11 ESTIMATING CROP PRODUCTION

Crop growing is the main activity of farming households and forms the biggest part of the income they earn. An important part of the work of an enumerator is therefore to obtain information about the quantities of crops that are harvested.

There are many ways of estimating crop production and yields, but as most of them require that part of the crop be weighed, the use of scales will first be discussed.

11.1 The use of scales

Most enumerators will use scales to weigh the crops, and perhaps also to weigh produce bought during a market survey. A scale is a sensitive instrument and should be handled carefully. Carrying it around in the rain or in high humidity can cause it to rust; this will prevent the mechanism from working properly. Dropping a scale, or pushing its needle will also damage it.

Hanging scales

A hanging scale can be used anywhere. It can be hooked to a tree or to a nail on the outside of a house. Once the scale has been hung in position, the needle of the scale should point to zero. Because of

transport and imprecision of the instrument, the scale may indicate some weight. If so, it must first be adjusted so that the needle points to zero. This is done by turning an adjustment screw on the scale, not by pushing the needle. Since the scale will probably have to be adjusted anyway, the easiest thing to do is to first hang on the scale the sack or tray in which the crop will be weighed, and then to adjust the scale so that it indicates zero. The sack or tray is then removed from the scale, filled with the crop, and hung on the scale again. In this way, only the weight of the crop will be weighed, not that of the sack or tray. When the sack or tray is hanging very still and the needle no longer moves, the weight of the crop can be read from the scale.

Enumerator weighing a crop

To read scales correctly, the enumerator should stand (or sit) so that his eyes are exactly in front of the needle.

Scales can only show weights up to the maximum for which they were made. If a scale has a maximum of 50 kg and quantities greater than 50 kg have to be weighed, the weighing will have to be done in batches. If the scale has markings every 100 grams, it is not possible to read weights more precisely than to the nearest 100 grams.

For example: If the needle indicates a weight somewhere between 700 and 800 grams, the enumerator should not try to guess the exact weight, but should take the marking (either 700 or 800) which is closest to the needle.

Some types of hanging scales have one or more weights attached to them. These weights have to be moved along a bar to keep the bar horizontal. The weights may range from tens of kilograms to one tenth of a kilogram or even much less. The weight of the crop is indicated by the position of the weight on the bar.

Table scales

When only small quantities are to be weighed, table scales can be used. Table scales are more precise than hanging scales, but are also more sensitive. They should therefore be kept in the house of the enumerator and not taken into the fields so that their mechanism remains in good working order.

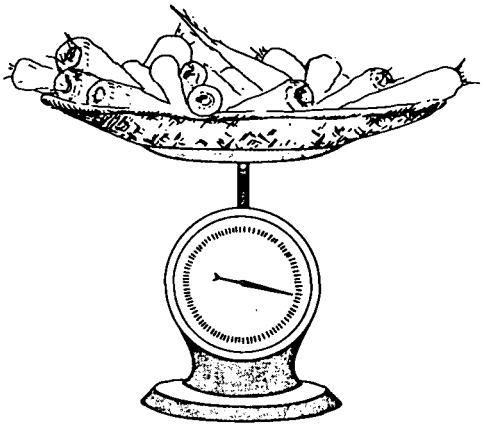
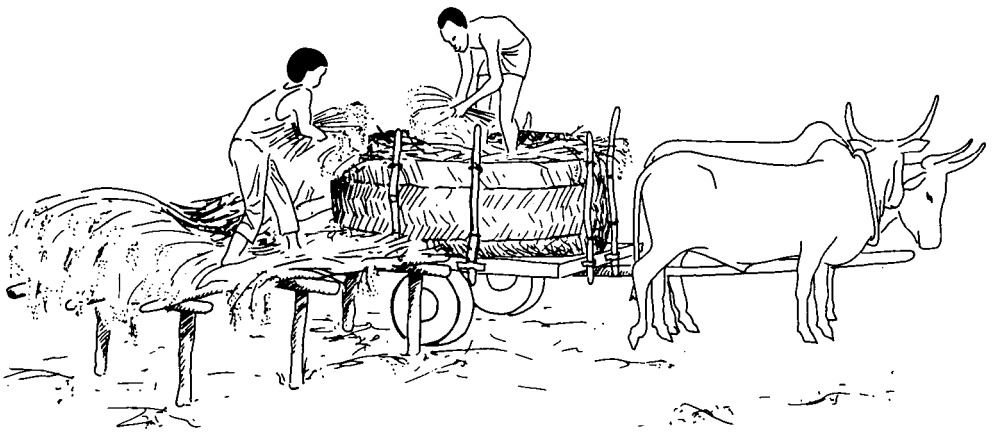


