2. Counting

2.1 Overview of the Method

Counting involves assessing the number of items that make up FLW and using the result to determine the weight. The items may be a single product (e.g., a banana, a can of soup) or a number of products in various types of containers (e.g., a bag of grain, a pallet of product).

Several approaches incorporate counting as a means to calculate the amount of FLW. The three approaches described in this chapter are basic counting, scanning, and using visual scales. The latter two approaches do not rely solely on counting FLW but are included because they utilize counting as a foundational step.

Counting-based methods involve the following steps:

- Determine the unit to be counted (e.g., individual item, container, bag, truck)
- If the weight is not already known, weigh one—or a representative sample—of these units
- Count the units
- Multiply a unit's weight (or average sample weight) by the count

ADVANTAGES AND DISADVANTAGES

Counting methods are generally low cost and may result in data with a high degree of accuracy, as long as the counting is carried out consistently and the assumptions used to convert counts to weight (e.g., weight per item or percent weight loss factors) are correct.

An entity may also use a scanning-based approach to gather more detailed information about the FLW and, potentially, its causes because the data are collected from bar codes, which provide other useful contextual information (e.g., an item's food category, brand, and price).

One disadvantage of counting is that inaccuracies may be introduced in the assumptions or calculations used to convert the count to a weight. This method is not well suited to quantifying FLW when there is a mix of multiple items in the FLW, when the items in the FLW vary considerably in size, or when the FLW is mixed with other non-FLW waste.

LEVEL OF EXPERTISE REQUIRED

The level of expertise required for counting varies greatly depending on the approach selected. At the very simplest level, no expertise is required beyond an ability to count and multiply data. A scanning approach requires an understanding of how the underlying database is accessed and structured to allow calculations to be made. Only basic skills are required to use visual scales (or picture cards) and associated tools (after appropriately detailed training). Developing visual scales requires a higher degree of expertise, including knowledge about the commodity of interest as well as about the type of FLW and how to measure it.

COSTS

The cost of counting-based methods is likely to be minimal unless the purchase of equipment is required (e.g., new scanning devices). Using visual scales is inexpensive although developing a visual scale and training people in its use requires an investment in human resources.

2.2 Guidance on Implementing the Method

An entity that uses counting, scanning, or visual scales to estimate FLW will need to undertake a series of steps.

1. SCOPE THE STUDY

As Chapter 6 of the *FLW Standard* explains, a well-defined scope, aligned with the five accounting principles and an entity's goals, is important for ensuring that an FLW inventory meets an entity's needs. The scope of an entity's inventory, defined by the timeframe, material type, destination, and boundary, will largely dictate the scope of the counting exercise. Chapter 6 also describes how the scope chosen by an entity for its FLW inventory should be aligned with its underlying goals for addressing FLW.

2. DEVELOP A SAMPLING STRATEGY AND TAKE THE SAMPLE

If there are too many items to count, sampling may be required. Guidance on sampling is provided in Appendix A of the *FLW Standard*.

3. COUNT, SCAN THE ITEMS, OR USE VISUAL SCALES, AND CONVERT TO WEIGHT

Guidance is provided for three approaches that are based on counting:

- Basic counting
- Scanning
- Visual scales

Basic Counting

Counting can be a straightforward way for an entity to quantify FLW where the weight of the items being counted is known. An example might be a retailer for whom tomatoes in cans have become FLW. If the net weight (i.e., excluding the can) of each can is 450 g and there are 100 cans, it can simply multiply the numbers (450 g x 100 cans) together and report 45 kg in its FLW inventory.

If the weight of an item is not known in advance or varies, an entity can derive an average weight by weighing a representative sample of items. Guidance on sampling is provided in Appendix A of the *FLW Standard*.

In an agricultural setting, an entity might take a sample consisting of several hundred grains, count the number of grains damaged, for example, by insects or rodents, and then apply "rule of thumb" conversion factors (see examples in Table 2.1) to derive an estimated percentage of the weight loss due to damage. This "percent weight loss" would then be applied to the weight of the sample to estimate the total weight of the FLW.

