Food and Agriculture Organization of the United Nations

Guidelines on planning rice production survey

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Contents

Acronyms

AfricaRice	Africa rice center
ASEAN	Association of southeast asian nations
CARD	Coalition for african rice development
CSPro	Census and survey processing system (USA)
CV	Coefficient variation
EA	Enumeration area
FAO	Food and agriculture organization of the United Nations
SD	Standard deviation
SSC	South-South cooperation
TrC	Triangular cooperation

1 Introduction

The project GCP/INT/161/JPN, "Strengthening agricultural statistics and food security information in coalition for african rice development (CARD) countries through South-South Cooperation (SSC)", was launched in November 2013 in order to improve the capacity of CARD members for timely collection and provision of reliable statistics on rice planted areas and/or yields. The Project is designed to draw statistical methods and experiences from the Association of Southeast Asian Nations (ASEAN) while taking advantage of Food and Agriculture Organization (FAO's) South-South (SSC) and Triangular Cooperation (TrC) Programme.

Since the commencement of the Project, appropriate survey methods were selected to be utilized for activities in nine target countries, namely the Republic of Benin, the Republic of Côte d'Ivoire, the Federal Democratic Republic of Ethiopia, the Republic of Ghana, the Republic of Kenya, the Republic of Madagascar, the Federal Republic of Nigeria, the Republic of Senegal and the Republic of Uganda, referencing to experiences in the ASEAN region. Subsequently, the Project also conducted training workshops and pilot surveys in the target countries, in order to enhance their capacities on rice production survey, inviting experts from both ASEAN and AfricaRice Center (AfricaRice). As the six years activities of the Project brought about many experiences and lessons learned, the need emerged for the compilation of Guidelines, to contribute to the further improvement of rice production survey in CARD Member Countries.

Official surveys are basically designed with the purposes and needs of the users in mind. In addition, when designing a survey, it is also crucial to consider its efficiency and ensure its feasibility, because the agricultural sector has a limited allocation of resources for official surveys. Moreover, the value of crop production surveys is enhanced further if they are conducted frequently and their results published periodically. Such chronological data allows users to analyse it in various ways. Hence, the effectiveness and feasibility of the rice production survey are guaranteed.

Providing official statistics is a part of the national governing system, so they may not be developed or improved easily. However, considering their [official statistics'] crucial role towards executing effective policies, it is expected the Guidelines will, as stated, contribute to improve rice production survey in CARD Member Countries.

2 Objective of the guidelines

The objective of the Guidelines is to contribute to improving rice production survey in CARD Member Countries. The Guidelines, written on the basis of lessons learnt from training workshops and pilot surveys in African countries, consist of technical components such as sampling methods, survey methods, as well as other basic knowledge to be considered when surveys are designed and implemented.

3 Planning of statistical surveys

3.1 Objective of the survey

The objective of the survey is to know rice area and production

The main objective of the rice production survey is to have a grasp of rice planted (harvested) area and production (yield). When a survey is planned, its details, such as schedule, methods and resources, must be considered cautiously to achieve its objectives. Only a limited number of human and financial resources are usually available for the survey, so it is important to consider developing as efficient a method as possible.

3.2 Survey subject

The subjects of the survey are farmers and cultivated lands

The Subjects of the rice production survey are farmers and cultivated lands. The subjects are also closely related to the population and the methods of the survey. Regarding population, a list frame is generally applied to a survey whose subject involves farmers, while an area frame is applied to one whose subject is embodied by cultivated lands. On the other hand, in the case of field survey methods, an Interview Survey Method is applied to one whose subject entails farmers, whereas an Objective Survey Method is compatible with one whose subjects are cultivated lands.

3.3 Classification of survey subject

Survey subjects are classified by administrative districts

After selecting survey subjects, the next consideration is how to classify them, in order to develop a sampling method. Based on the classification, the result of a survey is also analysed and published. The subject of the rice production survey is commonly classified by administrative districts, such as regions, states and cities. In addition, subjects can also be classified in terms of other items, such as the varieties of rice, cultivation methods and harvesting methods.

Although classification should be based on the utilization of results, available resources must also be taken into account. In fact, to secure the accuracy of results in each

category, more samples need to be selected within more categories. In order to make the survey feasible, it is recommended to classify its subject(s) using administrative districts, such as states or regions, which are not broken down too distinctly, particularly when a full-scale national rice production survey is newly developed. In this instance, the primary objective of the rice production survey is to know rice area and production in a whole nation.

3.4 Survey items

Rice planted (harvested) area and production (yield) are necessary

Survey items are basically decided based upon the use of results. Rice planted (harvested) area and production (yield) are essential items of the rice production survey. In addition, other items, such as the varieties of rice, the harvesting and planting methods, and the usage of machines and chemicals, can be included. Although the necessary items, area and production, can be surveyed by both the Interview and the Objective Survey Methods, only the Interview Survey Method is applicable for collecting data related to other items.

Furthermore, the way to calculate production and yield is different depending on field survey methods. For the Interview Survey Method, production and area are usually surveyed; then, yield is calculated by dividing production by area. On the other hand, in the case of the Objective Survey Method, area and yield (yield is estimated on the basis of the weight of sample grains) are measured; then, production is calculated by multiplying area by yield.

Survey items tend to increase at the planning stage of a survey because more survey items lead to more results. However, it is important to select only the survey items highly required by users, considering the negative aspects caused by an increase in their number. (Please see Chart 1 and Annex.)

Examples of negative aspects:

- **the result of a survey can be less reliable because of an increase in the burden of enumerators and farmers that answer questionnaires;**
- **it takes more days for the whole survey process;**
- **the cost of a survey increases.**

1. Identification of sample household

Name of Household_____				
District_____				County_____
District		Country		Enum. Ar

2. Farming situation

Total farming plots (plots) (1)	Total farming areas (ha) (2)

3. Rice farming situation

Crop season	Farming date	
1st Season = 1 2nd Season = 2 (6)	Planted (7)	Harveste (8)

(Chart 1) One of the questionnaires used for the project

FORM D

Questionnaire

Interview to sample household

_____	Tel Number_____								
_____	Village_____								
rea	Village				Household			Coordinaters	
								E	N

	Rice farming in this crop Season		
	Total harvested plots (plots) (3)	Total harvested areas (ha) (4)	Production (expected) (tons) (5)

	Planting method	Ecosystem	Variety	Growing conditions
d	Transplanting = 1 Broadcastong = 2 (9)	Irrigated = 1 Rainfed = 2 Upland = 3 (10)	Hybrid = 1 Inbred - Certified = 2 Farmer's/Good seed = 3 Traditional/Native = 4 (11)	Very bad = 1 Bad = 2 Normal = 3 Good = 4 Very good = 5 (12)
		5		

3.5 Survey methods

A sample survey method should be applied; a dot sampling method is promising in terms of efficiency

There are roughly two survey methods: i) each subject (i.e. farmer and cultivated land) is individually surveyed; and ii) each subject is not individually surveyed. The former includes a complete survey and a sample survey. Conversely, the latter method involves a reporting system. Although there are advantages and disadvantages in each method, the sampling method is usually applied to rice production survey, because the results need to be released at least once a year, as soon as a harvesting season ends, in order to secure the reliability of the survey. Therefore, it is clear why the Project chose to apply the sample survey method.

In the event of a lack of resources for the application of more suitable methods, such as the Sample Survey Method, the reporting system can be applied to a survey method on rice production. (As stated earlier, survey methods must [also] be decided on the basis of available resources.)

3.5.1 Survey methods for each subject individually surveyed

3.5.1.1 Complete survey

This method involves a survey of all suitable subjects in a target population. The FAO recommends that a World Census of Agriculture be conducted every 10 years.

Advantages

- **the real value of a target population can be established;**
- **any detailed category is feasible, as all members of a population are surveyed;**

Disadvantages

- **it cannot be conducted frequently because of its high costs;**
- **the whole survey process is lengthy and time-consuming;**
- **in general, more non-sampling errors occur compared to the sample survey.**

3.5.1.2 Sample survey

In this method, samples are selected from a target population based on a sampling theory.

Advantages

- **cost is usually less than the complete survey, and the results of the survey are released more expeditiously than those of the complete survey;**
- **because samples are selected on the basis of a sampling theory, the reliability of results is objectively demonstrated;**
- **in general, less non-sampling errors occur compared to other survey methods.**

Disadvantages

- **because all survey subjects in a population are not surveyed, sampling errors always occur;**
- **it is usually more expensive than the reporting system.**

3.5.1.2.1 Details of sample methods (methods used for the project)

3.5.1.2.1.1 List frame sampling method

This method utilizes a list whereby individuals or companies, etc., are the "population" of a survey. In the case of rice production survey, the list of farmers/

Enumeration Area (EA) (commonly compiled based on the result of a census of agriculture) is utilized. Although the list frame is typically used for statistical surveys, including the census of agriculture, it is extremely expensive and takes a long time to develop. The frame also undermines its integrity as time goes by, because new farmers start businesses and existing farmers retire, after compiling the frame. Therefore, it needs to be maintained periodically.

Advantages

- **officers and enumerators are relatively familiar with the method, hence a training and a survey tend to be conducted without major difficulties;**
- **enumerators find sample farmers relatively easily using their (the farmers') address and EA maps;**
- **because the subject of the rice production survey is not the cultivated land, but the farmer under the List Frame Sampling, the frame is compatible with the Interview Survey Method.**

Disadvantages

- **without a complete frame, the result of the survey is not estimated properly;**
- **it is very expensive and the frame takes a long time to develop, as it requires carrying out a census of agriculture;**
- **the frame needs to be maintained periodically, because its integrity is undermined as time goes by;**
- **there is a possibility that the list frame method may not be applicable to rare crops, because it is sometimes difficult to develop the list of farmers for such crops.**

3.5.1.2.1.2 Area frame sampling method (dot sampling method)

This method uses images, such as aerial photographs or satellite images, to establish the population for the survey. The area frame is usually divided into sampling units, from which some units are subsequently selected to be surveyed.

The Project applied the Dot Sampling Method, which can be considered a type of Area Frame Sampling Method for conducting pilot surveys. The Dot Sampling Method uses dots as sampling units, instead of using a certain delimited area. Furthermore, the Project applied Google Earth, which provides satellite images free of charge, as a frame for the Dot Sampling Survey.

As this method is relatively new and officers and enumerators involved in a survey may not be familiar with it, its details need to be explained carefully during training workshops; it takes time for officers and enumerators to get accustomed to the method. On the other hand, there are some advantages. For example, i) the frame requires almost no cost and effort to develop; and ii) in the process of the survey (including the field survey), the estimation of results is simpler than in the list frame. Therefore, because of its high efficiency, this method can be ideal in countries that develop a rice production survey from scratch.

Advantages

- **because Google Earth is used, there are no additional costs to develop the frame and the frame does not need to be maintained. For this reason, the total cost of the method is lower than that of the List Frame Sampling Method;**
- **sample dots are selected automatically by an Excel Macro programme and the estimation process is also easier than the List Frame Sampling Method;**

- **the method is applicable to surveys on rare crops and mixed cropping;**
- **enumerators do not need to measure the area of cultivated lands in the field; instead, they just confirm if rice is cultivated on sample dots. Therefore, enumerators hardly incur an error during field surveys;**
- **the efficiency of the method can be improved further. For instance, enumerators will not need to visit fields to survey rice planted areas if more precise and frequent satellite images are available at a low cost in the near future;**
- **since the subjects of the rice production survey are not farmers but cultivated lands under the area frame, the method is compatible with the objective survey;**
- **the second and subsequent surveys are conducted more efficiently than the first one because the same sample dots of the first survey are applicable to the following ones. Hence, i) a preparatory survey and the preparation of maps are not necessary; and ii) it takes less time for enumerators to reach sample dots.**

Disadvantages

- **before the field survey, a preparatory survey is conducted. During the preparatory survey, officers select, through Google Earth, dots classified as cultivated areas from all sample dots. Albeit simple, this is no small task and officers are usually not familiar with this type of work. Therefore, the process takes more days than expected and might seem burdensome, especially when officers work on it for the first time;**
- **in case a sample dot on a cultivated land is not identified properly, some issues may arise. When a sample dot actually located on a non-cultivated field is classified as a cultivated area by the preparatory survey, enumerators may take more time than usual to visit the sample dot for the field survey, because roads are not often constructed in such area. On the other hand, if a sample dot actually located on a cultivated area is classified as a non-cultivated area by the preparatory survey, the total rice planted area is underestimated;**
- **internet access with sufficient data communication speed for using Google Earth is necessary for sampling and the preparatory survey;**
- **the safety of enumerators must be ensured, for they may visit dots located in the wilderness.**

3.5.2 Survey methods for each subject not individually surveyed

3.5.2.1 Reporting system

Under the reporting system, additional information is collected when Governmental officers execute their original tasks. As for surveys related to agriculture, extension officers generally fill in questionnaires on the basis of information collected during their daily work. This method is broadly used in developing countries because of its cost efficiency. However, it should be noted that the result of the method is less reliable than that of the census and the sample survey because the result of the reporting system is easily affected by the subjectivity and the intentions of officers involved in the survey. For instance, a rice production estimate based on the result of the reporting system is prone to be larger than a production target developed by Government, regardless of actual crop conditions. Since survey subjects are not directly surveyed, more errors also occur in general.