Table scales

On most table scales, the produce to be weighed is placed on a tray mounted on a spring. The principle of adjustment is the same as for a hanging scale. When being used, the scales should be placed on a flat surface and the enumerator should sit or stand so that his eyes are in front of the needle.

11.2 Direct estimates of crop production

If a field is harvested in one cut and the harvest is stored afterwards, the total weight of the harvest of that field can be estimated directly. The crop will usually first be dried and then placed in a granary. When the crop is being put into the granary, it will be carried in sacks or baskets. By counting the number of times the sacks or baskets have to be filled before the entire harvest is in the granary, one can work out how much the harvest weighs. This is done by taking a few sacks or baskets at random, finding the average weight of their contents, and multiplying this weight by the number of times the sacks or baskets were filled.



After being dried, the harvest will be transported to the granary

Example of a production estimate: basket method

A farmer has harvested a sorghum field and brings the crop by cart to his compound to dry. He then stores it in his granary. The enumerator

has arranged with the farmer to be called when the farmer is ready to put the sorghum into the granary. A big basket, filled with roughly the same amount each time, is used to carry the sorghum into the granary. The enumerator counts that the basket has been filled 68 times. This is easy for him to do: he simply puts a mark in his notebook for every basket filled; or, as an aid to memory, he puts one stem of sorghum aside for every 10 baskets filled. (This is what some Moslem farmers do traditionally so farmers might understand that procedure.) Three times at random the enumerator takes a full basket and weighs its contents. He obtains the weights of 16.5 kg, 18.5 kg, and 17.5 kg. The weight of an average filling is then calculated to be $\frac{16.5 + 18.5 + 17.5}{3} = 17.5$ kg. Since the entire crop filled up 68 baskets, the total production of the field can be estimated at $17.5 \times 68 = 1{,}190$ kg.

If several baskets of different sizes are used, the method can still be applied, by counting the times that each type of basket is filled and weighing a few random samples of each type.

It may ease the work of the enumerator and thus improve the accuracy of the data he obtains if all the farmers are given identical baskets to be used at harvest time.

For an estimate of the weight of the harvest in grains, the farmer should be asked to thresh one of the baskets already weighed so that the weight lost by threshing can be estimated. If the farmer wants to thresh the entire crop before putting it in his granary, the principle remains the same. When writing down the number of baskets, the enumerator should always indicate whether their contents were threshed or not.

If the harvest is brought to the granary a little at a time, it will be difficult for the enumerator to be there each time, but when the farmer is very cooperative and careful, he will usually be able to inform the enumerator how many times he filled his baskets.

11.3 Indirect estimates of crop production

The crop production of a field can also be estimated indirectly. This means that one does not have to consider the entire harvest of the field, but only the harvest of part of the field.

What one does is to mark off part of the field early in the growing season and measure its area. At harvest time, the crops produced on this area are weighed. Knowing this weight and the area on which it was produced, one can calculate the crop yield. As was explained in Chapter 7, the crop yield is the number of kilograms of crop that a field would produce if its area was precisely one hectare.

If one knows the crop yield and the actual area of a field, one can estimate that field's crop production by multiplying the yield by the area.

