Second Regional Training Course on Sampling Methods for Producing Core Data Items for Agricultural and Rural Statistics

## Module 3: Sampling Methods for Crop-Cutting Surveys

# Session 3.1: Crop Cutting Surveys

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UNITED NATIONS SIAP Statistical Institute for Asia and the Pacific

IMPROVING AGRICULTURAL STATISTICS Global Strategy

BPS, Statistics Indonesia

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# Agricultural Surveys



## Agricultural Surveys

### Agricultural Statistics

- **Agricultural statistics**
  - **Stock of Resources**
    - Number of holdings
    - Operational area & arable land
      - Irrigated & unirrigated
    - Land use
    - Machinery & equipment
    - Agricultural workers etc.
  - **Agricultural Production**
    - Qnty. & value of produce
    - Qnty. & value of inputs
    - Sale of produce
    - Labour inputs
    - Exports and imports
    - Consumption etc.

## Collection of Agricultural Statistics

* Stock of resources data
  - These do not change rapidly and usually follow a secular trend with hardly any annual fluctuations
  - Mostly collected in Agricultural Census
  - Considered as baseline data
* Data on Agricultural Production
  - These are subject to annual and seasonal fluctuations
  - Thus these are collected more frequently – annually and for different seasons
  - Most of these are collected thru' *Agricultural Surveys*.





## Agricultural Surveys (1)

Most countries carry out agricultural surveys to collect current data on

* agricultural production including
  - Quantity and value of main produce
  - Quantity and value of bye-products
  - Livestock products & changes in livestock
* associated variables, such as
  - land under the crop & their irrigation status,
  - labour input,
  - equipment used – owned and hired,
  - use of fertilizers, seeds, fodder & chemicals, etc.

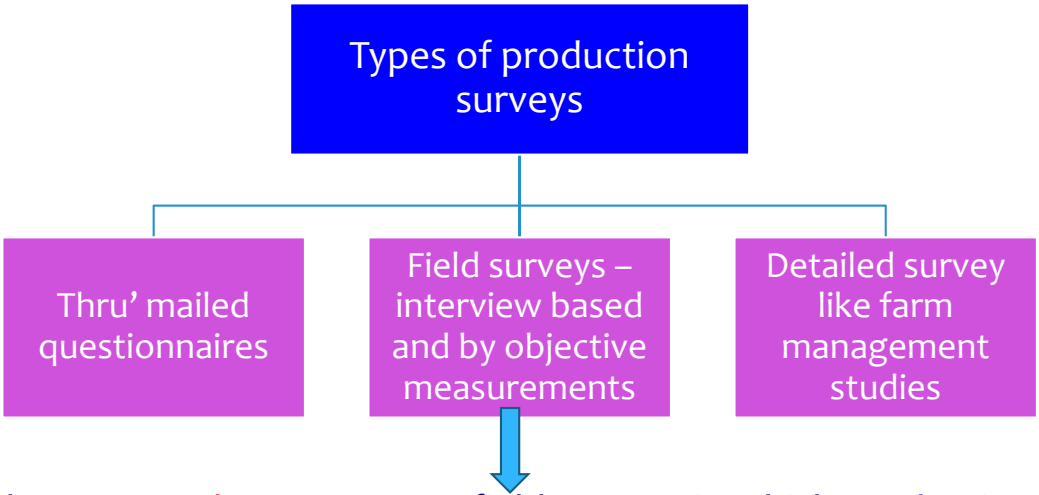
## Agricultural Surveys (2)

* These are carried out at regular intervals – each agricultural season or at least annually,
* mainly to collect data on quantity and value of produce and use of inputs.
* In developing countries, agricultural activities are carried out in small holdings. Thus, sampling techniques are employed to carry out these surveys.





## Agricultural Surveys on Crop Production




The ***crop cutting surveys*** are field surveys in which production data are collected thru' direct measurement.

# Important Definitions





## Crops Classification by Periodicity

* **Seasonal crops:** Crops that are traditionally harvested mainly during a specific season are defined as the seasonal crops of the respective season.

  Example: autumn paddy, pulses, winter wheat, tapioca, etc.

* **Annual crops:** Harvested throughout the year.

  For example, banana, sugarcane, plantain, pineapple and betel leaves are classified as annual crops for horticulture surveys.

* **Perennial crops:** Crops, which are standing for more than one year, are treated as perennial crops. These are permanent crops, which do not have to be replanted after each harvest.

## Relating to Pieces of land

* **Holding:** An economic unit under a single management for agricultural production.

  In most of the developing countries, agricultural activities are carried out by individual households operating small holdings.

* **Plot:** A patch or piece of land, which has separate legal / administrative identity, such as

  survey sub-division number in tax register / land records.

* **Sub-plot:** A part of predetermined size located at random within the plot which is being harvested.

  A sub-plot is harvested by the enumerator(s).





## Crop Yield

Crop yield is the average quantity of a crop harvested from a specified unit area.

