MEASURING FOOD LOSSES

Session 3:
Analysis of losses at the lab
Objectives of the presentation

• Provide guidance on the measurement of grain losses at a lab

• Present the different methods to assess losses at a lab
Outline

Introduction

1) Standard Volume/Weight Method (SVM)

2) Conventional Count and Weight or Gravimetric Method

3) Modified Count and Weight Method

4) Thousand Grain Mass Method (TGM)

5) Converted Percentage Damage Method
Introduction

• Sample taken from the field and sample taken from the farmers’ storage

• Samples of 1000 g are needed in o assess the losses

• The main principle is to separate damaged and undamaged grains

• The original techniques for measuring weight loss because of bio deterioration can be found in the manual compiled by Kenton L. Harris and Carl J. Lindblad (1978); Boxall et al. (1986); and in Compton A. J (1998)
Standard Volume/Weight Method (SVM)
1. Standard Volume/Weight Method (SVM)

• Also called Volumetric/Bulk Density

• Dry weight of a standard volume of grain is measured by a standard method at the beginning of the storage period

• Comparison is made with the dry weight of the same volume of grain after a certain storage period

• Dry weight of a standard volume of grain depends on moisture content and variety
1. Standard Volume/Weight Method (SVM)

• One of the most reliable methods to assess losses at the storage stage

\[
\%\text{Loss} = \frac{\text{Weight Undamaged Grain} - \text{Weight Damaged Grain}}{\text{Weight Undamaged grain} + \text{Weight Damaged Grain}} \times 100
\]

• Modified standard volume/weight method: use of artificial baseline prepared by selecting undamaged samples from the grain present in the storage at the time of loss determination (Boxall, 1986)
Conventional Count and Weigh or Gravimetric Method
2. Conventional Count and Weigh or Gravimetric Method

• Two subsamples of 200 g and 500 g grains are taken using a riffle divider.

• The grains in each subsample are separated into two group: damaged and undamaged.

• The damaged and undamaged grain in each group are then counted and weighted.
2. Conventional Count and Weigh or Gravimetric Method

• Percentage weight loss can then be calculated separately for each subsample

\[
\% \text{Weight Loss} = \frac{ND \times \text{Weight Undamaged Grain} - NU \times \text{Weight Damaged Grain}}{\text{Weight Undamaged grain} \times (NU + ND)} \times 100
\]

With NU= number of undamaged grains and ND=number of damaged grains

• The average of the two subsamples is taken as the weight loss

• *Weight might be adjusted to a given moisture content (14%) or at least the moisture content should be stated*
Modified Count and Weigh Method
3. Modified Count and Weigh Method: example of maize

**Step 1:**
- A sample of maize cobs is taken. A sample of 30 cobs has been found to provide precise results.

**Step 2:**
- Cobs are shelled one by one and the number of destroyed and missing grains are recorded for each cob.
- Then, the sum of the 30 cobs is used to obtain the total number of destroyed and missing grain called **TND**.
- If required, cob-related characteristics, such as husk cover and grain type, can also be recorded.
- Important: Clear definition of destroyed grains:
  - Grains that are crushed during shelling into fragments smaller than one third of a grain.
  - Grains that passed through a 3.35 mm sieve in step 3.
3. Modified Count and Weigh Method: example of maize

Step 3:
• Shelled grains from each cob are sieved through a standard sieve set (3.35/2/0.85 mm mesh)
• If desired, the number and species of insects on each cob can be recorded at this point

Step 4:
• The sieved grains from the cobs are then pooled
• A typical pooled sample contains 7,000 to 15,000 grains and weigh about 1.5 to 3.5 kg
• The pooled sampled is weighed. The weight is recorded to the nearest gram and is referred to as the final weight (FW)
3. Modified Count and Weigh Method: example of maize

Step 5:
• A riffle divider is used to subdivide the pooled sample several times to obtain two subsamples containing **about 400 to 600 grains each**
• Remaining grains are discarded
• The number of grains per subsample **should be increased if there is a high proportion of damaged grains**
  ➢ The total number of undamaged grains primarily determines precision
  ➢ Minimum of 50 undamaged grains per subsample is suggested

Step 6:
• Grains in each subsample are separated into two groups: damaged and undamaged
3. Modified Count and Weigh Method: example of maize

**Step 7:**

- For each subsample, the groups of damaged and undamaged grains are counted and weighed to obtain \( Nd \) (number of damaged grains), \( Nu \) (number of undamaged grains), \( Wd \) (weight of damaged grains) and \( Wu \) (weight of undamaged grains)

**Step 8:**

- The percentage weight loss is calculated for each subsample

\[
\frac{TND(Wd+Wu)Wu+FW(NdWu−NuWd)}{TND(Wd+Wu)Wu+FW(Nd+Nu)Wu} \times 100
\]

- The average of the two losses is used
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Thousand Grain Mass Method (TGM)
4. Thousand Grain Mass Method

• Advocated by Boxall (1986) as capable of determining insect losses

• Can overcome the problems encountered with the Volumetric and the Count and Weight Method

• Variations of the Thousand Grain Mass Method have been proposed:
  ➢ to take into account the variations in grain size;
  ➢ the difficulties in obtaining representative samples when using the standard method

• The Thousand Grain Mass Method does not require knowledge of the weight at the beginning of the season
4. Thousand Grain Mass Method

• A sample of grain is taken from the lot in strict accordance with representative sampling principles

• The number of grains in the sample is recorded (N) and the sample is weighted to obtain its mass in wet basis (m)

• The Thousand Grain Mass Method on a wet basis is equal to:

\[
\text{TGM(wet)} = \frac{1000}{N} \times m
\]
4. Thousand Grain Mass Method

• The Thousand Grain Mass Method on a dry basis is calculated using the following formula:

\[ TGM(\text{dry}) = TGM(\text{wet}) \times \frac{100-H}{100} \]

*With H the moisture content of the sample*

• The dry weight of 1000 grains is determined from a sample of grain collected at the beginning of the storage season \( TGM_0 \)

• It is compared with subsequent measurements throughout the season \( TGM_t \)

• The weight loss in a sample of grains between period 0 and t is given by:

\[ \frac{TGM_0 - TGM_t}{TGM_0} \times 100 \]
Converted Percentage Damage Method
5. Converted Percentage Damage Method

• Relies on the determination of **the percentage insect-damaged grains** in a sample and the conversion of it to a weight loss using a **predetermined factor**

• Suitable only for insect damage

• Recommended to use it if other methods cannot be applied
Conclusion

• This presentation gives an overview of standard methods to estimate grain losses at the storage stage

• The method should be chosen before designing the survey

• Each method requires a certain amount of resources (human and financial)

• Most of the methods use the principle of damaged and undamaged grains

• Important: check the materials available before choosing the method
References


Thank You