



REPUBLIC OF THE PHILIPPINES

**PHILIPPINE STATISTICS AUTHORITY**

Palay and Corn Production Survey

## **PALAY PRODUCTION SURVEY**

### **3. Survey Methodology**

#### **3.1 Sampling Frame**

The 1991 Census of Agriculture and Fisheries (CAF) provides the primary basis for the sampling frame for the PPS. Except for Isabela, Laguna and Bukidnon where the traditional complete enumeration strategy was employed, the 1991 CAF used sampling techniques for selecting the primary sampling units (the barangays) for these three provinces.

The largest barangay in a municipality was taken with certainty while a one in two sampling rate was used in selecting the remaining barangays in the municipality. This scheme effectively resulted in the generation of two sub-universes: a sub-universe of barangays with probability of selection equal to 1.0 and another sub-universe of barangays with probability of selection equal to 0.5. This characteristic of the 1991 CAF is considered in the sampling design for the PPS.

Updating of frame on the list of agricultural households in the same sample barangays were generated through interview of key informants in 2007 and 2011 in order to get a precise estimate.

#### **3.2 Sampling Design**

The domain of the survey is the province. A two-stage stratified sampling design is used. The psu is the barangay which is selected using pps sampling. The farming household, systematically selected, serves as the ssu. To provide ease and flexibility in estimation, rotation of samples, etc., a replicated sampling design is instituted. The complete design includes four (4) independent sets of sample replicates (Figure 1).



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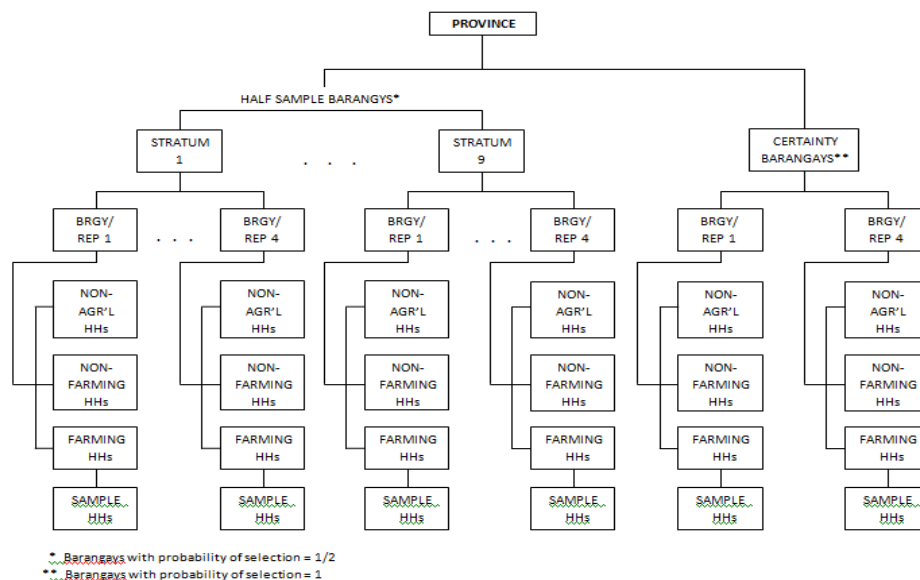


Figure 1. Schematic Diagram of the sampling Design for the Palay Production Survey

### 3.2.1 First Stage (Primary) Sampling Unit Selection

A general feature of the sampling design used for the survey is the division of primary sampling units into strata of approximately equal sizes relative to total farm area devoted to palay. Considering, however, that the 1991 CAF effectively curved out two sub-universes, the division of the barangays within the province was affected as follows:

All barangays with probability of selection equal to 1.0 (certainty barangays) were first lumped into one stratum (generally, it is the 10<sup>th</sup> stratum). The remaining barangays (those with probability of selection equal to 0.5) were then divided into nine strata such that the aggregate palay farm area of all the barangays constituting any one stratum was approximately of the same magnitude with the rest of the individual strata. To compensate for the unlisted barangays in the 1991 CAF and to have an estimate of the palay farm area in the province, this aggregate area was doubled for provinces with half-listed strata. Using the estimated area to devoted to palay as the estimated size of the barangay, a pps sample of four (4) independent barangays were selected from each stratum. Each sample barangay represents the  $i^{\text{th}}$  replicate sample for that stratum.<sup>1</sup>

<sup>1</sup> The original four replicates per province have been reduced due to budgetary considerations. The current set of samples covers two replicates per province.

The number of sample barangays for each province varies based on palay production. The provinces were classified in two (2) groups covering a predetermined number of sample barangay as follows:

Classification	No. of Sample Barangays
Major palay producing provinces	20
Minor palay producing provinces	10

### 3.2.2 Second Stage (Secondary) Sampling Unit Selection

Households in each sample barangay were categorized as either farming or non-farming based on the following definitions:

**Household** – a person or a group of person who sleeps under the same dwelling unit and usually has a common arrangement in the preparation and consumption of food. The household members may not necessarily be related by ties of kinship, although they are usually relatives. In some instances, more than one household may occupy the same dwelling unit.