Table 2.1 | Conversion Factors between Grain Damage and Grain Weight Loss

CROP	CONVERSION FACTORS (DIVIDE % OF DAMAGED GRAIN BY THIS FACTOR TO OBTAIN % WEIGHT LOSS)[A]
Maize (stored as shelled grain or as cobs without husk)	8
Maize (stored as cobs with husk)	4.5
Wheat	2
Sorghum	4
Paddy rice	2

[a] Using maize as an example: insect damage is expected to remove, on average, ⅛ of the weight of each infested grain. Therefore, if the proportion of grain with insect damage is known, dividing it by eight will give an estimate of the weight loss due to infestation.

Sources: Adams and Schulten. 1978. "Losses Caused by Insects, Mites, and Microorganisms." Washington, D.C.: USAID; Hodges R., M. Bernard, and F. Rembold. 2014. "APHLIS—Postharvest Cereal Losses in Sub-Saharan Africa, their Estimation, Assessment and Reduction." Table 10.1. Joint Research Centre (JRC) Technical Report EUR 26897. Brussels, Belgium: European Commission.

Scanning

A scanning approach makes use of scanning technology linked to printed or digital bar codes to count and record instances of FLW, and therefore is most often applicable in settings where the entire product is being discarded. An entity that uses a scanning approach will undertake the following steps. Where these are automated, an entity can use appropriate scanning technology and software.

- Scan the bar codes of individual items, cases, or pallets of product that are considered FLW. This is frequently done using a mobile scanning device connected to a database. In some cases, an entity may be able to extract data manually from the inventory database.
- Convert the number of units scanned to weight using standard product weight data linked to the bar code. Scanning technology typically links the data electronically though it is also possible to look up bar code numbers manually in the underlying database.

If desired, an entity can roll up the data from the individual product level (e.g., tilapia) to the broader food category (e.g., seafood). Moreover, the information may then be combined with data on annual turnover for each product group to understand the economic implications.

Where an entity (e.g., a retailer) is also including in its FLW inventory items *without* standard product weights (commonly referred to as "loose products"), it will need to estimate the weight of these loose products separately.

At the point of scanning, an entity may also record the reason for FLW (e.g., "damaged" or "past sell-by date") as part of its FLW quantification.