Advantages

- **the method is cost efficient compared to other methods.**

Disadvantages

- **the results are less reliable because the survey subjects are not surveyed directly and the results are easily affected by the officers related to the survey;**
- **since the method is not designed on the basis of a sampling theory, accuracy is not shown objectively.**

3.5.3 Survey with tablet

Tablets have become widespread in the field of agricultural surveys as well. Tablet streamline surveys by i) reducing costs related to purchasing paper, printing materials and postage; ii) eliminating work on inputting results into PCs; iii) shortening the term of field surveys; and iv) simplifying work on managing enumerators. On the other hand, additional costs and tasks, such as initial investment, maintenance feed and the update of applications, arise with the continuous use of tablets. Therefore, the sustainability of the method must be carefully considered before its adoption.

The Project introduced tablets into activities in few target countries. The Project selected models with minimum required specifications[1]. Free applications to develop questionnaires, namely Survey Solutions (developed by the World Bank) and CSPro (developed by the U.S. Census Bureau and ICF International Development), were used for the Project. One of the differences of the applications is that Survey Solutions is equipped with functions to send the results of surveys and manage the progress of field surveys online. It also provides a server available for saving reported results during a fixed period at no cost[2].

Although Survey Solutions can contribute to streamlining surveys considerably because of the above-mentioned functions, the latter might still not be fully utilized in CARD Member Countries, mainly because internet access is not always stable, especially in rural areas. When the Project conducted the pilot surveys with tablets, all of them were collected at the headquarters of the Ministries and data was sent using their stable internet access.

Through the activity of the project, the following issues emerged:

- **resistant tablet cases are necessary to protect tablets from damage (although enumerators often visit sample dots by motor bike, roads are not always paved. Therefore, tablets sometimes fall during transportation and their screens easily break without protection);**
- **power banks should be provided (tablet batteries might not always be recharged, due to frequent power outages in rural areas);**
- **if the GPS function of a tablet is to be used, a tablet with higher performance GPS functions needs to be provided instead of a basic model (if GPS functions are not precise enough to fix the exact position, enumerators cannot find the places of sample dots accurately and cannot properly measure the area of cultivated lands);**
- **some online functions cannot be used because of unstable internet access.**

3.6 Field Survey method

The objective survey method provides more accurate results

Field survey methods are roughly divided into two types. The first method is to ask questions to people, and the other is to

[1] With a unit cost of approximately USD 200 (in order to reduce costs).

[2] For further details: https://mysurvey.solutions/

actually measure survey subjects. The former method includes the Interview Survey Method, a mail survey method, a declaration survey method, etc. The Project applied the Interview Survey Method and the Objective Survey Method.

When rice planted (harvested) area and production are surveyed, the Objective Survey Method provides more reliable results than the Interview Survey Method. The reason is twofold: i) in many cases, farmers do not know their data on area and production accurately; and ii) rice area and production are actually measured by enumerators under the Objective Survey Method.

Although the Interview Survey Method has this disadvantage, it can survey more items, such as planting date, the workforce amount and the number of machines, all of which cannot be surveyed by the Objective Survey Method. As there are different advantages with each method, both methods can be applied to a survey simultaneously, considering the objective of the survey and available resources.

3.6.1 Interview survey method

Enumerators meet people identified as survey samples and ask questions -through questionnaires-, for the collection of data. The enumerators of the rice production survey should ask questions to the head of the sample farm because such person is usually the most familiar with the farm business and crop condition as a whole. Although its results are usually less reliable compared to those of the objective survey, it is still possible to collect various data related to sample farms.

Advantages

- **it is more cost efficient than the Objective Survey Method;**
- **not only details on production and planted rice area, but also other information can be surveyed.**

Disadvantages

- **the results of the method tend to contain more non-sampling errors than those of the objective survey (please refer to Section 3.7.2.2);**
- **it is more time-consuming than the Objective Survey Method, because enumerators need to ask questions on a one-by-one basis to farmers and must also visit farmers several times if they are not available the first time.**

3.6.2 Objective survey method

Enumerators actually measure survey subjects to obtain data. In the case of rice production survey, the planted area of sample plots and the weight of sample grains are measured. Therefore, this method provides more accurate results compared to the Interview Survey Method. On the other hand, its costs are usually higher than the Interview Survey Method because tools and equipment need to be prepared for measurement.

The project used the following two objective survey methods in order to conduct area surveys:

- **under the List Frame, they measured the area of sample plots using GPS receivers;**
- **under the Dot Sampling, they confirmed the land utilization of sample dots.**

The project also used the following method for a yield survey, under both the list frame and the dot sampling methods:

- **enumerators harvest rice in two sample spots (both of which measure one square meter) in each sample plot; then, harvested sample grains are measured.**

Advantages

- **the results are more accurate than those of the Interview Method because of less non-sampling errors;**
- **compared to the Interview and Objective Surveys using GPS receivers, the Dot Sampling Method is less time-consuming in terms of work on field surveys for the collection of accurate data on rice planted areas.**

Disadvantages

- **costs are usually higher than those of the Interview Survey because tools and equipment need to be prepared (since no cost is incurred to develop and maintain the frame of dot sampling, this disadvantage does not apply to the Dot Sampling Method);**
- **farmers might only accept the Interview Survey and refuse Objective Surveys conducted on their fields;**
- **more enumerators need to work together in order to measure the area of sample plots by tape measure, in case GPS receivers are not ready (since the areas of sample plots do not need to be measured under dot sampling, this disadvantage does not apply to the Dot Sampling Method);**
- **an Uncultivated Area Survey and a Harvest Loss Survey are needed to estimate more accurate results on yield under the List Sampling Method. The Harvest Loss Survey is needed under the Dot Sampling Method.**

3.7 Error

Fewer errors lead to more reliable results

Although some errors usually occur when surveys are conducted, they need to be minimized as much as possible to obtain more reliable survey results.

3.7.1 Sampling error

This type of error always occurs when sample survey methods are used because only "selected samples", as opposed to the "whole population, are surveyed. On the other hand, the size of the sampling error is controllable through sample size. The figures of the sampling errors are also indicated objectively to users.

3.7.2 Non sampling error

Although this type of error could be avoidable if a survey is designed and conducted cautiously, the size of non-sampling errors is not indicated objectively to users. Non-sampling errors include the following:

3.7.2.1 Error caused by uneven population

If the population of a survey is uneven, the results of the survey will not be estimated correctly, even when its field survey is conducted properly by enumerators. For example, in a rice production survey, if all the rice cultivating farmers are not included in the list denominated as "population", there is a risk of underestimating the total rice planted area within this population.

3.7.2.2 Error caused during field survey

The results of a field survey are not always correct. When conducting a rice production survey, the following errors may occur:

The interview survey method

- **sample farmers do not accurately know their production or area;**
- **sample farmers do not want to answer correctly/honestly;**
- **enumerators also make mistakes when they convert units (i.e. farmers sometimes use a local unit, such as number of sacks per rice production, instead of a unit used in a questionnaire, such as tonnes; enumerators thus need to calculate values carefully before filling in the questionnaires).**

The objective survey method

- **enumerators make mistakes when they measure the weight of sample rice grains or rice planted areas in sample plots.**

3.7.2.3 Error caused during estimation process

Personal computers are usually used to estimate results, hence this type of errors do not occur frequently. However, there are still some cases where a programme with defects causes such errors. To avoid this problem, programmes must be always checked before usage, especially when they are used repeatedly.

3.8 Sample size

A sample size needs to be decided based on the utilization of results and available resources

A sample size is decided at the beginning of a sample survey. The higher the precision required for the survey, the more samples need to be selected. In addition, the survey also becomes more expensive with an increase in sample size. Although the sample size is basically decided based on required accuracy, it also needs to be considered based on secured human and financial resources, so as to ensure the feasibility of the survey.

A bigger sample size leads to a smaller Coefficient Variation (CV) of results, albeit, in general, more non-sampling errors. Therefore, too many samples are not recommended and the appropriate sample size must be carefully considered, also in terms of the reliability of the results.

When survey subjects are classified into categories, officers need to decide which category of "aimed precision" to set. As Tables 4 and 5 show, the total sample size is much smaller when aimed precision is set at national level, than when it is set at state/region level. In Table 4, the total sample size is 300 farmers, and aimed precision is set at national level; in Table 5, total sample size is 3 600 farmers, and aimed precision is set at state level.

3.8.1 Calculation of sample size

The sample size is calculated by a simplified formula and is determined by aimed precision and the CV of population. On the other hand, the CV is calculated in different formulas, depending on the different methods used. The CV of the area survey is calculated using the below formulas: "a" for the List Frame Sampling

$$\text{Number of Samples} = \frac{CV\_population^2}{aimed\ precision^2}$$

$$CV\_population = \frac{SD}{\bar{X}}$$

$$CV\_population = \frac{\sqrt{pq}}{p}$$

Method; and "b" for the Dot Sampling Method. As for the Production (yield) Survey, the formula "a" is used for both sampling methods. The sample sizes corresponding to each aimed precision are shown in Tables 1 and 2.

Aimed precision:

This is decided based on the utilization of primary results. When it is set between 3 and 10%, it is expected that the results of a survey are reliable.

CV_population:

Coefficient variation, as this value is not available, it is substituted with the CV of a past survey or a pre-test.

SD:

Standard deviation; it is substituted with the SD of the past survey or the pre-test.

$\overline{X}$*:*

Average; it is substituted by the result of the past survey or the pre-test.

p:

The ratio of the rice planted area of a survey population; it is substituted by the result of the past survey or the pre-test.

q:

The ratio of the area other than the rice planted area of the surveyed population (100-p).

(Table 1) Quick chart on sample size (area: list, production: list/dot)

C	Aimed precision (%)				
	1	3	5	7	10
0.10	100	11	4	2	1
0.15	225	25	9	5	2
0.20	400	44	16	8	4
0.25	625	69	25	13	6
0.30	900	100	36	18	9
0.35	1 225	136	49	25	12
0.40	1 600	178	64	33	16
0.45	2 025	225	81	41	20
0.50	2 500	278	100	51	25
0.55	3 025	336	121	62	30
0.60	3 600	400	144	73	36
0.65	4 225	469	169	86	42
0.70	4 900	544	196	100	49
0.75	5 625	625	225	115	56
0.80	6 400	711	256	131	64
0.85	7 225	803	289	147	72
0.90	8 100	900	324	165	81
0.95	9 025	1 003	361	184	90
1.00	10 000	1 111	400	204	100
1.05	11 025	1 225	441	225	110
1.10	12 100	1 344	484	247	121
1.15	13 225	1 469	529	270	132
1.20	14 400	1 600	576	294	144
1.25	15 625	1 736	625	319	156
1.30	16 900	1 878	676	345	169

(Table 2) Quick chart on sample size (area: dot)

p	q	Aimed precision (&)				
		1	3	5	7	10
1	99	990 000	110 000	39 600	20 204	9 900
2	98	490 000	54 444	19 600	10 000	4 900
3	97	323 333	35 926	12 933	6 599	3 233
4	96	240 000	26 667	9 600	4 898	2 400
5	95	190 000	21 111	7 600	3 878	1 900
10	90	90 000	10 000	3 600	1 837	900
15	85	56 667	6 296	2 267	1 156	567
20	80	40 000	4 444	1 600	816	400
30	70	23 333	2 593	933	476	233
40	60	15 000	1 667	600	306	150
50	50	10 000	1 111	400	204	100
60	40	6 667	741	267	136	67
70	30	4 286	476	171	87	43
80	20	2 500	278	100	51	25
90	10	1 111	123	44	23	11
100	0	0	0	0	0	0

