



Food and Agriculture Organization
of the United Nations

MEASURING FOOD LOSSES

Session 4:
Sampling design

Objectives of the presentation

- Provide guidance on the sampling approach to better assess post-harvest loss (PHL)
- Present the different issues related to the sampling strategy

Outline

Introduction

- 1) Sampling approach at farm-gate level
- 2) Sampling approach off-farm

Introduction

- Important considerations when designing a survey:
 - **Representativity**
 - **Extrapolation of the results at national or regional levels and for other domains**
- All the units, at any stage of selection, should be chosen using a random procedure
- At farm-gate level
 - **Selection of the holding**
 - **Selection of the fields and plots**
 - **Identification of the crops, operations and channels**
 - **Selection procedures to take grain at the storage**



Sampling approach at the farm-gate level

1.1. Sampling approach at farm-gate level: Selection of the holding

Goals: a representative sample of holdings growing the respective crops

Example:

Selection of primary sampling units (PSUs)

- A list of PSUs to be prepared
- A sample of PSUs is prepared with equal probability selection or proportional to size (number of farmers, crop areas etc.)

Selection of second sampling units (SSUs)

- A list of all SSUs in the selected PSUs to be prepared
- A sample of SSUs (such as villages) to be selected randomly from the list

Selection of tertiary sampling units (TSUs):

- Enumeration of each SSU selected
- List of farming households where crops are being grown or identified crops are grown
- Could also stratify farming households into categories

1.2. Sampling approach at the farm-gate level: selection of fields and plots

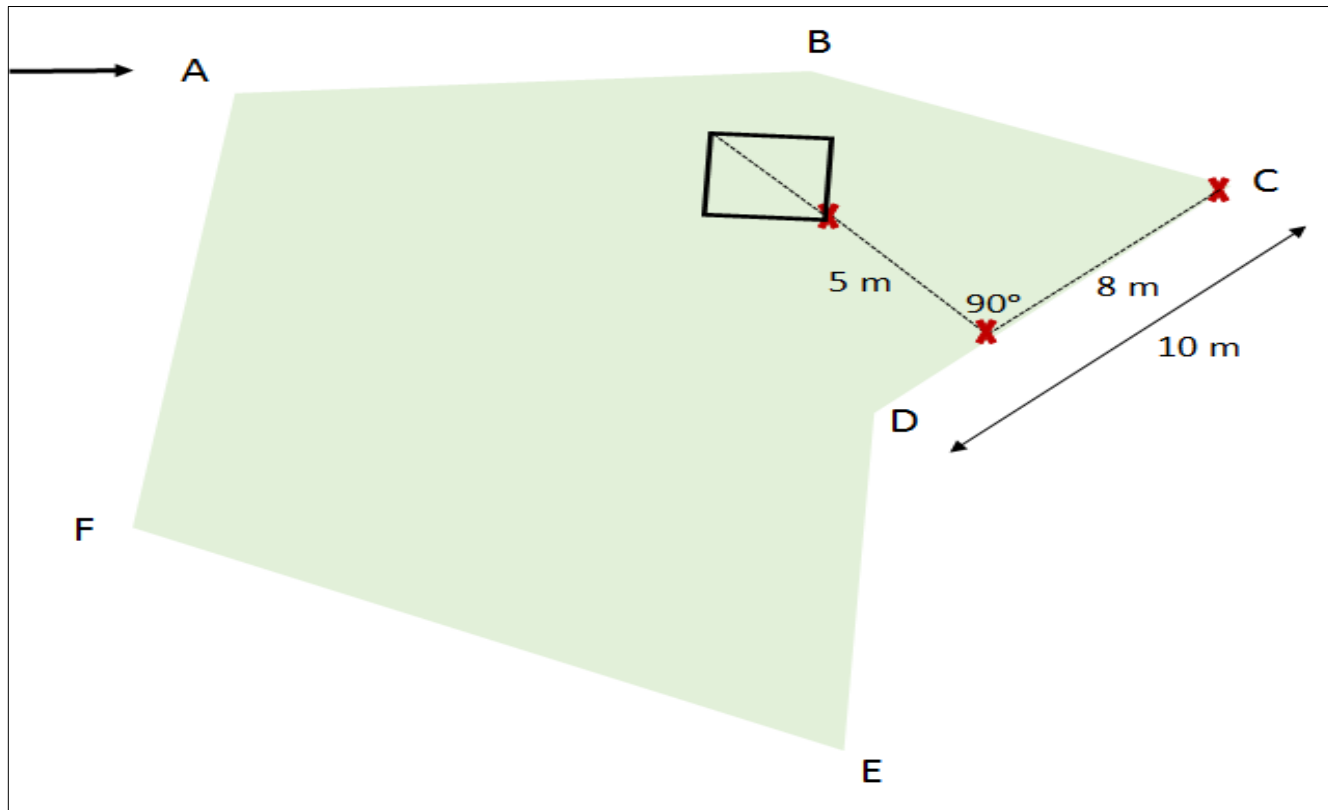
- A list of all fields of the selected farmers for each crop grown
- One field for a particular crop selected to be selected randomly
- Two plots (for example 5 x 5 m, depending on the crop) to be placed for physical measurement
- A sample of PSUs is prepared with equal probability selection or proportional to size (number of farmers, crop areas etc.)