Two ways of making indirect estimates of crop production are: the sample plot method and the row method. These will now be explained.

Sample plot method

With the sample plot method, one or more squares of known size (the sample plots) are picketed off in the field when the crop is beginning to grow. At harvest time the production of the sample plots is weighed and the crop yield is calculated.

For example: Suppose 12 kg of sorghum are harvested on a sample plot of 10 m by 10 m. The area of the sample plot is $10 \times 10 = 100$ m^2. There are 10,000 m^2 in one hectare, so it would take $\frac{10,000}{100} = 100$ of these sample plots to make up a field of one hectare. The crop yield of such a field can be estimated to be $12 \times 100 = 1,200$ kg.

The sample plot method can be used in fields that grow only one crop, but is equally suitable in fields that grow mixed crops.

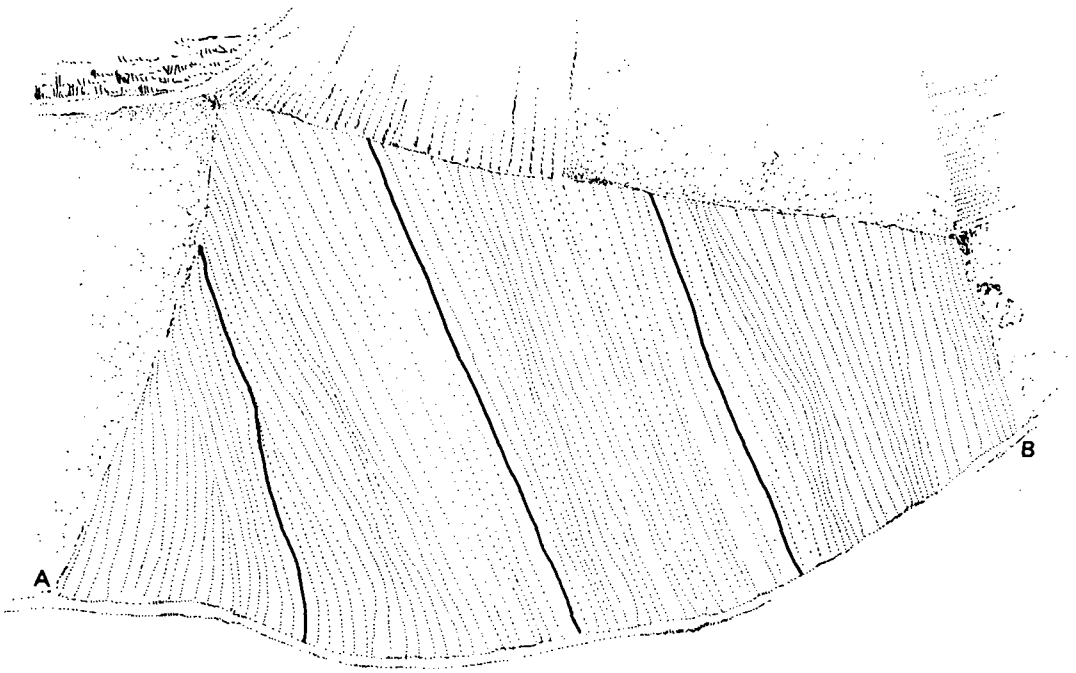
An estimate made with the sample plot method is correct only if the plants in the sample plot performed in the same way as those in the rest of the field - not better, not worse, just the same.

When the location of sample plots is being chosen, it is best to do this at random. One then has a good chance of selecting plots that are representative of the field. There are various ways of locating sample plots at random, but it is beyond the scope of this book to discuss them. The important thing to remember is that whatever method is applied, the same method should be applied in all the fields in the sample.

Row method

For crops sown in rows, the row method may be preferable to the sample plot method. With the row method, a few sample rows are chosen early in the crop season and their area is measured. At harvest time their production is weighed and the crop yield is calculated.