3.9 Survey plan

A survey does not succeed without a proper plan

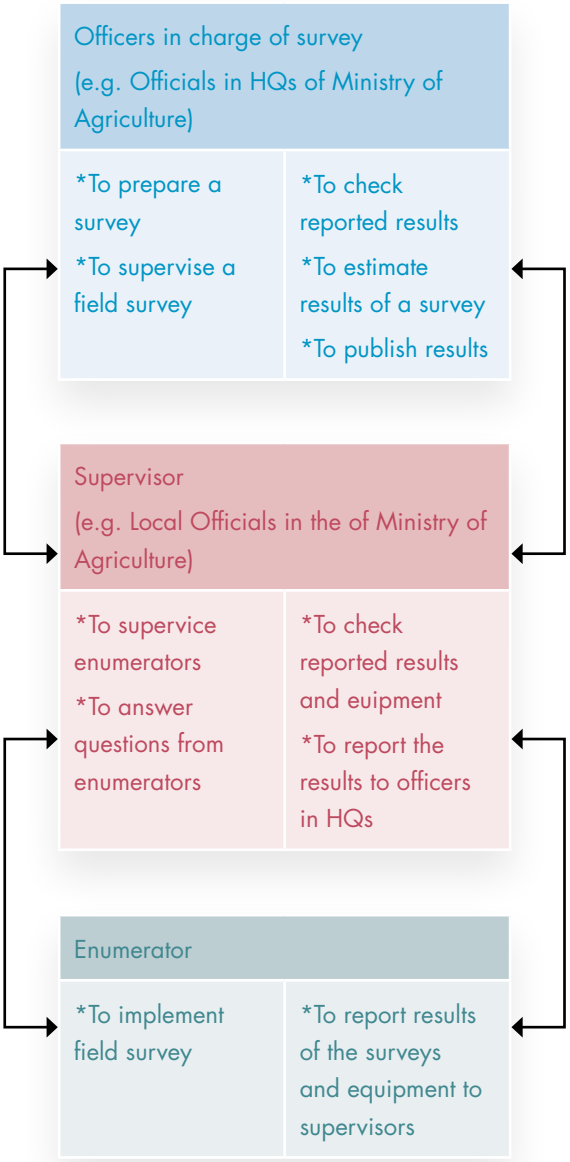
Before the start of field surveys, a proper plan needs to be developed and all preparatory activities need to be concluded, in order to conduct the survey properly and estimate reliable results. The following sections further elaborate this point and provide a model survey plan.

3.9.1 Preparation

Before conducting the field survey, preparatory activities such as: i) the organization of survey structure (please see Chart 2 for the standard structure used for the Project); ii) the development of survey design (the survey method, the sample size, etc.); iii) the procurement of tools; iv) the development and the printing of questionnaires; v) training

workshops for enumerators; vi) distributing questionnaires and tools to enumerators; and vii) the development of programmes to estimate results must be executed perfectly. Therefore, enough time needs to be allocated for preparation.

Chart 2/ Structure of Survey.



3.9.2 Field survey

Field surveys for rice production survey are usually conducted during harvest season. Therefore, if rice is cultivated twice a year, rice production (yield) should be surveyed in each harvest season to estimate accurate results.

The ideal period of the survey on rice production (yield) varies depending on the types of field survey methods adopted. The Interview Survey should be conducted just after the harvest of sample farmers, in order to collect data on rice production actually harvested. If enumerators interview farmers before their harvest, farmers will only inform enumerators of their forecast on production. On the other hand, the Objective Survey should be conducted just before the harvest of sample farmers, in order to measure rice grains corresponding almost entirely to those actually harvested by farmers, so that results are more accurate. If the survey is not conducted in a proper period, accurate data may not collected. In particular, the Objective Yield Survey must be conducted before the harvest of sample farmers; otherwise, it should not be undertaken. Therefore, proper survey plans need to be developed carefully, considering the circumstances related to the survey.

3.9.3 Report of results

The results of surveys are usually reported using the structure shown in Chart 2. Once enumerators finish their duties in the fields, they take all completed questionnaires and rented tools to supervisors. Then, Supervisors confirm whether all questionnaires and tools have been returned by enumerators. In case something is missing, enumerators are requested to return the item(s). Supervisors also verify results of each questionnaire and ask enumerators to reconfirm and correct them if necessary. Officers in headquarters verify reported results and estimate results of the survey. Finally, they publish results of the survey, making them available to users.

3.9.4 Estimation and publication of results

The results of surveys must be estimated before being utilized. Since the result of the

rice production survey is used to develop rice related policies and the production plan of farmers for the next crop season, the result needs to be estimated as soon as the field survey finishes and with enough time before the next crop season. Therefore, in consultation with the users, an estimation format and a publication form should be decided before conducting the field survey.

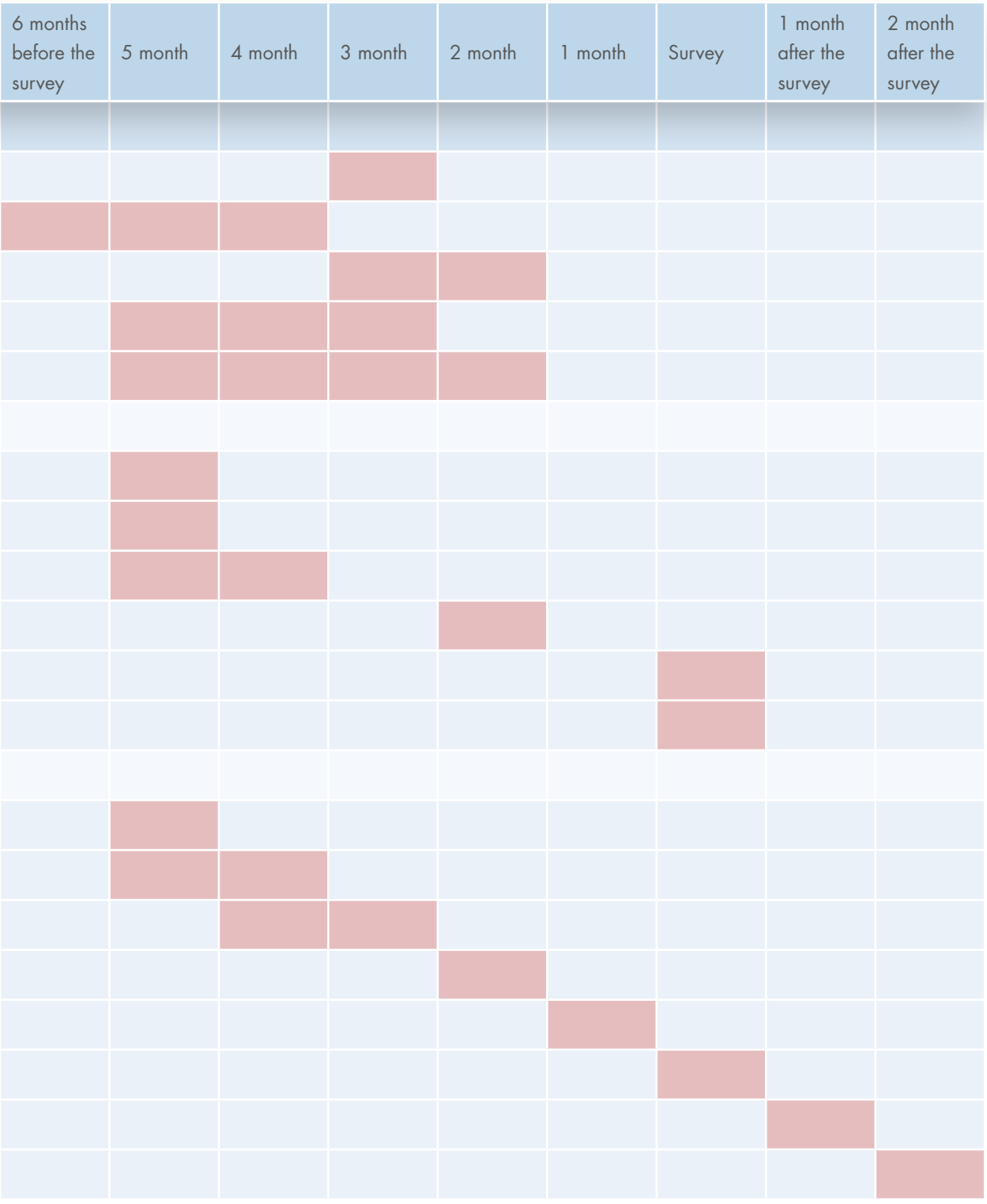
It is important that accuracy of results is ensured in each category, so as not to mislead users by providing uncertain results. It is also important to provide information on sampling errors for users, when the sampling survey is conducted. Estimation formats used for the Project are included in the Technical Manuals attached to the Guidelines.

(Table 3) Model survey plan

Item
1. To Decide outline of the survey
1. Schedule of whole activities
2. Framework of the survey
3. Survey method
4. Sample size
5. Number of enumerators and supervisors
2. To Prepare training workshop
1. Agenda
2. Participants
3. Venue
4. Invitation letter to participants
5. Catering (lunch coffe break)
6. Transportation to the Field
7. To Write manuals and materials
8. To Print necessary documents
9. To prepare for equipment
10. To conduct training workshop

6 months before the survey	5 month	4 month	3 month	2 month	1 month	Survey	1 month after the survey	2 month after the survey

Item
3. Survey
1. Period of the field survey
2. Questioners
3. Tabulation system
4. To select enumerators
5. Samplig
a) List
List of EAs
Selecting sample EA maps
To prepare sample EA maps
To allocate sample EAs to enumerators
Listing rice farmers in each sample EAs
Selecting sample farmers
b) Dot
Selecting sample dot
Preparatory survey
Making guide maps for fields survey
Allocate sample dot of field survey to enumerators
6. To distribute materials and tools to enumerators
7. To conduct survey
8. Estimation of results of the survey
9. Publication of the results


6 months before the survey
5 month
4 month
3 month
2 month
1 month
Survey
1 month after the survey
2 month after the survey

3.10 Survey costs

Costs vary depending on survey details

Proper budget allocation is difficult to establish because it varies significantly, depending on sample design, necessary tools, the number of enumerators, prices, etc.

In the following section, four Draft Budget Plans are prepared based on the results of the pilot surveys of the Project, in order to provide a rough idea for a national rice production survey. These Draft Plans indicate the minimum costs for conducting the survey in a country composed of 10 regions, according to different survey designs. These draft plans, however, do not include costs to develop the population for the List Frame Sampling. A list of field survey tools is also provided (Table 8).

(Table 4) Draft plan 1 (List / aimed precision 5% (Nation))

** The plan does not include budget items to develop the population of the list frame sampling*

	Activity
1	Preliminary meeting with relevant authorities for cre
1.1	One day meeting to discuss work plan
1.2	One day meeting with regional officers to explain v
2	Preparation of documents, materials, equipment, et
2.1	Preparation of manuals, questionnaires/field survey and relevant documents
2.2	Copy of the documents
2.3	Purchase of survey tools
2.4	Stationaries
3	Allowances of supervisors and employment of enur
3.1	Supervisors (extension officers in sub-counties)
3.2	Enumerators

	Requirements	No. of Units	No of Days
eation/explanation of work plan			
	No cost		
work plan	MOFA Regional Officers (1 offical / 1 Region)	10 persons	2
	Transportation cost	10 persons	2
c. for training and field survey			
y notes	prepared by Consultants	1 set	10
	Printing for Manuals, Questionnaires and documents (Supervisors + Enumerators + Officials)	117 set	---
	Tape measures	50 pieces	---
	Crop Cutting squares frame	50 pieces	---
	Sickle	50 pieces	---
	Plastic bags for harvested rice	50 pieces	---
	Tablet	50 pieces	---
	Note book (Supervisors + Enumerators + Officials)	117 pieces	---
	Pencil (Supervisors + Enumerators + Officials)*2	234 pieces	---
	Eraser (Supervisors + Enumerators + Officials)	117 pieces	---
	Sharpener (Supervisors + Enumerators + Officials)	117 pieces	---
merators for training and field survey			
	Allowances (Supervisors)	17 persons	12
	Transportation cost (Supervisors)	17 persons	12
	Allowances (Enumerators)	50 persons	12
	Transportation cost (Enumerators)	50 persons	12

	Activity
4	Trainings for regional officers and supervisors
4.1	2 days training 1st day: Field survey method 2nd day: Field practice
5	Trainings for enumerators
5.1	2 days training - 1st day: Field survey method - 2nd day: Field practice
6	Laboratory work, data entry, tabulation and analys
6.1	Laboratory work for harvested rice crops
6.2	Data entry
6.3	Compensation of rice sample for farmers
6.4	Tabulation/Estimation
6.5	Analysis