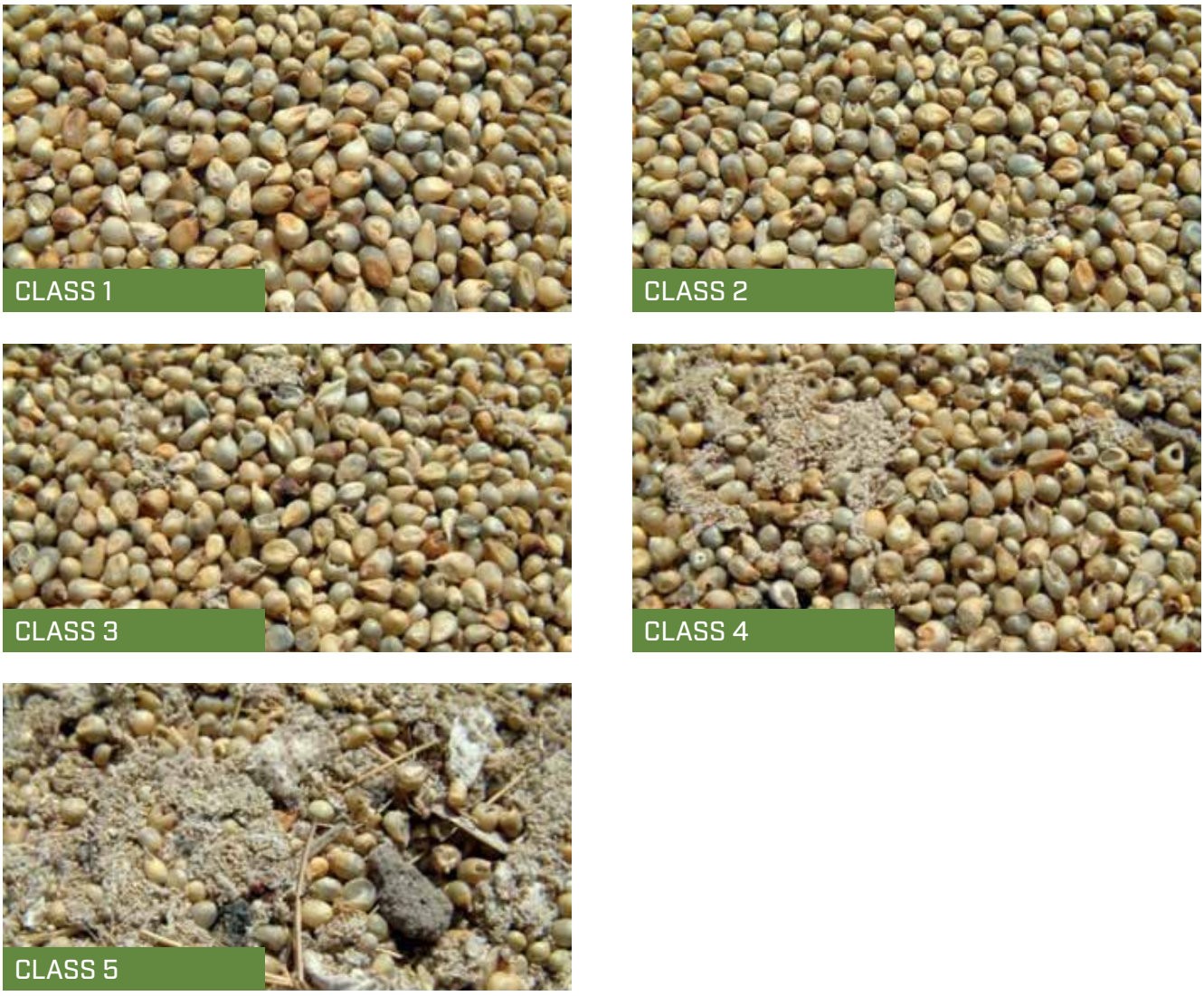
Visual scales

In agricultural contexts, picture cards and visual scales are useful aids in evaluating the condition of perishable as well as durable crops. They are a relatively quick and low-cost method of evaluating and quantifying FLW, typically to assess damage by pests to stored crops.

The visual scales developed to date for cereal grains are based on a "count and weigh" technique. If used exclusively to estimate weight loss, the "pest damaged" and "undamaged" grain from samples is first counted and then weighed. The number and weight of the grains are used to calculate the "percentage weight loss" associated with each class shown on the scale, with the more badly damaged classes losing more weight per unit than the less badly damaged classes. Reference samples, or pictures of reference samples of the full range of quality expected, are then produced and used in the field to estimate FLW. A sample visual scale for millet is shown in Figure 2.1.

The weight loss factor also corresponds to various commercial quality grades because visual scales are more generally used to ascertain the quality of the grain in terms of its market value. In this case, the reference samples, or the pictures, will include all types of grains of low quality, whether they correspond to a particular level of weight loss or not.

Figure 2.1 | Example of a Visual Damage Scale for Millet



Source: Hodges R., M. Bernard, and F. Rembold. 2014. "APHLIS – Postharvest Cereal Losses in Sub-Saharan Africa, their Estimation, Assessment and Reduction." *Joint Research Centre (JRC) Technical Report* EUR 26897. Brussels, Belgium: European Commission.

Several approaches incorporate counting as a means to calculate the amount of FLW. The three approaches described in this chapter are basic counting, scanning, and using visual scales.

An entity using visual scales in the field takes samples and then assesses each sample, using the visual scales, for insect damage and quality, recording the results along with the total quantity of grain. As part of its sampling and calculations, an entity may also apply other quantification approaches and methods (e.g., it may use sampling spears—see Appendix A of the *FLW Standard*—and/or may measure the volume of stored grain and then convert the volume to weight—see Chapter 3 of this document).

The data collected from a visual scale will represent quality grade scores. The "percentage weight loss" for each of the scores will have been determined when developing the scale, and thus the scores are converted into percentage weight loss figures. From the sampling regime chosen, a mean percentage weight loss is calculated.

Detailed guidance on developing and using visual scales for cereal grains under a range of different scenarios, as well as additional detail on using percentage weight loss figures, is provided in a report produced for the European Commission.[5] (See source note to Table 2.1. and Figure 2.1.)

4. SCALE UP THE DATA

If the data were produced from a sample, they will require scaling up. Guidance on scaling is provided in Appendix A of the *FLW Standard*.

Endnotes

5. Hodges et al. (2014).