

# CROP YIELD ESTIMATION SURVEYS IN PAKISTAN: APPLICATION OF CENSUS AND SAMPLE ENQUIRY METHODS IN CROP SURVEYS

By

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## INTRODUCTION AND SIGNIFICANCE

This paper is written with the purpose of introducing the readers with different survey methods used by various institutions of public and private sector for survey purpose.

The paper is descriptive one and discusses in detail the application of census and sample survey methods for estimating the yield of various crops in our country.

Crop yield estimation surveys in Pakistan are mainly conducted by Revenue and Agriculture Departments. Revenue Department adopts census survey method and Agriculture Department makes use of sample survey method for ascertaining the yield per acre of various crops.

The methodology of crop yield estimation surveys as followed by Revenue and Agriculture departments in our country is discussed below:

Crop yield estimation surveys are of great significance for countries like Pakistan where agricultural products, consisting, mainly the food and cash crops, are not only important for the consumption of local people and industries but these are also the main source of foreign exchange earning for the country. Due to this importance of our agricultural products, it is necessary to know in advance as to how much will be the output of each of the various products of our agriculture sector during a particular year. In order to ascertain the output, it is essential to know:

- a) Area under cultivation of a crop, the output of which is to be ascertained.
- b) Average yield per acre of that crop in different areas. Crop yield estimation surveys conducted by various agencies are mainly meant to have basic information about areas under cultivation and yield per acre in different areas. The other objectives with which these surveys are conducted are:
  - i) To compare the area and production figures of a current year with that of previous year and ascertain the current year's divergence in the area and production figures of different crops.
  - ii) To find out the factors responsible for the variation in the area and production of different crops.
  - iii) To compute the total receipts of the country out of land revenue, water charges, local fund and mosque fund collected through revenue department in the country and to compare current year's receipt under each of the above heads with that of previous year's receipts.

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- (v) To ascertain whether the current year's output of various commodities shall be sufficient to meet the internal and external requirements of the country i.e for local consumption and for exports as estimated.
- v) To know if the current and future plans of the country need any revision as per information revealed from survey results.

These are some of the main objectives with which various agencies in the public and private sector, conduct crop yield estimation surveys and collect the data. The data so collected are compiled, tabulated and analysed to draw inferences out of it.

### METHODOLOGY

Usually crop yield estimation surveys are conducted on a large scale in the public sector by some of the government and semi-government departments, research institutions and some public limited companies in the country. However, in certain cases some private companies also conduct such surveys to plan for the production and marketing of their commodities. Usually Revenue Department, Agriculture Department, Central Statistical Organisation and various Research Institutions and Corporations in the public sector carry on these surveys to collect the data needed by them. As far as the methodology of crop yield estimation surveys is concerned, it may slightly differ from institution to institution. Most of the institutions make use of sample survey method because it is not only economical but also gives the representative reliable results.

In spite of these sample survey methods some of the agencies like Revenue Department adopt census method of survey to ascertain the area under each crop in the country. Since it is not possible to discuss the methodology of crop yield estimation surveys adopted by various agencies in this paper, I have only discussed the methodology followed by two big agencies in the public sector i.e Revenue Department which follows census method, and Agriculture Department which makes use of sample survey method to conduct crop yield estimation surveys.

The Revenue Department is mainly concerned with collection and computation of Land Revenue, Water Charges, Usher and several other government taxes collected from landlords or tenants of land. For the above purpose, the department needs the information pertaining to the cultivation of each and every acre of cultivated area in their jurisdiction.

In order to facilitate the administrative set up and collection work, the entire area i.e universe, is divided into a number of divisions and districts and each district into sub-divisions, talukas, tappas and dehs. The entire deh is surveyed and assigned survey numbers. As such there is a complete record concerning a) total cultivated area b) total cultivable area c) total area under current fallow land of each and every deh, tappa,

taluka, district and province of the country. That information is known as land utilization statistics of the area.