	Requirements	No. of Units	No of Days
	Venue	10 room	2
	Lunch and coffee break (Supervisors + Officials)	67 persons	2
	HQ officers - DSA	30 persons	3
	Driver of HQ	10 persons	3
	HQ officers - Transportation cost (fuel)	10 set	3
	Regional officers - DSA	20 persons	3
	Transportation cost (Regional officers: fuel)	10 sets	3
	Venue	10 room	2
	Lunch and coffee break (Enumerators + Officials)	100 persons	2
	HQ officers - DSA	30 persons	3
	Driver of HQ	10 persons	3
	HQ officers - Transportation cost	10 persons	3
	Regional officers - DSA	20 persons	3
	Transportation cost (Regional officers)	10 persons	3
is			
		4 persons	5
	Allowances for consultants	4 persons	5
		100 persons	
	Allowances for consultants	2 persons	3
	Allowances for consultants	1 person	10

Basis of calculation

1. Target Region

10 Regions

2. Personnel

Necessary human resources

- **1 Supervisor for 3 Enumerators**
- **1 employed Enumerator (1 enumerator will survey 2 EAs)**

In total,

- **17 Supervisors**
- **50 Enumerators**

Supervisors

- **3 days for Training for Supervisor**
- **9 days for supervision for Enumerators**
- **In total, 12 days**

Enumerators

- **Working days per EA by enumerator: Total 4.5 days**
- **Confirmation of rice households: 2 days**
- **Interview to rice growing farmers: 1.5 days**
- **Area Measurement & Crop Cutting: 1 days**
- **In total, 12 working days (4.5 Working days x 2 EAs + 3 days for training)**

Sample design

Aimed CV / Nation	5
Sample farmer / EA	3
Total sample region	10
Total sample EA	100
Total sample farmer	300

(Table 5) Draft plan 2 (List / Aimed precision 5% (State))

** The plan does not include budget items to develop the population of the list frame sampling*

	Activity
1	Preliminary meeting with relevant authorities for cre
1.1	One day meeting to discuss work plan
1.2	One day meeting with Regional officers to explain
2	Preparation of documents, materials, equipment, et
2.1	Preparation of manuals, questionnaires/field survey and relevant documents
2.2	Copy of the documents
2.3	Purchase of survey tools
2.4	Stationaries
3	Allowances of Supervisors and Employment of Enu
3.1	Supervisors (Extension Officers in Sub-Counties)
3.2	Enumerators

	Requirements	No. of Units	No of Days
eation/explanation of work plan			
	No cost		
work plan	MOFA Regional Officers (1 offical / 1 Region)	10 persons	2
	Transportation cost	10 persons	2
c. for training and field survey			
y notes	prepared by Consultants	1 set	10
	Printing for Manuals, Questionnaires and documents (Supervisors + Enumerators + Officials)	583 set	---
	Tape measures	400 pieces	---
	Crop Cutting squares frame	400 pieces	---
	Sickle	400 pieces	---
	Plastic bags for harvested rice	400 pieces	---
	Tablet	400 pieces	---
	Note book (Supervisors + Enumerators + Officials)	583 pieces	---
	Pencil (Supervisors + Enumerators + Officials)*2	1 166 pieces	---
	Eraser (Supervisors + Enumerators + Officials)	583 pieces	---
	Sharpener (Supervisors + Enumerators + Officials)	583 pieces	---
merators for Training and Field survey			
	Allowances (Supervisors)	133 persons	18
	Transportation cost (Supervisors)	133 persons	18
	Allowances (Enumerators)	400 persons	18
	Transportation cost (Enumerators)	400 persons	18

	Activity
4	Trainings for Regional Officers and Supervisors
4.1	2 days Training 1st day: Field survey method 2nd day: Field practice
5	Trainings for Enumerators
5.1	2 days Training - 1st day: Field survey method - 2nd day: Field practice
6	Laboratory work, data entry, tabulation and analys
6.1	Laboratory work for harvested rice crops
6.2	Data entry
6.3	Compensation of rice sample for farmers
6.4	Tabulation/Estimation
6.5	Analysis

	Requirements	No. of Units	No of Days
	Venue	10 room	2
	Lunch and coffee break (Supervisors + Officials)	183 persons	2
	HQ officers - DSA	30 persons	3
	Driver of HQ	10 persons	3
	HQ officers - Transportation cost (fuel)	10 set	3
	Regional officers - DSA	20 persons	3
	Transportation cost (Regional officers: fuel)	10 sets	3
	Venue	10 room	2
	Lunch and coffee break (Enumerators + Officials)	450 persons	2
	HQ officers - DSA	30 persons	3
	Driver of HQ	10 persons	3
	HQ officers - Transportation cost	10 persons	3
	Regional officers - DSA	20 persons	3
	Transportation cost (Regional officers)	10 persons	3
is			
		4 persons	5
	Allowances for Consultants	4 persons	5
		1 200 persons	
	Allowances for Consultants	2 persons	3
	Allowances for Consultants	1 person	10

Basis of calculation

1. Target region

10 Regions

2. Personnel

Necessary human resources

- **1 Supervisor for 3 Enumerators**
- **1 employed Enumerator (1 enumerator will survey 3 EAs)**

In total,

- **133 Supervisors**
- **400 Enumerators**

Supervisors

- **3 days for Training for Supervisor**
- **15 days for supervision for Enumerators**
- **In total, 18 days**

Enumerators

- **Working days per EA by enumerator: Total 5 days**
- **Confirmation of rice households: 2 days**
- **Interview to rice growing farmers: 1.5 days**
- **Area Measurement & Crop Cutting: 1.5 days**
- **In total, 18 working days (5 Working days x 3 EAs + 3 days for training)**

Sample design

Aimed CV / Region	5
(Aimed CV / Nation)	(2 - 3)
Sample farmer / EA	3
Total Sample Region	10
Total Sample EA	1 200
Total Sample Farmer	3 600

Table 6/Draft plan 3 (Dot/aimed precision 5% [nation])

	Activity
1	Preliminary meeting with relevant authorities for cre
1.1	One day meeting to discuss work plan
1.2	One day meeting with Regional officers to explain
2	Preparatory Survey
2.1	To cheack land usage of sample dots by Google Ea
2.2	To cheack land usage of sample dots by Google Ea
2.3	Xerox paper (boxes)
2.4	Black cartrige
3	Preparation of documents, materials, equipment, et
3.1	Preparation of Manuals, Questionnaires/Field Surv and relevant documents
3.2	Copy of the documents
3.3	Purchase of survey tools
3.4	Stationaries

	Requirements	No. of Units	No of Days
eation/explanation of work plan			
	No cost		
work plan	DRAE Officers (1 offical / 1 Regiom)	10 persons	2
	Transportation cost	10 persons	2
arth	Allocation for consultants	10 persons	5
arth	Printing Maps for field survey	5 persons	2
	1 box (2500 sheets)	1 boxes	- - -
		1 piece	- - -
c. for training and field survey			
vey Notes	prepared by Consultants	1 set	10
	Printing for Manuals, Questionnaires and documents (Supervisors + Enumerators + Officials)	90 sets	- - -
	Tape measures	30 pieces	- - -
	Crop Cutting squares frame	30 pieces	- - -
	Sickle	30 pieces	- - -
	Plastic bags for harvested rice	30 pieces	- - -
	GPS	30 pieces	- - -
	Note book (Supervisors + Enumerators + Officials)	90 pieces	- - -
	Pencil (Supervisors + Enumerators + Officials)*2	180 pieces	- - -
	Eraser (Supervisors + Enumerators + Officials)	90 pieces	- - -
	Sharpener (Supervisors + Enumerators + Officials)	90 pieces	- - -

	Activity
4	Allowances of Supervisors and Employment of Enu
4.1	Supervisors (Extension Officers in Sub-Counties)
	Enumerators
5	Trainings for Enumerators
5.1	2 days Training - 1st day: Field survey method - 2nd day: Field practice
6	Trainings for Enumerators
6.1	2 days Training - 1st day: Field survey method - 2nd day: Field practice
7	Laboratory work, data entry, tabulation and analys
	Laboratory work for harvested rice crops
	Data entry
	Compensation of rice sample for farmers
	Tabulation/Estimation
	Analysis

	Requirements	No. of Units	No of Days
merators for Training and Field survey			
	Allowances (Supervisors)	10 persons	16
	Transportation cost (Supervisors)	10 persons	16
	Allowances (Enumerators)	30 persons	16
	Transportation cost (Enumerators)	30 persons	16
	Venue	10 room	2
	Lunch and coffee break (Enumerators + Officials)	60 persons	2
	HQ officers - DSA	30 persons	3
	Driver of HQ	10 persons	3
	HQ officers - Transportation cost	10 Sets	3
	Regional officers - DSA	20 persons	3
	Regional officers - Transportation cost (fuel)	10 persons	3
	Venue	10 room	2
	Lunch and coffee break (Enumerators + Officials)	80 persons	2
	HQ officers - DSA	30 persons	3
	Driver of HQ	10 persons	3
	HQ officers - Transportation cost	10 Sets	3
	Regional officers - DSA	20 persons	3
	Regional officers - Transportation cost (fuel)	10 persons	3
is			
		4 persons	5
	Allowances for Consultants	6 persons	10
		300 persons	
	Allowances for Consultants	2 persons	3
	Allowances for Consultants	1 persons	10

Basis of calculation

1. Target region

10 Regions

2. Personnel

Necessary human resources

- **1 Supervisor for 3 Enumerators**
- **1 employed Enumerator (1 enumerator will take care 40 dots)**

In total,

- **10 Supervisors**
- **30 Enumerators**

Supervisors

- **3 days for Training for Supervisor**
- **13 days for supervision for Enumerators**
- **In total, 16 days**

Enumerators

- **Working days per EA by enumerator: Total 16 days**
- **Confirmation of dot: 3 days**
- **Farm interview: 5 day**
- **Crop Cutting: 5 day**

Sample design

Aimed CV / Nation	5
Total Sample Region	10
Total Sample Dot	9 600
Total Sample Dot for Field Survey	390

	Activity
1	Preliminary meeting with relevant authorities for cre
1.1	One day meeting to discuss work plan
1.2	One day meeting with Regional officers to explain
2	Preparatory Survey
2.1	To cheack land usage of sample dots by Google Ea
2.2	To cheack land usage of sample dots by Google Ea
2.3	Xerox paper (boxes)
2.4	Black cartrige
3	Preparation of documents, materials, equipment, et
3.1	Preparation of Manuals, Questionnaires/Field Surv and relevant documents
3.2	Copy of the documents
3.3	Purchase of survey tools
3.4	Stationaries

Table 7/ Draft plan 4 (dot/aimed precision 5% [state])

	Requirements	No. of Units	No of Days
eation/explanation of work plan			
	No cost		
work plan	DRAE Officers (1 offical / 1 Regiom)	10 persons	2
	Transportation cost	10 persons	2
arth	Allocation for consultants	25 persons	20
arth	Printing Maps for field survey	20 persons	5
	1 box (2500 sheets)	1 boxes	- - -
		1 piece	- - -
c. for training and field survey			
ey Notes	prepared by Consultants	1 set	10
	Printing for Manuals, Questionnaires and documents (Supervisors + Enumerators + Officials)	250 sets	- - -
	Tape measures	150 pieces	- - -
	Crop Cutting squares frame	150 pieces	- - -
	Sickle	150 pieces	- - -
	Plastic bags for harvested rice	150 pieces	- - -
	GPS	150 pieces	- - -
	Note book (Supervisors + Enumerators + Officials)	250 pieces	- - -
	Pencil (Supervisors + Enumerators + Officials)*2	500 pieces	- - -
	Eraser (Supervisors + Enumerators + Officials)	250 pieces	- - -
	Sharpener (Supervisors + Enumerators + Officials)	250 pieces	- - -

	Activity
4	Allowances of Supervisors and Employment of Enu
4.1	Supervisors (Extension Officers in Sub-Counties)
	Enumerators
5	Trainings for Enumerators
5.1	2 days Training - 1st day: Field survey method - 2nd day: Field practice
6	Trainings for Enumerators
6.1	2 days Training - 1st day: Field survey method - 2nd day: Field practice
7	Laboratory work, data entry, tabulation and analys
7.1	Laboratory work for harvested rice crops
7.2	Data entry
7.3	Compensation of rice sample for farmers
7.4	Tabulation/Estimation
7.5	Analysis

	Requirements	No. of Units	No of Days
merators for Training and Field survey			
	Allowances (Supervisors)	50 persons	18
	Transportation cost (Supervisors)	50 persons	18
	Allowances (Enumerators)	150 persons	18
	Transportation cost (Enumerators)	150 persons	18
	Venue	10 room	2
	Lunch and coffee break (Enumerators + Officials)	100 persons	2
	HQ officers - DSA	30 persons	3
	Driver of HQ	10 persons	3
	HQ officers - Transportation cost (fuel)	10 Sets	3
	Regional officers - DSA	20 persons	3
	Regional officers - Transportation cost (fuel)	10 persons	3
	Venue	10 room	2
	Lunch and coffee break (Enumerators + Officials)	200 persons	2
	HQ officers - DSA	30 persons	3
	Driver of HQ	10 persons	3
	HQ officers - Transportation cost (fuel)	10 Sets	3
	Regional officers - DSA	20 persons	3
	Regional officers - Transportation cost (fuel)	10 persons	3
is			
		4 persons	5
	Allowances for Consultants	6 persons	10
		1 200 persons	
	Allowances for Consultants	2 persons	3
	Allowances for Consultants	1 persons	10