**Operator** – a person who takes the technical, financial and administrative responsibility in managing the farm, including the management and supervision of hired labor; he may work on the land himself or may employ others to work on the land. He may or may not be the owner of the land.

**Farm** – a parcel or parcels of land which has a total land area of at least 1,000 square meters (one-tenth of a hectare) used for agricultural purposes.

**Parcel** – one contiguous piece of land under one form of tenure without regard to land use. Both the contiguity and one form of tenure conditions should be met for a piece of land to be classified as one parcel. Contiguous means that the piece of land is not separated by natural or man-made boundaries such as river, dike, and road that are not part of the holding. A parcel may be surrounded by other lands, water, road, forest or other features that are not

part of the holding or part of the holding under different land tenure. A parcel may consist of one or more fields or plots adjacent to each other.

**Agricultural household** – any household in which a member operates an agricultural land either a “Farming Household” or “Non-Farming household”.

**Farming household** – any household in which a member operates an agricultural land, either solely or jointly with other members, and the aggregate area operated by the operator-members of such household qualifies to be called a farm.

**Non-farming household** – any household in which a member operates an agricultural land, either solely or jointly with other members, and the aggregate area operated by the operator-members of such household does not qualify as a farm.

**Non-agricultural household** – any household in which none of the members operates any agricultural land.

**Palay Household** - the sample household operates an agricultural land, whole or part of which is palay area within the nine-month period, or the land is temporarily in-fallow but the respondent declares that it is devoted to palay production. Specifically, any of the following conditions must be satisfied:

Nine-month period

- a) Household harvested palay during reference quarter;
- b) Household has standing palay crop in the farm as of the last day of the reference quarter that is expected to be harvested during the next five months;
- c) Household intends to plant palay anytime in the succeeding quarter; and
- d) The land is temporarily in-fallow but the respondent declares that it is devoted to palay production.

**Non-palay household** - household operates an agricultural land which is not intended for/devoted to palay production, i.e., zero palay production, no standing palay crop and planting intention.

For this survey, the selection of sample households has been limited to the group categorized as **farming households**. The number of sample households drawn for each

sample barangay varies. The initial size of sample households is determined using the general formula:

$$n'_{ijk} = \frac{1}{b_{ij}} \cdot \frac{P_{ij}}{P_{ijk}} \cdot \frac{N_{ijk}}{Rk_i}$$

where:

$N_{ijk}$  - total number of farming households in the  $k^{th}$  sample barangay in the  $j^{th}$  stratum of the  $i^{th}$  province

$Rk_i$  - uniform raising (expansion) factor used for the  $i^{th}$  province

$b_{ij}$  - number of sample barangays in the  $j^{th}$  stratum of the  $i^{th}$  province  
(4)

$P_{ijk}$  - palay area of the  $k^{th}$  sample barangay in the  $j^{th}$  stratum of the  $i^{th}$  province

$P_{ij}$  - aggregate palay area in the  $j^{th}$  stratum of the  $i^{th}$  province

This will result to a self-weighted sampling scheme that will facilitate estimation of the survey characteristics.

The uniform expansion factor  $Rk_i$  for the  $i^{th}$  province used in determining  $n'_{ijk}$  is:

$$Rk_i \text{ (rounded off to the lower 50)} = \frac{1}{b_{i.}} \cdot \frac{\overline{P_{i.}}}{\overline{P_{i..}}} \cdot \frac{\overline{N_{i..}}}{\overline{n_{i..}}}$$

where:

$\overline{b_{i.}}$  - average number of sample barangays per stratum in the  $i^{th}$  province (4)

$\overline{P_{i.}}$  - average total area planted to palay per stratum in the  $i^{th}$  province,

or  $\frac{\text{total palay area planted to all strata in the } i^{th} \text{ province}}{\text{total number of strata in the } i^{th} \text{ province}}$

$\overline{P_{i..}}$  - average total area planted to palay per barangay

$\overline{N_{i..}}$  - average number of farming households per barangay

$\overline{n_{i..}}$  - average number of sample farming households per barangay (=10)

For economic reasons, the sample size at the SSU level was set to a minimum of 4 and a maximum of 25 households. The function below will give the final sample size conforming to the sample size limitation.

$$n_{ijk} = \begin{cases} n'_{ijk}, & \text{if } 4 \leq n'_{ijk} \leq 25 \text{ and } N_{ijk} \geq 4 \\ 4, & \text{if } n'_{ijk} < 4 \text{ and } N_{ijk} \geq 4 \\ 25, & \text{if } n'_{ijk} > 25 \text{ and } N_{ijk} \geq 25 \\ N_{ijk}, & \text{if } n'_{ijk} > 25 \text{ and } 4 \leq N_{ijk} \leq 25 \end{cases}$$