So far as the survey of area and production is concerned, the work is assigned to the Incharge of each Tappa who is known as Tapadar. Tapadar conducts a detailed survey of his Tappa by census method. He personally visits each and every acre of a Deh in his Tappa and collects information about the area under cultivation and crops cultivated on it. The method of survey followed by Tapadar can be called collection of personal investigation as he personally goes to the fields and makes investigation about the crops standing there. The information so collected by him, on consolidation, helps him not only to know the area under each crop in his Tappa but also enables him to calculate and collect the Land Revenue, Water Charges, Usher and other taxes from landlords/tenants as per law of the land. The complete information so collected is recorded in the book known as "Field Book". In addition to that he also pays frequent visits to different areas in his jurisdiction to ascertain the position of standing crops and estimates the yield per acre of different crops in different areas of his Tappa.

The information so collected and compiled on Deh and Tappa level by concerned Tapadars is sent to Taluka Office where figures of cropwise cultivated area of the Taluka and yield per acre in that Taluka are compiled. Taluka-wise statistics of the standing crops and their yield are to be sent to District Head Quarters for consolidation on district level.

The method of ascertaining yield per acre of various crops is primitive and unscientific, as the yield is estimated as per report of the investigator (i.e Tapadar) who inspects the position of the standing crops of his area by frequent visits to each and every acre of the area and makes estimation by personal inspection.

Revenue Department on consolidating the reports as received from concerned Tapadars, issues estimates about area and cultivation of main crops thrice during the course of cropping season. These estimates are known as first crop estimate, second crop estimate and final estimate. First estimates of area and yield of the major crops are consolidated and issued by Revenue Department as soon as cultivation is over; second estimate is issued after six to eight weeks after cultivation and final estimate at the time crop is about to be harvested. The information regarding area and production of the standing crops collected by Revenue Department by census method of survey is mostly used as a base for planning purpose by various government agencies.

In addition to that, Agriculture Department and Agricultural Institutes also conduct crop-yield estimation surveys from time to time.

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The main objective of their survey is to ascertain the utility of various varieties of fertilizers, seeds and insecticides in increasing the yield per acre and popularity of each variety in the private sector. They, therefore, do not stand in need of making use of census method of survey, but adopt sample method of survey of collecting the data needed for the above purpose. Here it is essential to point out that, Agricultural Department of the Province of Sindh does not conduct crop yield estimation survey of each and every crop cultivated but restricts itself to the survey of major food and cash crops, like cotton, wheat, rice and sugarcane due to limited resources available to it. For this purpose it takes a sample from universe and studies the same instead of the study of each and every member of the universe. Application of sampling method in crop surveys is as under:

Firstly they make use of revenue record and select at random the required number of villages of different areas out of total number of the list of selected villages where crop yield estimation survey is to be conducted, the list of villages is afterwards supplied to the concerned crop reporters together with random number tables and columns of the tables allotted to each of them through District Agricultural Officers. The above work of selection of sample villages for different areas and allotment of the columns of random number tables for survey purpose is done on Regional and Provincial level. Crop reporters are required to conduct a detailed survey of the sample villages and maintain its record according to survey numbers. If a cultivator has cultivated more than one crop on the field, the area under each crop is to be recorded separately in acres alongwith the type and mode of irrigation. The work of crop reporter is almost similar to that of village Tapadar. However, he is required to work independently and conduct overall crop-wise surveys of the sample village known as Khasra Girdwari and Ginswara respectively. On completing the crop-wise survey of the sample villages, the information pertaining to the area under cultivation of crop becomes available. Thereafter the crop fields are numbered to have a representative village for survey purpose of particular crop and actual survey work is started by making use of random number tables as under:

Suppose total number of fields in a sample village is 359 and column of a random number table allotted is 18. Investigator refers to that column and finds a first available random number given in a table. Suppose the number is 173. The number will be divided by total number of fields i.e. 173 to be divided by 359. The result i.e. remainder will be 173. Therefore, field with serial number 173 is randomly selected field for yield estimation survey purpose. Similarly for selecting the second field we shall have to proceed further in the same column of a table. Suppose the next random number is 894 which when divided by 359 gives 176 as remainder. Therefore,

the field with serial number 176 is the second selected field of a sample village. In this way the third field for survey purpose will also be selected by making use of the same method. Here I would like to mention that the number of fields usually selected from each sample village is three. After location of a field demarcation is essential to proceed with the survey work.