Basis of calculation

1. Target region

10 Regions

2. Personnel

Necessary human resources

- **1 Supervisor for 3 Enumerators**
- **1 employed Enumerator (1 enumerator will take care 40 dots)**

In total,

- **50 Supervisors**
- **150 Enumerators**

Supervisors

- **3 days for Training for Supervisor**
- **15 days for supervision for Enumerators**
- **In total, 18 days**

Enumerators

- **Working days per a enumerator: Total 18 days**
- **Confirmation of dot: 7 days**
- **Farm interview: 4 day**
- **Crop Cutting: 4 day**

Sample design

Aimed CV / Region	5
Aimed CV / Nation	2 - 3
Total Sample Region	10
Total Sample Dot	96,000
Total Sample Dot for Field Survey	3,900

Table 8/ List of field survey tools

Tools	To Estimate Number of Items	Surveys			
		List / Interview	List / Objective	List / Interview	List / Objective
Paper Questionnaire*1	1*the number of samples	▲	▲	▲	▲
Tablet*1	1*the number of enumerators	▲	▲	▲	▲
EA map	1*the number of sample EAs	●	●		
Road map	2*the number of sample dots			●	●
GPS receiver	1*the number of enumerators		*2	●	●
Tape measure	the number of enumerators/2		*2		
Crop cutting frame	1*the number of enumerators		●		●
Sickle	1*the number of enumerators		●		●
Bag to put harvested rice	2* sample plots		●		●
Cord to tie the opening of a bag	2* sample plots		●		●
ID cards for sample rice	2* sample plots		●		●
Digital Scale	1*the number of supervisors		●		●
Moisture meter	1*the number of supervisors		●		●
Total		2	9	3	9

*1 Paper questionnaire or tablet must be prepared for all surveys.

*2 GPS or tape measure must be prepared to measure area.

3.11 The (field) survey method to be applied

A survey method needs to be decided, ensuring the reliability of results and the feasibility of the survey

As has been pointed out previously, a (field) survey method needs to be decided, ensuring the reliability of results and the feasibility of the survey; therefore, an appropriate method varies in each country because of the different circumstances related to the survey.

Although each country should consider a survey method best suited to its situation, other options may be applying successful survey methods currently used in other countries. As indicated in Table 9, the Member Countries are roughly divided into 5 types.

Type A countries conduct a census of agriculture every 10 years and a sampling crop (or rice production) survey every year. In these countries, annual crop surveys are conducted under the List Sampling Method, hence the list frame is developed and maintained well enough for reutilization. In other words, the List Sampling Method can continuously be used for the survey. On the other hand, should dot sampling also be applicable, the Dot Sampling Method can be an alternative option, especially when the current method in place needs to be streamlined.

Type B countries have conducted the census of agriculture before, although not every 10 years. They also conduct the sample crop survey every year, usually using the list sampling frame. Although these countries may be able to continuously apply the List Sampling Method, they should consider

Table 9/ Survey methods to be applied

	Current Survey M		
	Census of Agciculture		Crop Surve
	Every 10 yrs	more than 10 yrs	E Sample Survey
Type A	●		●
Type B		●	●
Type C		●	
Type D		●	
Type E	●		

applying the Dot Sampling Method in order to improve the reliability of the data on rice area and production. An incomplete frame, in many cases developed more than 10 years ago, based on the last census of agriculture, makes the result of the crop survey less reliable; however, the frame may be maintained by the annual crop survey. If the list frame is well developed and maintained, it can be continuously used.

Type C countries have conducted the census of agriculture before, although not every 10 years. They also conduct the crop survey under the reporting system every year. Type D countries have conducted the census of agriculture before, although not every 10 years. They have conducted an ad hoc crop survey using the sampling method or the reporting system, yet they do not conduct an annual crop survey. Type E countries conduct the census of agriculture every 10 years. They also conduct the crop survey under the reporting system every year. The majority of African countries seem to be classified in this category. Since these countries do not have reliable list frames and do not conduct the annual crop survey based on a sampling theory, they should develop a reliable and feasible survey method, using the Dot Sampling Method. In case of a severely limited budget, the reporting system may be an option for the survey.

Regarding the field method, all country types should apply the Objective Survey Method to area and rice production, consistent with budget and user needs. Moreover, for all other data not related to area and production, the Interview Survey Method should be applied.

Method			Survey Method to be Applied				
y (including rice production survey)			Survey Method			Field Survey Method	
very Year		ad hoc	List sampling	Dot sampling	Reporting system	Interview survey method	Objective survey method
	Reporting System						
			●	●	×	▲	●
			▲	●	×	▲	●
	●		×	●	▲	▲	●
		●	×	●	▲	▲	●
	●		×	●	▲	▲	●

	Survey Method to be Applied	
	Comments	
	Survey Method	Field Survey Method
Type A	The list sampling method can continuously be used for the survey. The dot sampling is also applicable, especially when the method needs to be streamlined.	The objective survey method should be selected to survey area and production of rice ,if it is reasonable, considering a budget and user needs. To survey data except area and production, the intervew method needs to be applied.
Type B	The dot sampling should be considered to applying because the list frame is not incomplete in many caces. The list sampling can be used, in case the list frame is developped and maintained well.	The objective survey method should be selected to survey area and production of rice ,if it is reasonable, considering a budget and user needs. To survey data except area and production, the intervew method needs to be applied.
Type C	The dot sampling should be applied in order to develop a reliable and feasible annual survey because a reliable list frame is not available. The reporting system can be the option of an annual survey, if a budget is severely limitied.	The objective survey method should be selected to survey area and production of rice ,if it is reasonable, considering a budget and user needs. To survey data except area and production, the intervew method needs to be applied.
Type D		
Type E		

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(Annex)

Survey manuals used for the project

1. Technical Manual for Statistical Officers: Rice Production Survey (Area and Yield) under the List Frame Sampling;

2. Technical Manual for Statistical Officers: Rice Production Survey using the Dot Sampling Method.

Technical manual for statistical officers

Rice production survey (area and yield) under the list frame sampling

FAO South-South Cooperation project strengthening agricultural statistics and food security information in CARD countries through South-South Cooperation (GCP/INT/161/JPN)

Appendix

Form A-1	List of EAs for PPS aampling
Form A-2	List of EAs for SRS sampling
Form B	List of households
Form C	Selection of sample households on rice production
Form D	Questionnaire, interview to sample household
Form E	Field survey note, identification of rice plots for crop cutting & area measurement by tape measure
Form F	Field survey note, identification of rice plots for crop cutting & area measurement by GPS receiver
Form G	Field survey note, crop cutting
Form H	Field survey note, identification of sample units for harvesting loss
Form I	Field survey note laboratory work for crop cutting
Table 1	Conversion factor from wet grains to dry grains at 14% moisture content
Table 2	Raw data from the survey

1 Introduction

Accurate and up to date data and information on crop production is important and necessary for planning and formulating the right policy on crop production and trade. To generate a more accurate data, a statistically sound survey method should be introduced where both harvested area and yield are based on data from the field with predicted level of error or variance. It is recommended to introduce the Actual Measurement method for both area and yield survey instead of the Interview method because there is the tendency that many farmers do not know accurate acreage/production and do not want to give a reply to the interview correctly. This document is the Technical Manual for Statistical Officers in which the survey design, methods of field survey, estimation and the precision calculation are described. This Manual provides the List Frame Sampling system and field survey methods using interview and actual measurements (area and yield). The basic idea of the system was developed by projects of Japan International Agency (JICA) and Food and Agriculture organization (FAO) of the United Nations (UN). Currently, the method has been well applied in Thailand and Philippines. Other countries of Association of South-East Asian Nations (ASEAN) are also challenging to introduce it. The validity of this survey system was confirmed through the Pre-Test in Uganda, February – March 2015 in cooperation with Africa Rice Centre and an International Consultant from ASEAN. Furthermore, a separate Field Survey Manual for Enumerators is also prepared for the easy field survey operation by enumerators. It is hoped that this methods, can be used in CARD countries in Africa for further development of rice production survey.

2 Survey objectives

The purpose of the survey is to grasp rice production in certain domain, for example a province, a region or a country.

Specifically the objectives are:

- **To estimate the production, harvested area and other concerned production related items of rice in particular area or domain (ex. district) by using Interview method.**
- **To estimate the average of rice yield in particular area or domain by using crop cutting method.**
- **To estimate the cultivated/harvested area in the domain by using actual area measurement method.**
- **To consider the relationship among results from both Interview and actual measurement methods for further development of survey system, survey items/forms.**

3 The main parts of the survey system

The List Frame Sampling system explained in this document is composed of four (4) parts of operation.

- **Part 1 Creation of sampling frame and selection of sample households**
- **Part 2 Interview to sample households**
- **Part 3 Area Measurement (by Actual Area Measurement)**
- **Part 4 Yield Measurement (by Crop Cutting)**

Part 1 Creation of sampling frame and selection of sample households

1. Major steps for sample selection

For this manual, the design unit which means the domain of estimation is assumed the District. The two-stage sampling design is adopted. The District will be further divided into sub-areas by using the boundary of village or Enumeration Area (EA) of Census, which is the Primary Sampling Unit (PSU), and the rice growing household is the Secondary Sampling Unit (SSU).

The major steps for sample selection are as follow:

- **Step 1 Listing of villages/EAs**
- **Step 2 Selection of sample villages/EAs (Primary Sampling Unit: PSU)**
- **Step 3 Selection of sample households**

2. Selection procedure

Step 1 Listing of villages/EAs

Based on the latest Population/Agricultural Census, the list of villages or EAs will be establish as the sampling frame for selecting the Primary Sampling Unit (PSU). If data on rice planted/harvested area and/or number of rice growing households in the village/EA are existed through the recent Agricultural Census, it is recommended to apply the Probability Proportional to Size (PPS) sampling for selection of PSU

Step 2 Selection of sample villages/EAs (Primary sampling unit: PSU)

The sample villages/EAs are selected from the District randomly.

(1) by Probability proportional to size (PPS) sampling

The following is the procedure to select PSU with PPS method (see FORM A-1):

- **a) List the villages/EAs as Primary Sampling Units [PSU, column (1) ~ (3)] and their sizes [rice planted/harvested area or number of rice growing households: column (4)];**
- **b) Calculate the cumulative sum of the population sizes [column (5)]. The Total Population will be the last figure in [column (5)];**
- **c) Determine the Number of PSUs to be sampled, which is "d";**
- **d) Determine the Number of Secondary Sampling Unit (SSU) to be sampled from each selected PSU. In case of this manual, it is three (3). In order to ensure that all individuals in the population have the same probability of selection irrespective of the size of their PSUs, the same number of individuals (the SSUs) has to be sampled from each PSU with Simple Random Sampling (SRS) technique;**
- **e) Divide the total population by "d" to get the Sampling Interval (SI).**
- **f) Choose a random number between 1 and the "SI". It will be the Random Start (RS). The first PSU to be sampled contains this cumulative population [column (5)]. [Excel command @RANDBETWEEN(1;SI)];**
- **g) Calculate the following series: RS; RS + SI; RS + 2SI; ..... RS+(d-1)×SI;**
- **h) The PSUs selected are those for which the cumulative population [column (5)] contains one of the serial numbers calculated in item g). Depending on the population size of the PSU, it is possible that big PSUs will be sampled more than once. Mark the sampled PSUs in another column [column (6)].**

(2) by Systematic random sampling (SRS)

The following is the procedure to select PSU with SRS method (FORM A-2):

- **a) List the Primary Sampling Units [PSU: column (2) and (3)] and count the total number of PSU in the population, which is "M";**
- **b) Determine the number of PSU to be sampled, which is "d";**
- **c) Run Excel function @ RANDBETWEEN(1;M), which has been entrered. By the function, a random number between 1 to M will appear. It is the Random Start (RS), and insert "Check" symbol in the correspoding row;**
- **d) Divide the total number of PSU by "d" to get the Sampling Interval (SI);**
- **e) Calculate the following series: RS; RS + SI; RS + 2SI; ..... RS+(d-1)×SI, and insert "Check" symbol in the correspoding row.**

Step3 Selection of sample households (Secondary sampling unit: SSU)

In each selected village/EA, the rice farming households, which is as defined in the definition section in the Enumerator Manual, are listed and three (3) sample households are selected using simple random sampling method. This procedure is applicable to both PPS and SRS method, and the same Form, Form B and C, will be used. Procedure to select SSU from the selected PSUs are as follows:

a) Visit all households (HHs) in the village and confirm the rice cultivation [Colum (4)], then put the running number [Colum (5)] in Form B;

b) Check the total number of rice farming

households in the sample village/EA.;

c) Three (3) sample households can be selected from the Random Number Table in Form C corresponding total number of rice farming households;

d) Confirm the name and contact address of three (3) selected sample households in Form B, and transcribe them to Form C;

e) In case of that the farm operator is not available at the time of interview, he/she doesn't cooperate, and the crop has already harvested, enumerators should implement the survey to alternative sample households. For this purpose, three (3) alternative sample households are selected at the same time of the sample household selection using Form C.