1.2. Sampling approach at the farm-gate level: selection of fields and plots

Random placement of a sub-plot in a field

- 1) Location of the field, identification and numbering of all its points or vertices
- 2) Measurement of the length of each side, ideally using an adapted global positioning system or computation of the perimeter, area and half-perimeter of the field
- 3) Selection of a random number between 1 and the number of sides of the fields. This first random number determines the vertex (point) and side from which the enumerator enters inside the field
- 4) Selection of a second random number between 1 and the half-perimeter of the field to determine how far, perpendicularly from the side, the enumerator will go into the field. The point reached in the field to be marked with a peg. This is the first point of the sub-plot
- 5) The sub-plot can then be selected

1.2. Sampling approach at farm-gate level: selection of fields and plots



1.3. Sampling approach at the farm-gate level: identification of the crops, operations and channels

- The first choice to make often concerns the set of commodities to be covered
- Different units can be sampled depending on the activity, operations and points of the supply chain targeted for the assessment
- The choice of activities, operations or points of the supply chain to cover in a sample survey is a function of the objective of the assessment

1.3. Sampling approach at farm-gate level: identification of the crops, operations and channels

| Activity or channel | Coverage of the activity | Unit Observation |
|--|---|--|
| Harvesting | Cutting of standing crop | Plots, fields, parcels |
| Collection | Stacking, bundling and transportation up to the threshing floor | Stacks, heaps, bundles, etc. |
| Threshing | Separation of grain from crop manually or using thresher and collection of straw and grain | Bundles, heaps, stacks, etc. |
| Winnowing or cleaning | Collection of threshed material, winnowing to remove chaff, dust, etc. | Bags, specific containers, etc. |
| Drying | Collection of material after cleaning, spreading for drying, heaping after drying | Bags, boxes, specific containers, etc. |
| Packaging | Collection after winnowing/cleaning/drying/sorting/grading/threshing, filling in bags/baskets/other packaging material | Bags, baskets, packaging material |
| Transportation | Loading of packed material in threshing yard, transportation to store of farmer, unloading for storage, transportation from threshing yard to market yard, unloading at market yard | Trucks, bags, boxes, etc. |
| Storage at farm level | During storage, cleaning/grading, before sending to market for sale or own consumption | Bags, baskets, boxes, granaries, etc. |
| Storage at warehouse | Unloading, during storage, loading for further sale/disposal | Bags, drums, boxes, etc. |
| Storage at wholesale level | Unloading, during storage, loading for further sale or disposal | Bags, drums, boxes, etc. |
| Storage at retail level | Unloading and loading, during storage, sorting or grading for sale | Bags, drums, boxes, etc. |
| Storage at millers or processors level | Unloading material for storage during storage | Bags, drums, boxes, etc. |

1.4. Sampling approach at the farm-gate level: selection of grains at storage

- The same sample of farmers (as drawn for data collection at the farm level) is taken for data collection on storage losses
- The grains and cobs should be selected at different places at the storage facility
- If the storage has more than one unit (for examples bags), one, two or three bags (depending on the number of bags) are selected randomly
- **For example, if the type of storage is a bag, the selection should be from the top, the middle and the bottom of the bag**



Sampling approach off-farm

2.1. Sampling approach off-farm: wholesalers

- The list of wholesale market yards at the PSUs headquarters (capital) is prepared
- One market is selected randomly
- All the wholesalers in the market are enumerated
- A sample of wholesalers for each crop or commodity is randomly selected
- The strategy to select the bags, grains, etc. is the same as the one applied at storage

2.2. Sampling approach off-farm: retailers

- A list of main retail markets at the PSUs headquarter, including fruits and vegetables are prepared
- One or more (depending on resources available and desired precision level) markets are randomly selected and enumerated
- A number of retailers are randomly selected in each selected market
- The strategy to select the bags, grains etc. is the same at the one applied at storage

2.3. Sampling approach off-farm: milling and processing units

- A list of processing units related to the crops or commodities at the PSUs headquarters, including fruits and vegetables, are prepared
- Selection is then done
- In case some of them are not available in the PSUs, units in neighbouring PSUs are taken

Conclusion

- This presentation covered the main sampling approaches for different types of units
- The definition of the units being observed is very important and should be the first topic to be discussed
- The sample size depends on financial and human resources

Conclusion

Required sample size to achieve a given degree of precision

| | | Range of expected weight losses (%) (difference in % between highest and lowest) | | | | | | | | |
|-------------------|------|--|-------|-------|------|-----|-----|-----|-----|-----|
| | | 100% | 80% | 60% | 50% | 40% | 30% | 20% | 10% | 5 % |
| Desired precision | ±1% | 5 625 | 3 600 | 2 025 | 1406 | 900 | 506 | 225 | 54 | 14 |
| | ±2% | 1 406 | 900 | 507 | 351 | 225 | 126 | 57 | 14 | 4 |
| | ±5% | 225 | 144 | 81 | 56 | 36 | 20 | 9 | 2 | ... |
| | ±10% | 57 | 36 | 21 | 14 | 9 | 5 | 3 | ... | ... |

Source: Harris and Lindblad, 1978

References

- **Harris, K.L & Lindblad, C.J.** 1978. *Postharvest Grain Loss Assessment Methods: A Manual of Methods for the Evaluation of Postharvest losses*. American Association of Chemists Publication: Eagan, MN, USA.

Thank You