or volume is lost here, what do you do with them?

MARKETING / SALES

17. Main destination market:  
   □ national  □ export
18. Location of the target market: ______________

19. Main type of customer
   □ venta directa en finca □ intermediario □ mercado local □ CENADA
   □ feria del agricultor □ supermercados □ hoteles restaurantes □ industria

20. Reference price for kg/ton/Unit: ______________

21. By whom or based on what is this price given?: ________________

22. Indicate if there are price differences by size, maturity, etc.

23. How is the transportation process carried out? (Indicate timetable, type of containers, vehicle, equipment or machinery, how many people are involved, type of people involved (women, youth, migrants, indigenous people) and their approximate salaries. Comment on any other relevant aspect).

24. Are there any losses at this stage?
   □ No (pass to 16) □ Yes

25. Tell us about these losses: why does it happen, what causes them, what kind, what amount or volume is lost here, what do you do with them?

26. Total % of products that do not reach the market: ______________
   (no sales, shrinkage, discards)
27. Reasons for failure to sell

28. Other destinations or uses given to unsold product

PACKAGING

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- □ 4 (strong, moderate protection)
- □ 3 (relatively strong, protects to some extent)
- □ 2 (weak, does not protect much)
- □ 1 (without packaging) intermediary

Field FLW Measurement Data Collection Tool

**Product:** ________________________________ **Variety:** ________________________________

Date ______________________ Location ______________________ Data

collector ______________________

Evaluated stage

- □ Crop  □ Selección/clasificación  □ Transportation  □ Conditioning  □ Packaging
- □ Marketing

**Total received:** ______________________ □ g □ kg □ ton □ unit
Total sorted/conditioned (ready for sale): ____________________  □ g □ kg □ ton □ unit
Total weight of discarded product: ____________________  □ g □ kg □ ton □ unit

Quality types observed in this lot

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Packhouse FLW Measurement Data Collection Tool

**Product:** ______________________________ **Variety:** ______________________________

**Date:** ______________________ **Location:** ______________________ **Data collector:** ______________________

**Evaluated stage**

- □ Crop
- □ Selección/clasificación
- □ Transportation
- □ Conditioning
- □ Packaging
- □ Marketing

**Total received:** ______________________ **□ g □ kg □ ton □ unit**

**Total sorted/conditioned (ready for sale):** ______________________ **□ g □ kg □ ton □ unit**

**Total weight of discarded product:** ______________________ **□ g □ kg □ ton □ unit**

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Annex 3: Wholesale and fair prices according to PIMA's information system

25/04/2022 PRECIOS DE REFERENCIA DE AYOTE SAZON. CENADA: 250 col./kg. FERIA: 370 col./kg. INFORMA SECTOR AGROALIMENTARIO/ICE

ELOTE

25/04/2022 PRECIOS DE REFERENCIA DE ELOTE. CENADA: 100 col./unidad FERIA: 120 col./unidad. INFORMA SECTOR AGROALIMENTARIO/ICE

BANANO

25/04/2022 PRECIOS DE REFERENCIA DE BANANO. CENADA: 30 col./unidad FERIA: 40 col./unidad. INFORMA SECTOR AGROALIMENTARIO/ICE

CAÇAO

Especifique uno de los siguientes productos:
BANANO

El nombre del producto no existe o está mal escrito.
Annex 4: Images of focus groups and interviews conducted during fieldwork.

Cassava processing plant

EARTH University Food Service
Focus group papaya

Focus group cassava

Focus group banana
Annex 5: Workshop attendance lists.

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Annex 6: Complementary images.

Mercado Mayorista

Mercado Mayorista
Rescate de alimentos en CENADA

RESULTADOS A LA FECHA 2018-2021

756 toneladas recogidas
0.1% desperdicio
84 productos

Papaya
Papa
Banano
Chayote
Zanahoria
Ayote

Fuente: Carolina Rodríguez, CENADA (2021)

Para alimento animal
Group discussion exercises for agro-chain valuation with preliminary matrix
Plenary at the Validation Workshop, remarks by MAG authorities

Closing session with MAG Team and Central
Validation Workshop Lunch Space

MAG and Central Equipment
Annex 7: Zoom screenshots from CLA session