Part 2 Interview to sample households

1. Abstract of the interview

The major operations for interview are basically done by interviewing the head of sample households. Enumerators collect data on harvested/cultivated area, production and other related data on rice in each sample household. Enumerators also obtain the permission on the actual area measurement and Crop Cutting.

In the case where the head of the household or persons who know the farm management of the household are not available, enumerators has to reschedule and revisit to do the interview.

2. The questionaire

The households selected as the sample will be interviewed using the FORM D. The basic survey items are the total farming area, number of rice planted plots, planted area, production. Under the interview method, the yield will be generated Form figures of both production and cultivated/harvested area through the production divided by the area.

The data on rice farming situation on date of planting/harvesting, planting method, ecosystem, variety and crop conditions are collected for further analysis in generating additional information such as cross tabulation of the yield by planting method, by variety and so on if the sample size is big enough.

Additionally, since the Form D is designed only for the pilot survey, the survey items to be interviewed are limited. Survey items can be considered according to the needs of the countries. More on this will be explained in the following specific instructions for each of the variables or item in the questionaire.

3. Specific instruction

Most of the interview items in the questionnaire are self explanatory.

The first bloc "1. Identification of Sample Household" is expected to enter the address and name of the sample household. Since this information will be used for other survey operations for actual area measurement and Crop Cutting, the code administration is important.

In the second bloc "2. Farming Situation", the Total Farming Plots/Area [item (1) and (2)] is the total area dedicated to all crops including rice in hectare. Total harvested Plots, Area and Production [item (3), (4), (5)] of Rice Farming in this Crop Season are only the items dedicated to rice by the household during the said season.

In the third bloc "3. Rice Farming Situation", survey items on Crop Season, Farming Date, Planting Method, Ecosystem and Variety are self explanatory. The explanation on the alternative choices on Growing Condition [item (12)] is explained as follows:

- **"5": The current crop situation in the sample field in this year shows very**
- **good growth and the yield is expected to be very good in the harvesting**
- **time**
- **"4": The current crop situation shows good growth and the yield is expected to be good in the harvesting time.**
- **"3": The current crop situation shows normal growth and the yield is expected to be normal in the harvesting time.**
- **"2": The current crop situation shows bad growth and the yield is expected to be bad in the harvesting time.**
- **"1": The current crop situation shows very bad growth and the yield is expected to be very bad in the harvesting time.**

The situation might be very "simple and unclear ". Therefore, the sample farm households can answer based on only their "feeling". Some of the answers might be wrong. However, the result of interview with the sample farm household on this item will be very useful information, that is, if we can find the correlation between the crop conditions and the crop cutting yield are significant then it can be used for forecasting yield in the future.

Part 3 Area measurement

1. Abstract of the Actual Area Measurement

The major operations for area measurement are actually done by measuring the area of all rice harvested plots owned by the sample households by using the GPS receiver or the traditional tape measurement.

In general, it is thought of as the planted area responded by farmers (by interview) includes the unused portion of the plots. The countries' official statistics on crop areas might include the unused portion.

The actual area measurement method will also include the un-cultivated area as the nature of the system. On the other hand, the yield (production per hectare) obtained by the actual measurement method (Crop Cutting, to be explained in Part 4) will be the result from the actual planted area without un-cultivated area (unused portion). In this regard, we need to adjust the yield by Crop Cutting through the proportion of un-cultivated area.

2. Identification of rice fields/ plots owned by sample households

For the first step of the actual measurement methods, identification of the farm fields/ plots owned by sample households is indispensable. In this regard, the location of the farm fields/plots should be sketched in the page 1 of the FORM E or F and put running numbers as the preparation area measurement and Crop Cutting.

[Reference]

Field:

The parcel/cluster of cultivated areas managed by farm households.

Plot:

The cultivated area bounded by clear dyke, road/foot-pathes and canal/drain with same cultivation in terms of period, variety and planting method.

Form E:

Field Survey Note for Identification of Rice Plots for Crop Cutting & Area Measurement by Tape Measure

Form F:

Field Survey Note for Identification of Rice Plots for Crop Cutting & Area Measurement by GPS Receiver

3. Area measurement procedure

3.1. by Tape measurement

Step 1 Rice harvested area measurement

In case of using the tape measurement method for the area measurement, there are several kinds of methods. This manual will introduce one of the easy methods using the Heron's Formula as follows:

- **a) prepare page 1 and 2 of Form E. Regarding the page 2, it should be prepared for all rice plots identified in the "2. Location of the rice fields/plots" in page 1. If there are five rice plots in the sample household, the page 2 should be prepared five;**
- **b) In case that the fields are not in a rectangular shape, divide it into several triangle shape parts as many as necessary (see Figure 1).**

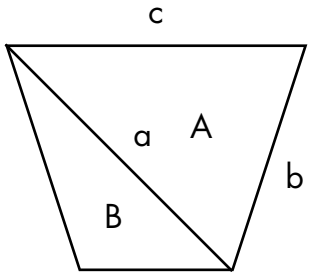


Figure 1. A field divided into two triangles A and B

- **c) measure the length of three (3) sides of each triangle for all triangles**
- **d) the area of triangle can be calculated by Helon's Formula using the length of three (3) sides;**

$$T(A) = \sqrt{s(s-a)(s-b)(s-c)} \quad \text{.....(1)}$$

T(A): Area of part A

a, b, c: The length of each side of the triangle

$$s = (a+b+c)/2 \quad \text{.....(2)}$$

- **e) sum up the area of all triangle areas to obtain the total area of the sample plot.**

Step 2 Un-cultivated area measurement

The un-cultivated area measurement will be carried out for the third (3rd) sample household in the sample village. Only the same sample plot for Crop Cutting can be used for the un-cultivated area measurement to reduce the workload.

The operation procedure is as follows:

- **a) Measure the length of dyke, ditch, canal etc. of all plots in the sample field and measure the width 3 points for each and every dyke (Figure2).**
- **b) Calculate the area of each dyke using the following Formula:**

$$\text{Area}_A = W_A \times L_A \quad \text{.....(3)}$$

Where:

$$W_A = [a_1 + a_2 + a_3]/6 \quad \text{.....(4)}$$

= the average width of the dyke A

LA = the length of dyke A

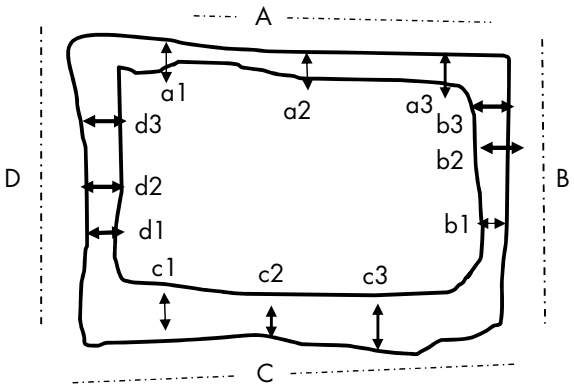


Figure 2: Show the measurement procedure for the dyke area

Please note that the average width of the dyke is calculated as total of three parts of width divided by 6. The reason is that the dyke is on the border of the plots or adjacent to other area. The half width of the dyke should be belonged to other area.

For other sides of the plots the procedure is the same.

Total area of particular dyke [N1] =

$$Area_A + Area_B + Area_C + Area_D \quad \text{.....(5)}$$

Total area of all dykes and other uncultivated area [T(N)]

$$= N_1 + N_2 \quad \text{.....(6)}$$

Where N2 is other un-cultivated areas in the inside of rice plot (such as trees, ditch, canal, cottage, etc.), which can be applied the rectangular area for the calculation by tape.

3.2. by GPS Receiver

Recently, many models of GPS receiver are equipped the function of acreage calculation by marking all corners of the field. The function can be used for the area measurement of rice plots.

Step 1 Rice harvested area measurement

The procedure is same as the Step 1 of 3.1. by Tape Measurement.

a) Prepare page 1 and 2 of FORM F. Regarding the page 2, it should be prepared for all rice plots identified in the "2. Location of the rice fields/plots" in page 1. If there are five rice plots in the sample household, the page 2 should be prepared five;

b) The acreage can be measured using GPS receiver by marking all corners of the plot automatically in general although the detail operation is different by model.

Step 2 Un-cultivated area measurement

It is same as the procedure of Step 2 of 3.1. by Tape Measurement.

4. Calculation of the proportion of uncultivated area

The proportion of un-cultivated area will be used for the adjustment of yield obtained from the Crop Cutting. The proportion of un-cultivated area of rice for the district is calculated as follows:

$$r_u = \frac{T(N)}{T(A)} \quad \text{.....(7)}$$

Where

ru = the proportion of uncultivated area for the target district

T(A) = the sum of the total cultivated areas measured from all selected plots in the district

T(N) = the sum of all un-cultivated areas measured from the same selected fields in the district.

Then, the Formula to adjust the yield is as follow:

Yield (adjusted) = Crop Cutting Yield × (1 - ru)

The detail will be explained at the "Part 4 Crop Cutting, 3.Yield Estimation Procedure".

Once carry out the un-cultivated area survey, it will not be needed carry out every year although the area measurement is needed for every year. The field situation (the proportion of un-cultivated area) is the same so long. It will not be changed rapidly. Probably, this can be done once every five years.

Part 4 Crop cutting

1. Major steps for Crop Cutting

The method of Crop Cutting is the best way to obtain accurate yield of crops. It is needed to select the sample units for Crop Cutting keeping the randomness without the arbitrary manner.

After the Crop Cutting, It is also needed to adjust the yield to reflect the actual harvest situation in the countries with three factors, i.e., moisture content, harvesting loss and uncultivated area. From Step 1 and 2 will be implemented by enumerators at the field level using the FORM G, Step 3 will be implemented by statistical officer at the field level using the FORM H, and Step 4 and 5 by statistical officer at the laboratory in central level.

Step 1 Selection of the place for Crop cutting

Step 2 Crop Cutting Operation

Step 3 Harvest Loss Survey

Step 4 Adjustment of Moisture Content

Step 5 Grain threshing and weighing

2. Crop cutting procedure

Step 1 Selection of the place for crop cutting

The place for Crop Cutting should be selected step by step for the "field" at first, then "plot" and "unit" randomly without enumerators' subjective view.

The definition of the areas of Crop Cutting is as follow:

Field:

The parcel/cluster of cultivated areas managed by farm households.

Plot:

The cultivated area bounded by clear dyke, road/foot-paths and canal/drain with same cultivation in terms of period, variety and planting method.

Unit:

The area of Crop Cutting. In this manual, two units per one sample plot are selected. The size is 1m × 1m per unit.

(1) Sample plot selection

In each selected household, one (1) sample rice plot should be selected randomly even if the household has more than one plot in scattered fields (parcel/cluster).