Different measures of yield:

- **Biological yield**: yield obtained before subtraction of any losses during harvest.
- **Harvested yield**: yield after netting out harvesting losses.
- **Economic yield**: Yield after netting out any losses incurred in post-harvest operations such as drying, shelling etc.

# Crop-Cutting Surveys (CCS)



## Crop Cutting Surveys

### Crop Cutting

* Crop cutting is the most wide spread method of yield estimation used through the world.
* The techniques were developed in India in 1940s and 1950s.
* In this method, yield of a crop is measured as follows:
  - A sample of plots planted with the crop is randomly selected.
  - A sub-plot of a given size is selected at random from each selected plot.
  - The selected sub-plot is harvested by the enumerator and weighed after processing appropriately.
  - The *harvested yield rate* is calculated as the weight of the harvested crop divided by the area of the sub-plot.

## Data Collection in CCE

* Locating and marking of sub-plot for harvesting by the enumerator selected on the principles of random sampling
* Harvesting and threshing of its produce
* Recording weight of the produce in the prescribed forms
* Driage experiments





## Crop Cutting – issues involved

* Shape of the sub-plot
  - triangular or circular or rectangular?
* Size of the sub-plot
  - Involves a trade-off between accuracy and ease of operation
* Number of sub-plots per plot
* Number of holding / plots to be sampled.

## Crop Cutting Surveys – Important observations

1. Appropriate size of the sub-plot depends on the density of the crop in the field.
   - For widely spaced crop, 10 to 25 meters sub-plot is appropriate
2. CCSs are more effective when the crop is densely planted and it is fairly uniform throughout the plot.
3. CCS is NOT appropriate for perennial crops that are harvested continuously for considerable lengths of time.

   In such cases, farmers' estimates of production provides better results.



## Estimation of Crop Area and Production

## Estimation - Two Main Variants

* The main objective of conducting CCS is estimating production (***P***) and area (***A***) under a crop, based on the objectively measured yield rate (***Y***) in selected sub-plots.
* Two main variants of the procedure:
  I. In which ***A*** is obtained from administrative land records
  II. In which ***A*** is estimated from the CCS.





## Administrative Records

* Many countries have reporting systems of one form or the other that provide agricultural data, such as
  - Register recording crop area statistics maintained by village accountant / local headman
  - Report of agricultural extension workers
* In many countries, the cadastral survey conducted in the past provide plot-wise map of the village. The village officials are required to ascertain and record the crops sown in the plots in a register.
* These registers are updated every season.

# Procedure I of Estimating *A* and *P* (1)

* In countries with regular agricultural reporting system, crop area ***A*** is obtained from the records on complete enumeration basis.
* Average Crop yield ***Y*** is estimated by CCS on a sample basis.
* Crop production, ***P***, is estimated as a product of area and yield estimates. That is

$$P = A * Y$$

* Any delay in area estimation results in delayed estimates of crop production





# Procedure II of Estimating *A* and *P* (2)

* In countries where there are cadastral maps but no regular reporting system, both ***A*** and ***Y*** are estimated on the basis of sample surveys.
* Usually, a large sample of villages (primary units) is selected for crop area enumeration. This provides estimate of ***A***.
* CCS is carried out in a sub-sample of the primary units selected for area enumeration. This provides the estimate of ***Y***.
* Estimate of production is obtained in the same way as in the case regular reporting system.

## Procedure II of Estimating *A* and *P*

* In countries which do not use administrative records, both ***A*** and ***Y*** are estimated on the basis of sample surveys.
* Usually, a large sample of villages (primary units) is selected. A list of holdings in a selected village is made, of crop cultivated.
* For each crop, a sample of holdings reporting cultivation of the crop is drawn. This provides estimate of ***A***.
* CCS is carried out in a sub-sample of holdings. This provides the estimate of ***Y***.
* Estimate of production is obtained in the same way as in procedure I.



## Sample Selection and Sampling Unit

# Sampling Units for CCS

* Usually, a stratified multi-stage random sampling design is adopted.
* Typically, stratification is done at a sub-district level.
* **first stage unit (FSU):** Villages within a stratum are the of sampling
* **second stage unit (SSU):**
  - **Procedure I:** Survey plots within each selected village
  - **Procedure II:** Holdings within each selected village
* **Ultimate unit of sampling (USU):** Experimental sub-plot of a specified shape and size.





# Sampling for CCS

* The number of crop cutting experiments to be conducted during a season is most often decided before hand.
* Number of experiments allotted to a district is distributed among the strata within the district roughly in proportion to the area under the crop in the stratum
* Allotted number of villages (FSUs) are randomly selected from the list of villages.

# Selection of SSUs

The two procedures are operationally different at the SSU selection stage.

* Procedure I: A sample of plots is selected from the list of plots reported to be under the crop.
* Procedure II: A sample of holdings is selected from the list of holdings reporting the crop.

In both the procedures, random samples are drawn.





# Selection of USU – sub-plot

* The sub-plots are selected using a pair of random numbers.
* The point corresponding to the pair of random numbers is located in the selected plot.
* A sub-plot of prescribed shape and location is marked for crop cutting experiment. This the USU for the CCS.

# *THANKS*