For example: A cotton field is sown in rows 80 cm apart. Early in the season, when the plants are still small enough for the enumerator to walk easily in the field, he counts the number of rows on one side, say Side AB. Suppose there are 94 rows on AB. The enumerator chooses three rows, evenly spaced over the field, but never taking any at the edge of the field. (The edge of a field is seldom representative of a field.) To do this, he divides the number of rows by 4: $\frac{94}{4} = 24$ (rounded off). He then starts walking along AB, counting the rows, and places a picket at the beginning of the 24th row, another picket at the beginning of the 48th row, and another at the beginning of the 72nd row. He then measures the length of each of these rows and places a picket at their other end to mark them. The length of Row 24 is found to be 30 m; that of Row 48 is 45 m, and that of Row 72 is 27 m.



Sample rows in a field

The area represented by these three rows then has to be calculated. The area of each row is found by multiplying its length by the spacing between the rows (80 cm).

For Row 24, the area is 30 m × 0.8 m = 24 m^2.

For Row 48, the area is 45 m × 0.8 m = 36 m^2.

For Row 72, the area is 27 m × 0.8 m = 21.6 m^2.

The total area of the three rows is therefore 24 + 36 + 21.6 = 81.6 m^2.

At harvest time, with the enumerator present, the three sample rows are harvested separately and their harvests are weighed. If the enumerator cannot be present at harvest time, he should make an arrangement with the farmer that the farmer leaves the sample rows and one or two rows beside them untouched. At a later date, the enumerator or the farmer will harvest the remaining rows, taking care to keep the harvest of the sample rows separate from the rest.

If the harvest of the sample rows is found to be 11.7 kg, the crop yield can be estimated to be $\frac{11.7 \times 10,000}{81.6}$ = 1,440 kg/ha (rounded off).

Instead of choosing rows evenly spaced over the field, the enumerator may choose the rows at random. The harvesting and weighing methodology remains the same.

The enumerator will ensure the cooperation of the farmer if he actively participates in the harvest of the sample plots or rows. It will help to build a better relationship between the farmer and the enumerator if the enumerator weighs the sample harvest on the spot and immediately informs the farmer of the result.

An important difference between the sample plot method and the row method is that, with the first method, a pre-determined area is harvested, whereas with the second, the area harvested depends on row length and the spacings between rows, which will be different for every field.

Chapter 11 : Questions

I. The amount of millet produced on a field is to be estimated by the basket method. The farmer and the enumerator both counted 12 large baskets and 18 small baskets. Two large baskets were selected at random and weighed. The first weighed 17 kg, the second 18 kg. The second basket was threshed, which left 12 kg grains. Two small baskets were also selected and weighed. Both were 12 kg.
   a) Calculate the total harvest of millet on head and in grains.
   b) Calculate the percentage of weight lost by threshing.

II. A field of 1.5 ha has been cultivated with sorghum and cowpeas. The enumerator has to estimate the harvest of the field by the sample plot method. The area of the sample plot is 200 m^2. It was harvested separately and its production was weighed. The sample plot produced 12 kg of sorghum and 8 kg of cowpeas.
   a) Calculate the productions of sorghum and cowpeas of the field.
   b) A more in-depth study of the sample plot showed that the ratio of the area under sorghum to the area under cowpeas was 2:1. Calculate the yields of sorghum and cowpeas separately.

III. The yield of a cotton field is to be estimated by the row method. The rows are 0.8 m apart. Four rows were selected, evenly spaced over the field. The lengths of the rows were 150, 175, 162, 138 m. The cotton was picked in two rounds. The first round produced 45 kg from the sample rows; the second 18 kg.
   Calculate the yield of the cotton field.

IV. The sorghum production of a field was estimated by the basket method; it was 1,800 kg. The production of a sample plot of 100 m^2 was 6 kg.
   a) Calculate the yield of the field.
   b) Calculate the area of the field.