The design of the 1991 CAF covered only 50% of the barangays of some municipalities outside the National Capital Region (NCR) and only 10% of the barangays of the cities/municipalities of NCR. To cope up with this and the sample selection procedure, the basic weights for the  $k^{th}$  sample barangay in the  $j^{th}$  stratum of the  $i^{th}$  province are computed as:

$$w'_{ijk} = \begin{cases} \frac{N_{ijk}}{n_{ijk}} & , \text{if certainty stratum} \\ \frac{1}{r} \left( \frac{P_{ij}}{b_{ij}P_{ijk}} \frac{N_{ijk}}{n_{ijk}} \right) & , \text{if non - certainty stratum} \end{cases}$$

where  $r$  is the sampling rate used for the cities/municipalities in the 1991 CAF.

$$r = \begin{cases} 0.50 & , \text{for non - certainty stratum outside NCR} \\ 0.10 & , \text{for non - certainty stratum within NCR} \end{cases}$$

To incorporate the adjustment factor given by the basic weights and to account for unit non-response, the adjusted weight is given as:

$$w_{ijk} = w'_{ijk} A_1$$

where  $A_1$  is the adjustment factor for non-response.

Household weights are encoded together with other household level data. During table generation, weighting adjustment is done to correct for sampling unit non-response due to the following reasons:

- refusal of target respondent or any other knowledgeable household member to be interviewed;
- sample barangay is not accessible during the survey period;
- entire household is temporarily away during the survey operation;
- sample household has transferred residence to another barangay; and
- sample household's residence could not be located / unknown in the sample barangay.

Weighting adjustment is done for each sample barangay, whenever applicable. This is calculated by multiplying the original household weight by the reciprocal of the response rate. Response rate is the ratio of the number of sample households who responded to the survey (either palay household or non-palay household) to the total number of sample households in the barangay. Calculation of the final weight is done afterwards, by multiplying the adjusted weight by the uniform raising factor  $R_k$ .

### 3.3 Estimation Procedure

#### 3.3.1 Stratum Estimates

Each replicate (represented by the psu) in a stratum will yield an independent estimate that will be used for the stratum. For the  $k^{th}$  barangay/replicate/psu in the  $j^{th}$  stratum of the  $i^{th}$  province, the independent estimate of the total is obtained by the weighted sum of the observations from the sample farming households, given by the equation:

$$X'_{ijk} = w_{ijk} \sum_{l=1}^{n_{ijk}} x_{ijkl}$$

where  $x_{ijkl}$  is the observation from the  $l^{th}$  sample farming household of the  $k^{th}$  sample barangay in the  $j^{th}$  stratum of the  $i^{th}$  province.

The unbiased estimate of the total for the  $j^{th}$  stratum of the  $i^{th}$  province is simply the sum of the independent estimates of the psu, given by the equation:

$$X'_{ij} = \sum_{k=1}^{b_{ij}} X'_{ijk}$$

The variance for the total of the  $j^{th}$  stratum of the  $i^{th}$  province is given by:

$$v(X'_{ij}) = \frac{b_{ij}}{b_{ij} - 1} \sum_{k=1}^{b_{ij}} \left( X'_{ijk} - \frac{X'_{ij}}{b_{ij}} \right)^2 (1 - f_{ij})$$

where  $f_{ij}$  refers to the sampling rate for the barangays in the  $j^{th}$  stratum of the  $i^{th}$  province or

$$f_{ij} = \frac{b_{ij}}{B_{ij}}, \text{ with } B_{ij} \text{ denoting the total number of barangays in the } j^{th} \text{ stratum of the } i^{th} \text{ province.}$$

The equation above for the variance is approximately equal to:

$$v(X'_{ij}) = \frac{b_{ij}}{b_{ij} - 1} \sum_{k=1}^{b_{ij}} \left( X'_{ijk} - \frac{X'_{ij}}{b_{ij}} \right)^2$$

if  $f_{ij} \approx 0$  or if  $b_{ij}$  is very small and  $B_{ij}$  is very large.

### 3.3.2 Provincial Estimates

The estimate of the total for the province is obtained simply by aggregating all the stratum estimates in the province. Hence, the estimate of the total for the  $i^{th}$  province is given by:

$$X'_i = \sum_{j=1}^{S_i} X'_{ij}$$

where  $S_i$  is the total number of strata in the  $i^{th}$  province (domain).

The variance for the total of the  $i^{th}$  province is simply the sum of the stratum variances:

$$v(X'_i) = \sum_{j=1}^{S_i} v(X'_{ij})$$

### 3.3.3 Regional and National Estimates

Estimates of total for the region and for the whole country, together with their respective variances, are obtained by aggregating relevant provincial estimates (for the region) and aggregating relevant regional estimates (for the whole country).