- **a) sketch the location of all rice plots of the sample households in the "2. Location of the Rice Plots" of FORM E or F, and put the running number to all plots (see Figure 3 for numbering the fields);**

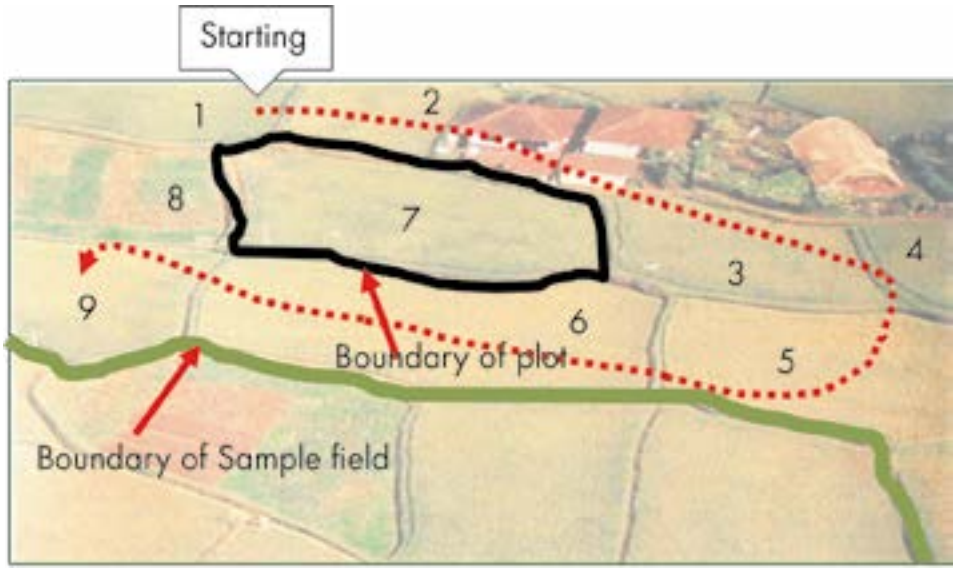


Figure 3: Numbering of plots in a sample field of the sample household having 9 plots, running from 1 to 9 using serpentine system.

- **b) select one (1) sample plot using the pre-assigned random number table.**

(2) Sample units selection

In each plot, two (2) units of one sq. meters (1m×1m) will be selected randomly as follow (see Figure 4):

- **a) From the most convenient (easy access) corner of the sample plot, walk along the ridge to the top taking 30 steps (paces) then turn right into the plot and take another 30 steps (paces). This is the Sample Unit No.1 for Crop Cutting;**
- **b) Start at the corner opposite to the first sample plot, walk along the ridge downwards taking 30 steps then turn right into the plot and take another 30 steps. This is the Sample Unit No.2 for Crop Cutting;**
- **c) Place the Crop Cutting frame at each sample unit. These two units will be used as the crop cutting areas.**

These two units will be used for the Crop Cutting. The yield estimation will be based on the average data of these two units. However, for the research purpose, information of each sample unit will be recorded separately.

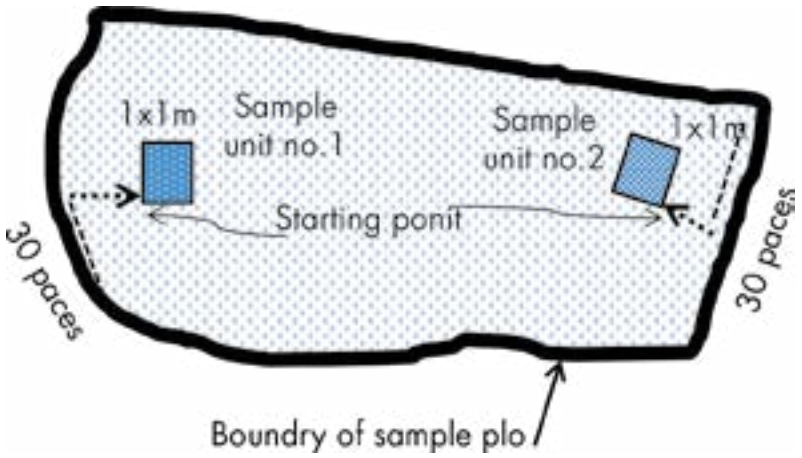


Figure 4: Show the location of 2 sample units in the sample plot.

Step 2 Crop cutting operation

The Crop Cutting should be operated carefully keeping objectiveness and randomness. Even if the growing condition of rice is not good in the selected sample units, enumerators must not change the place. He/she should cut the all rice panicles within the Crop Cutting frame, which is made of PVC pipes in 1m × 1m size, not include outside of the frame. The harvested rice panicle should be kept them in a mesh bag.

During the cutting, the enumerator has to do it carefully so that the grain will not be drop on the ground. If there are some grain fallen onto the ground, the enumerator has to collect and put all of them in the same bag. The information in each sample unit must be recorded in Form G separately.

The mesh bag with the harvested panicle in it must be tied with the respective ID tag containing the relevant information. The enumerator will deliver all the sample bags to the Central office through the appointed officer accordingly.

Step 3 Harvest loss survey

Usually the harvest loss occurs during the harvest operation by farmers. On the other hand, the harvest loss will not occur by the Crop Cutting if the operation is implemented precisely. Therefore, it is needed to estimate harvesting loss at the field level. The yield obtained from Crop Cutting should be adjusted to the yield by common harvest method by farmers.

The harvest loss survey will be implemented in the second (2nd) sample household only using Form H.

The Harvest Loss Survey should be implemented after the actual harvest by farmers. It might be a few days later than the Crop Cutting operation. As the result, enumerators/statistical officers should visit the 20 sample household/plot twice for the Crop Cutting operation and the Harvest Loss Survey.

(1) Sample plot selection and field operation

Case 1.

Using same rice plot of Crop Cutting Operation It is recommended to select the sample units for harvest loss survey from the same sample plot of Crop Cutting Operation. In this case, the sample units for Harvest Loss Survey should be selected at the opposite place of the Crop Cutting units.

- **(1) Enumerators/supervisors should stand at the opposite corner against the Crop Cutting operation in the plot, then walk along the ridge upwards taking 30 paces then turn left into the plot taking another 30 paces. This is the sample Unit No. 1 for Harvest Loss Survey. The Sample Unit No. 2 should be also selected through the same operation of sample unit selection for the Crop Cutting.**
- **(2) Place the Crop Cutting frame sized one square meter (1m × 1m) at the end of the 30th step towards the left hand side parallel to the ridge. Then, gather all rice grains fallen within the Crop Cutting frame and put into the mesh bag for the Harvest Loss Survey. The ID tag to be record the necessary information should be put together with the collected rice grains.**
- **(3) Dry the collected rice in the sun for 1-2 days without removal from the mesh bag prior to delivery to the statistical officers**

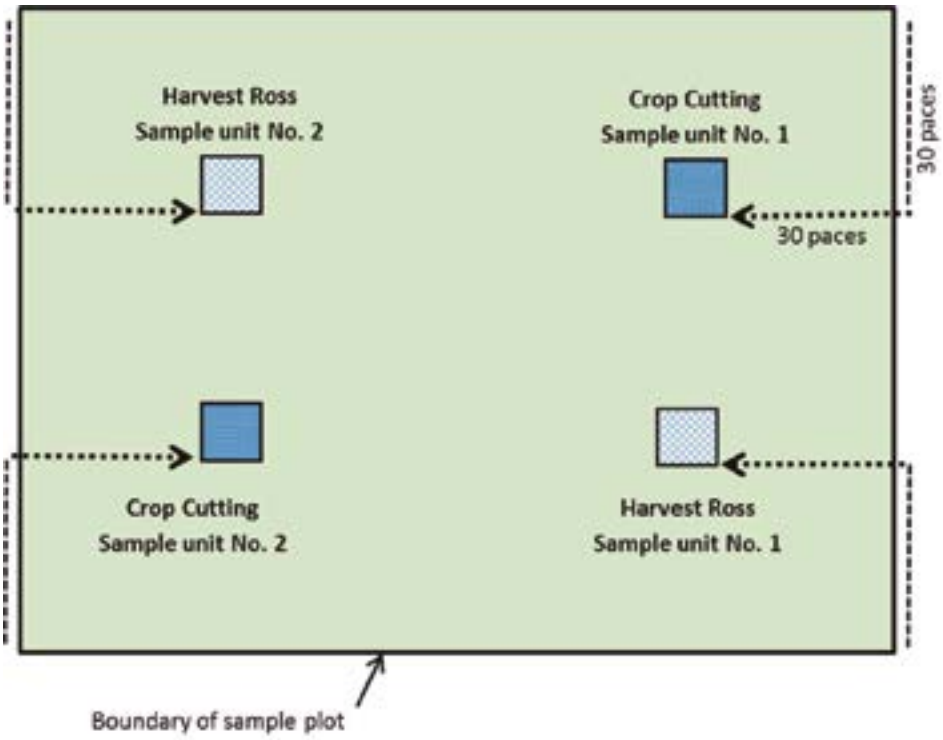


Figure 5 Selection of sample units for Harvest Loss Survey Using same rice plot of Crop Cutting Operation

Case 2.

Using different rice plot of Crop Cutting Operation In case of that the same sample plot of Crop Cutting Operation cannot be selected due to unforeseen circumstances, the next number of rice plot (Form E) owned by the sample household should be selected for the Harvest Loss Survey.

The sample units should be selected in same manner of the Crop Cutting Operation, and the procedure on gathering of all rice grains fallen within the crop cutting frame is same as Case 1. Using same rice plot of Crop Cutting Operation.

(2) Receiving harvested/gathered rice

Statistical officers should receive the harvested rice by Crop Cutting and the gathered rice by Harvest Loss Survey with corresponding forms.

At the laboratory of the central office, the grains will be also threshed, clean, weighed, and moisture content is measured similar to the Crop Cutting units (Form I).

(3) Calculation of the proportion of harvest loss

The average of these two units is used in calculation. The proportion of the harvesting loss for the district is calculated as follows:

$$\eta = \frac{\sum_{i=1}^{n} x_i}{\sum_{i=1}^{n} y_i}$$

1 - rl = correcting (adjusting) factor for the harvesting loss in the district

Where:

n = the number of sample household in the district,

xi = the average dry weight of grains collected from the two (2) units of the harvesting loss survey of the ith sample household in the district,

yi = the average of dry weight of grains obtained from two (2) crop cutting units of the same sample household (matching sample),

rl = the proportion of the harvesting loss of the survey district

In principle, the harvest loss survey is not required to implement every year while the harvesting practice of the farmers might be not changed rapidly. Then, the proportion of harvest loss can be used for several years. Probably, it is recommended to be conducted every five years or so.

Step 4 Adjustment of moisture content

The grains harvested by the Crop Cutting at the field might contain much of moisture more than the commercial based grain. Usually, the standard commercial based moisture is 14 %. Therefore, it is needed to be dried at the standard moisture, or wet grain weight should be converted to the standard moisture weight.

The Formula to convert the wet grain weight to the standard moisture weightis is as follow:

$$DW = \frac{100-X}{100-S} \times Y \quad \text{.....(9)}$$

Where:

X = % moisture content of grain from the sample unit

S = % standard moisture (e.g. 14 % Moisture Content)

Y = weight of wet grain from the sample unit

DW = dry weight of grain at standard moisture (marketing weight) from the sample unit

The conversion table from wet grain to dry grain at standard moisture (14 %) is given in the Annex.

Step 5 Grain threshing and weighing

The rice panicle will be threshed and cleaned to remove the unfilled (unripe) grain, chaffs and other dirt before weighing. The weight and moisture content for each sample unit is then recorded in the Form I.

3. Yield estimation procedure

The final (adjusted) yield estimate at the district level is obtained according to the following definition:

a. Marketing level yield

= Crop Cutting yield adjusted for moisture content (dry weight at standard moisture).

b. Final (adjusted) yield

= Marketing level yield × (1 – proportion of harvesting loss)

× (1 – proportion of un-cultivated area)

4. Necessary documents, tools/ equipment for rice survey

4.1. Updated the list of the paddy growing villages/EAs in the district to be used as the sampling frame.

4.2. Crop cutting frame: size 1 × 1 m, can be made up of PVC water pipe which is easy to assemble in the field (sample unit) and disassemble when carry.