Demarcation consists:

- a) Location of corners of a field
- b) Basic corner of experimental plot

It is essential that the field selected as per above procedure is rectangular but for our purpose we have to enclose the field in rectangular form and South West corner of the field will be used as corner number one and other three corners shall be as per round the clock. In case the field is irregular in shape, the area of adjacent field will be taken to give it a rectangular form. After that the allotted column of another random number table will be referred to find a first available random number equal to or less than four, as total number of corners of a rectangular field is four. Suppose it is three; therefore, the corner number three of the field will be the corner for demarcation of experimental plot. In the above case North East Corner (i.e corner number three) of the field will be the corner for the demarcation of experimental plot. After location of a corner of demarcation plot, the length and breadth of rectangular field is to be measured and separate columns of random number tables allotted for length and breadth are to be used. Suppose the length of demarcation plot is 380 feet and breadth is 360 feet and for selecting random numbers for length and breadth, the allotted columns of table-II and III are to be referred to find such random numbers for length and breadth which when multiplied by 16 and 12 respectively do not exceed total length and breadth of the sample field. Suppose selected random number for length is eight and for breadth is six.

The random number for length is to be multiplied by sixteen and breadth by twelve to have the first corner of demonstration plot. In the above case it will be:

$$\begin{aligned} 8 \times 16 &= 128F \\ 6 \times 12 &= 72F \end{aligned}$$

Therefore, the corner of experimental plot will be at a distance of 128F in length and 72F in breadth, from the North East corner of the field and first pole is fixed at that point. From first pole proceed 16F towards length and fix second pole. The diagonal of experimental plot must be 20F in breadth and fix the third pole. The diagonal of experimental plot must be 20F (i.e length between first and third pole). Similarly diagonal between 2nd and 4th pole must also be 20F.

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The area covered under all the four poles is the actual area of the experimental plot where demonstration is to be carried out and the crop standing in that 1/2 ghunta plot is to be cut and its weight is to be ascertained in terms of standard units of measurement for further consolidation purpose. The same above referred procedure will be followed to locate the basic corners of second and third experimental plots of each sample village with fresh sets of groups and random numbers for length and breadth. Fixing of poles in the demonstration plots will be done by following the same above procedure. However, it must be pointed out that the columns and random numbers once used, will not be used again. We shall have to proceed to next numbers and next columns in case the allotted columns are exhausted.

After demarcation of second and third experimental plots, the crop standing in these plots will also be removed from there to know its weight for consolidation purpose. The plots so located with 16x12 as their measurement are 1/2 ghunta plots and the output of each is to be multiplied by 80 to know the yield per acre in each sample field. Thus the yield per acre of all the three plots of sample village is the basic information for further consolidation.

On collecting such information pertaining to all the sample villages of a Taluka, the same is to be analysed with the help of statistical devices and techniques to know the average yield per acre, the standard error of sample means of yield per acre and variances in the yield per acre in the sample villages. Variances study consists the study pertaining to the variance within the samples and variance between the samples. These studies help us not only to know the average per acre yield and its control limits but also gives us the most reliable result about the universe (i.e. yield per acre in Taluka etc) in case the above sampling techniques are properly applied and demonstration is properly conducted.

### CONCLUSION AND SUGGESTIONS

From the detailed analysis of census and sample survey methods and their application in conducting crop yield estimation surveys, it is concluded that census survey method requires the study of each and every member of the universe. As such it is laborious, time-taking and expensive. Moreover due to very lengthy data pertaining to each and every member of universe under study, the analysis becomes difficult and chances of errors and omissions exists there. As against this the sample survey method is not only economical in terms of cost and time but also gives reliable results, provided the sample is properly taken to represent the whole universe. The conclusions drawn out of the study of such sample become true for the whole universe.

It is, therefore, suggested that we may make use of census survey method for our research purpose only under the situation when the study of each and every member of the universe is unavoidable. In all other cases we may make use of sample survey method. Unbiased sample of reasonable size may be had from the universe. The data pertaining to that sample may be collected, compiled, tabulated and analysed. The standard error of the sample be computed by making use of statistical devices and inference about the universe be drawn out of sample results.

The Inferences so drawn are reliable and useful for planning and decision making purposes.

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