

TECHNICAL GUIDELINES FOR MEASURING CROP YIELDS IN FIELD CROPS



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Methods for Measuring Crop Yields

1.0 Introduction

Monitoring crop yield is not only basic but also a fundamental piece of information. Crop yields vary with seasons, inputs and location and therefore regular monitoring is important. Normally yield monitoring is done through crop cuts. Crop cut is a technique used to estimate crop yields from a unit area. The methodology for taking crop cuts varies with the type of crop.

The primary objective of the crop cut is to measure the crop yield in that season.

2.0 Important points to consider while taking crop cuts

- Make sure that the crop is ready for harvest.
- Area for crop cut should be representative of the geog.
- As a rule of thumb 30% of the total geog area should be covered.
- Stratify the geog into high, mid and low altitudes.
- Select 50% of the villages representing the three altitude zones.
- From the selected villages take crop cuts from a minimum of 10% of the households.
- The crop cut area should be selected at random to avoid biases of selecting either poor or very good plant stands.
- Record the name of the variety of the crop for which crop cut is taken.
- Moisture should be recorded with a moisture meter and adjusted to safe moisture content, wherever possible. Moisture meters may however not be available in all the extension centres. In the absence of moisture meters, proper drying before weighing the sample is suggested. In any case, record whether the sample was weighed fresh after harvest, or air/sun drying was done.

3.0 Materials Required

1. Measuring Tape
2. Weighing Balance
3. Rope
4. Wooden Pegs
5. Basket, Container, Sacks, Winnowers, tarpaulin (Normally these will be available with the farmers)
6. Data recording sheet/Note book

4.0 Crop Cut Procedure

4.1 MAIZE

Normally maize crop will be ready for harvest when the grains are nearly dry and contain less than 20% moisture. Farmers are expert and can tell whether or not the crop is ready for harvest. Once the crop is ready for harvest, identify a representative plot. Fix a 2-meter tall wooden peg in the selected spot. Tie the nylon rope on the peg and make a sliding knot. The length of the rope from the centre of the peg to the other end should measure 1.5 m (See Figure 1). Walk in circular fashion holding the end of the string in the field. Chop and pile all the plants that fall within the string length as you walk. The area of the plot harvested will be 7 m². Detach the cobs. Dehusk the cobs and record the fresh weight using a weighing balance. Ideally moisture should be recorded with a moisture meter but it may not always be available. Field experiences under our conditions have shown that the grain moisture content usually ranges from 20 to 25%. As a rule of thumb, the moisture content may be taken in the range of 20-25%. Record the data as shown below and compute the grain yield (t/ha) using the formula given below.

$$\text{Sample Area (m}^2\text{)} = 3.14 \times (1.5\text{m})^2 = 7 \text{ m}^2$$

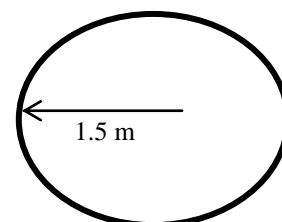


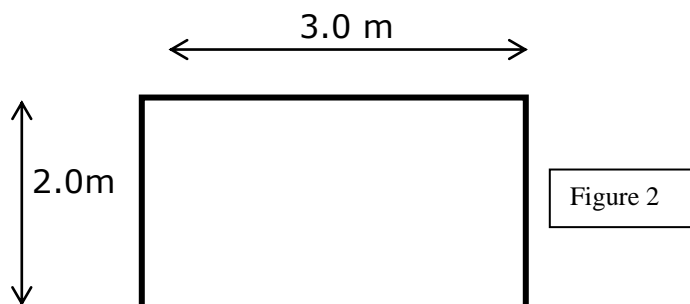
Figure 1

$$\begin{aligned} \text{Field Weight of Dehusked Cobs from } 7 \text{ m}^2 &= \text{ Kg} \\ \text{Actual Field Moisture Content (MC}_{(a)}) &= \% \\ \text{Adjusted Moisture Content (MC}_{(ad)}) &= \frac{(100 - \text{MC}_{(a)})}{85} \\ \text{Grain Yield (t/ha) at 15 \% MC} &= \frac{\text{Mean Yield/Plot (Kg)} \times 10,000\text{m}^2 \times \text{MC}_{(ad)} \times 0.8}{7 \text{ m}^2 \times 1000} \end{aligned}$$

Note: Average Shelling recovery of Maize is 80%. Moisture content is adjusted at 15%, hence divided by 85.

4.2 Rice

Normally rice is ready for harvest when more than 85% of grains in panicle turn golden yellow. With the help of wooden pegs and measuring tape, measure an area of 6 m² (3.0 m X 2.0m; see figure 2). As a rule of thumb, the moisture content of freshly harvested rice varies from 20-24%, which needs to be brought down to a standard of 14% after drying. The grains usually crack when you bite at this moisture level. Sample area = 3 m X 2.0 = 6 m².



Harvest the crop that falls in the demarcated area. Thresh it. Clean the grains by removing husks, chaff, damaged and unfilled grains. Record the weight of the grain with a weighing balance. Record the moisture content using a moisture meter, if available, otherwise indicate whether fresh or dried sample was weighed. Use this data to compute the yield in t/ha using the formula below.

$$\text{Brown Rice Grain Yield (t/ha) at 14\% MC} = \frac{\text{Yield/Plot} \times 10000\text{m}^2 \times \text{MC}_{(ad)}}{\text{Plot Size (6m}^2) \times 1000}$$

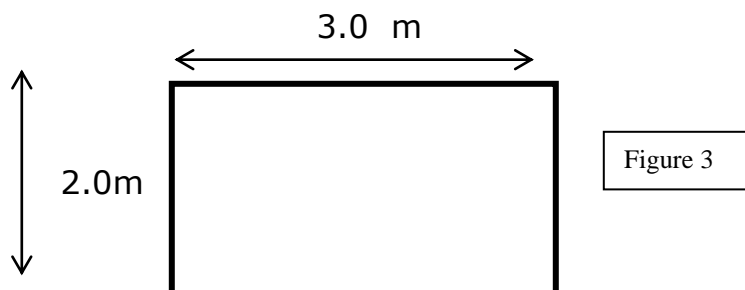
$$\text{Adjusted Moisture Content (MC}_{(ad)}) = \frac{(100 - \text{MC}_{(a)})}{86}$$

Important Terms (Adapted from Poehlman and Borthakur, 1969)

- **Rough rice:** The unhusked rice grain is known as the rough rice or paddy.
- **Brown rice:** The rough rice is converted to brown rice by removing the hulls (called dehulling or dehusking).
- **Milled Rice :** The brown rice is converted to milled rice by removing the outer bran layers (called milling or polishing).
- **Head rice:** Refers to the whole grains and the large broken pieces of (three-quarters sizes or larger) of rice.
- **Total Rice:** Refers to all the rice recovered after the milling process, both whole and broken kernels.
- **In general,** rice hulls form 20-22% of the rough rice, and rice bran + embryos form 8-10%. Head rice recovery can vary from as low as 25% to as high as 65%.

4.3 Other Crops (Wheat, Barley, Millet, Mustard, Buckwheat and Grain Legumes)

The crop cut procedure is not very different from that for rice. The minimum area for crop cut should be 5 m² but for convenience 6 m² is suggested. When the crop is ready for harvest identify a representative area for crop cut. With the help of wooden pegs and measuring tape measure an area of 6 m² (3 m X 2m; see figure 3). Harvest the crop that falls in the demarcated area. Thresh it. The method of threshing varies from crop to crop. Clean the grains to a standard level. Remove husks, damaged and unfilled grains. Record the weight of the grain with a weighing balance. Since it will be difficult record and adjust the moisture content, proper drying is very important.



$$\text{Grain Yield (t/ha)} = \frac{\text{Yield/Plot (Kg)} \times 10,000\text{m}^2}{6\text{m}^2 \times 1000}$$

4.4 Potato

In Bhutan it has been observed that farmers follow three distinct ways of potato cultivation. They are ridge planting, flat bed planting and mound/heap planting. The first two planting methods are the most common while the last one is practised in a few places. Depending upon the type of cultivation the following procedures are suggested for taking crop cuts.

4.4.1 Ridge Planting

Take four rows each with five meter length for one crop cut.

Area per crop cut = 4 rows X average distance between rows X length of row (5 m).

Use pegs and string to demarcate the plot.

Record the crop cut area.

Harvest the area and record the fresh tuber yield in kg.

$$\text{Yield (t/ha)} = \frac{\text{Yield/Plot (Kg)} \times 10,000\text{m}^2}{\text{Crop Cut Area (m}^2\text{)} \times 1000}$$

4.4.2 Flat Bed Planting

For flat bed planting measure an area of 4 m X 4 m = 16 sqm.

Use pegs and string to demarcate the area.

Harvest and record the fresh tuber yield in kg.

$$\text{Yield (t/ha)} = \frac{\text{Yield/Plot (Kg)} \times 10,000\text{m}^2}{\text{Crop Cut Area (m}^2\text{)} \times 1000}$$

4.4.3 Mound / Heap Planting

Harvest 20 heaps.

To calculate the crop cut area measure the average distance between heaps in m and compute as : No. of heaps harvested X average distance between heaps (m) .

Record the fresh tuber yield in kg.

$$\text{Yield (t/ha)} = \frac{\text{Yield/Plot (Kg)} \times 10,000\text{m}^2}{\text{Crop Cut Area (m}^2\text{)} \times 1000}$$

5.0 Desired Moisture content for storage

Maize	15%
Rice	14%
Wheat	12%
Mustard	8%
Soybean	12%
Groundnut	7%
Millet	16%