Photos: ©FAO

4.3. Iron stick or picket to keep the frame stable (2 pieces) during the crop cutting and counting the grain loss.

4.4. Digital balance scales for weighing the grain obtained from crop cutting and crop loss units

4.5. Moisture measurement equipment

4.6. Tape – measure 100 meters in length

4.7. Sickle to cutting the grains

Photos: ©FAO

4.8. GPS receiver to measure the area

4.9. Mesh bag to keep the sample grains

4.10. Threshing equipment (optional)

4.11. Identification card (ID card) for sample units

Name of Sample household..... ☐☐☐

Crop Cutting ☐ or Harvest loss survey ☐

Sample Unit Number..... ☐

District..... ☐☐☐

County..... ☐☐☐

EA/Village..... ☐☐ / ☐☐☐

Photos: ©FAO

Reference

Estimation procedures

1. Interview method

1.1. Production estimation[1]

Let pij be the production in the ith EA and the jth household (in kg),
i= the ith sample EA (i = 1, 2, ... , m),
j = the jth sample farm household (j = 1,2, ... , n),
m = the number of sample EAs,
M = number of EA in the district,
ni = the number of sample households,
Ni = the number of households in EAi

1.1.1. by Two stages with SRS at each stage:

$$\bar{p}_i = \frac{1}{n_i}\sum_{j=1}^{n_i} p_{ij} \quad \text{.....(1)}$$

= taverage production of the ith sample EA.

$$\hat{p}_i = N_i\bar{p}_i \quad \text{.....(2)}$$

= taverage production for the ith EA.
An unbiased estimator for the District total production is

$$\hat{\tau}_p = M.\frac{\sum_{i=1}^{m}\hat{p}_i}{m} = M.\frac{\sum_{i=1}^{m}N_i\bar{p}_i}{m} \quad \text{.....(3)}$$

Calculate the precision of the estimated production as follows:

$$\widehat{var}(\hat{t}_p) = M(M-m)\frac{s_{up}^2}{m} + \frac{M}{m}\sum_{i=1}^{m}N_i(N_i-n_i)\frac{s_{ip}^2}{n_i} \quad \text{.....(4)}$$

Where s_{up}^2
is the sample variance among the EA totals, and s_{ip}^2
is the sample variance within the i^{th}
EA, and

$$s_{up}^2 = \frac{1}{m-1}\sum_{i=1}^{m}\left(\hat{p}_i - \frac{\sum_{i=1}^{m}p_i}{m}\right)^2 \text{, and } s_{ip}^2 = \frac{1}{n_i-1}\sum_{j=1}^{n_i}(p_{ij}-\bar{p}_i)^2 \quad \text{.....(5)}$$

Coefficient of Variation of $\hat{t}$ i.e.

$$CV(\hat{t}_p) = \frac{\sqrt{\widehat{var}(\hat{\tau}_p)}}{\hat{\tau}_p}x100\% \quad \text{.....(6)}$$

[1] Modified from https://onlinecourses.science.psu.edu/stat506

1.1.2. by Two stages with PPS for the PSU and SRS for the SSU:

District total production is

$$\hat{t}_p = \frac{N}{m} \cdot \sum_{i=1}^{m} \frac{\bar{p}_i}{N_i} = N \cdot \frac{\sum_{i=1}^{m} \bar{p}_i}{m} \quad \text{.....(7)}$$

$$\widehat{var}(\hat{t}_p) = \frac{N^2}{m(m-1)} \sum_{i=1}^{m} (\bar{p}_i - \hat{\mu}_p)^2 \quad \text{.....(8)}$$

Where $\hat{\mu}_p$

the estimates of the population mean of production is given by

$$\hat{\mu}_p = \frac{\sum_{i=1}^{m} \bar{p}_i}{m} \quad \text{.....(9)}$$

And when N, the total number of households in the population is unknow can be estimated by,

$$N = \frac{\sum_{i=1}^{m} N_i}{m} \times M \quad \text{.....(10)}$$

The coefficient of Variation of $\hat{t}_p$
then is

$$CV(\hat{t}_p) = \frac{\sqrt{\widehat{var}(\hat{t}_p)}}{\hat{t}_p} x100\% \quad \text{.....(11)}$$

1.2. Harvested area estimation[2]

Let a_{ij} be the cultivated area in the i^{th} EA and the j^{th} household (in ha),
i= the i^{th} sample EA (i = 1, 2, ... m),
j = the j^{th} sample farm household (j = 1,2, ... , n),
m = the number of sample EAs,
M = number of EA in the district,
ni = the number of sample households
Ni = the number of households in EAi

1.2.1. by Two stages with SRS at each stage:

$$\bar{a}_i = \frac{1}{n_i} \sum_{j=1}^{n_i} a_{ij} \quad \text{.....(12)}$$

= average area of the i^{th} sample EA.

$$\hat{a}_i = N_i \bar{a}_i \quad \text{.....(13)}$$

= total area for the ith EA.

[2] Modified from https://onlinecourses.science.psu.edu/stat506

An unbiased estimator for the District total area is

$$\hat{t}_a = M.\frac{\sum_{i=1}^{m}\hat{a}_i}{m} = M.\frac{\sum_{i=1}^{m}N_i\bar{a}_i}{m} \quad \text{.....(14)}$$

Calculate the precision of the estimated area as follows:

$$\widehat{var}(\hat{t}_a) = M(M-m)\frac{s_{ua}^2}{m} + \frac{M}{m}\sum_{i=1}^{m}N_i(N_i-n_i)\frac{s_{ia}^2}{n_i} \quad \text{.....(15)}$$

Where s_{ua}^2

is the sample variance among the EA totals, and s_{ia}^2

is the sample variance within the $\mathbf{i}^{\mathbf{th}}$

EA, and

$$s_{ua}^2 = \frac{1}{m-1}\sum_{i=1}^{m}\left(\hat{a}_i - \frac{\sum_{i=1}^{m}\hat{a}_i}{m}\right)^2 \text{, and } s_{ia}^2 = \frac{1}{n_i-1}\sum_{j=1}^{n_i}(a_{ij}-\bar{a}_i)^2 \quad \text{.....(16)}$$

Coefficient of Variation of $\hat{t}_a$

i.e.,

$$CV(\hat{t}_a) = \frac{\sqrt{\widehat{var}(\hat{t}_a)}}{\hat{t}_a}x100\% \quad \text{.....(17)}$$

1.2.2. by Two stages with PPS for the PSU and SRS for the SSU:

District total area is

$$\hat{t}_a = \frac{N}{m}.\sum_{i=1}^{m}\frac{\hat{a}_i}{N_i} = N.\frac{\sum_{i=1}^{m}\bar{a}_i}{m} \quad \text{.....(18)}$$

$$\widehat{var}(\hat{t}_a) = \frac{N^2}{m(m-1)}\sum_{i=1}^{m}(\bar{a}_i - \hat{\mu}_a)^2 \quad \text{.....(19)}$$

Where $\hat{\mu}_p$

the estimates of the population mean of area is given by

$$\hat{\mu}_a = \frac{\sum_{i=1}^{m}\bar{a}_i}{m} \quad \text{.....(20)}$$

And when N, the total number of households in the population is unknow, it can be estimated by,

$$N = \frac{\sum_{i=1}^{m}N_i}{m} \times M \quad \text{.....(21)}$$

The Coefficient of Variation of $\hat{t}_a$ is

$$CV(\hat{t}_a) = \frac{\sqrt{\widehat{var}(\hat{t}_a)}}{\hat{t}_a}x100\% \quad \text{.....(22)}$$

1.3. Yield estimation[3]

For this interview method the yield is not accquired directly through the questionaire. It is derived from data on production and area cultivated as in the following equation:

$$\hat{y} = \frac{\hat{t}_p}{\hat{t}_a} \quad \text{.....(23)}$$

Where $\hat{t}_p, \hat{t}_a$

are unbiased estimator for the District total production and area and $\hat{y} =$ estimated yield at district level.

To derive the variance of $\hat{y}$

we follow the Formula provided by Goodman (1960)[4] as follows:

Given

$$w = f(x, y),$$

$$\text{var}(w) = [(df/dx)^2]\,\text{var}(x) + [(df/dy)^2])\,\text{var}(y) + (df/dx)(df/dy)\,\text{cov}(x, y) \quad \text{....(24)}$$

then for equation (13),

$$\widehat{var}(\hat{y}) = (1/\hat{t}_a)^2 \widehat{var}(\hat{t}_p) + \left(\frac{\hat{t}_p^{\,2}}{\hat{t}_a^{\,4}}\right) \widehat{var}(\hat{t}_a) + \left(\frac{1}{\hat{t}_a}\right)\left(\frac{\hat{t}_p}{\hat{t}_a^{\,2}}\right) \widehat{cov}(\hat{t}_p, \hat{t}_a) \quad \text{.....(25)}$$

Where

$$\widehat{cov}(\hat{t}_p, \hat{t}_a) = M(M-m)\frac{\widehat{cov}_u}{m} + \frac{M}{m}\sum_1^m (N_i(N_i - n_i))\frac{\widehat{cov}_i}{n_i} \quad \text{.....(26)}$$

Where

$$\widehat{cov}_u = \frac{1}{m-1}\sum_{i=1}^m \left(\hat{p}_i - \frac{\sum_{i=1}^m p_i}{m}\right)\left(\hat{a}_i - \frac{\sum_{i=1}^m a_i}{m}\right) \quad \text{.....(27)}$$

$$\widehat{cov}_i = \frac{1}{n_i - 1}\sum_{j=1}^{n_i}(p_{ij} - \bar{p}_i)(a_{ij} - \bar{a}_i) \quad \text{.....(28)}$$

Coefficient of Variation of $\hat{y}$, i.e.,

$$CV(\hat{y}) = \frac{\sqrt{\widehat{var}(\hat{y})}}{\hat{y}} x100\% \quad \text{.....(29)}$$

[3] Modified from https://onlinecourses.science.psu.edu/stat506

[4] Goodman, L. A. 1960. On the Exact Variance of Products. Journal of American Statistical Association. 55: 708 - 713.

2. Actual area measurement

Estimation procedure is as follows:

Let a_{ij} be the total cultivated area in the i^{th} sample village and the j^{th} household (in ha),

i= the i^{th} sample village (i = 1, 2, ... , m),

j = the j^{th} sample farm household (j = 1,2, ... , n),

m = the number of sample village,

M = number of vilages in the district,

n_i = the number of sample households (sample size),

N_i = the number of households in the i^{th} village.

2.1. by Two Stages with SRS at Each Stage:

$$\bar{a}_i = \frac{1}{n_i}\sum_{j=1}^{n_i} a_{ij} \quad \text{.....(30)}$$

= average area of the i^{th} sample EA.

$$\hat{a}_i = N_i \bar{a}_i \quad \text{.....(31)}$$

= total area for the i^{th} EA.

An unbiased estimator for the District total area is

$$\hat{t}_a = M.\frac{\sum_{i=1}^{m} \hat{a}_i}{m} = M.\frac{\sum_{i=1}^{m} N_i \bar{a}_i}{m} \quad \text{.....(32)}$$

Calculate the precision of the estimated area as follows:

$$\widehat{var}(\hat{t}_a) = M(M-m)\frac{s_{ua}^2}{m} + \frac{M}{m}\sum_{i=1}^{m} N_i(N_i - n_i)\frac{s_{ia}^2}{n_i} \quad \text{.....(33)}$$

Where s_{ua}^2

is the sample variance among the EA totals, and s_{ia}^2

is the sample variance within the ith EA, and

$$s_{ua}^2 = \frac{1}{m-1}\sum_{i=1}^{m}\left(\hat{a}_i - \frac{\sum_{i=1}^{m}\hat{a}_i}{m}\right)^2 \text{, and } s_{ia}^2 = \frac{1}{n_i-1}\sum_{j=1}^{n_i}(a_{ij} - \bar{a}_i)^2 \quad \text{.....(34)}$$

Coefficient of Variation of $\hat{t}_a$, i.e.,

$$CV(\hat{t}_a) = \frac{\sqrt{\widehat{var}(\hat{t}_a)}}{\hat{t}_a} x100\% \quad \text{.....(35)}$$

2.2. by Two Stages with PPS for the PSU and SRS for the SSU:

District total area is

$$\hat{t}_a = \frac{N}{m}.\sum_{i=1}^{m}\frac{\hat{a}_i}{N_i} = N.\frac{\sum_{i=1}^{m}\bar{a}_i}{m} \quad \text{.....(36)}$$

$$\widehat{var}(\hat{t}_a) = \frac{N^2}{m(m-1)}\sum_{i=1}^{m}(\bar{a}_i - \hat{\mu}_a)^2 \quad \text{.....(37)}$$

Where $\hat{\mu}_p$

the estimates of the population mean of area is given by

$$\hat{\mu}_a = \frac{\sum_{i=1}^{m}\bar{a}_i}{m} \quad \text{.....(38)}$$

And when N, the total number of households in the population is unknow, it can be estimated by,

$$N = \frac{\sum_{i=1}^{m}N_i}{m} \times M \quad \text{.....(39)}$$

The Coefficient of Variation of $\hat{t}_a$ is

$$CV(\hat{t}_a) = \frac{\sqrt{\widehat{var}(\hat{t}_a)}}{\hat{t}_a} x100\% \quad \text{.....(40)}$$

3. Crop cutting

Let y_{ij} be the yield in the i^{th} EA and the j^{th} household (in kg/ha),
i= the i^{th} sample EA (i = 1, 2, ... , m),
j = the j^{th} sample farm household (j = 1,2, ... , n_i),
m = number of sample EAs (in this Pre-test it is 40),
M = number of EAs (primary units) in the District,
n_i = number of sample households (in this pre-test it is 10),
N_i = number of secondary units (households) in the i^{th} EA.
N = $\sum_{i=1}^{M}N_i$ total number of households in the District.

3.1. by Two stages with SRS at each stage:

$$\bar{y}_i = \frac{1}{n_i}\sum_{j=1}^{n_i}y_{ij} \quad \text{.....(41)}$$

= average yield of the i^{th} sample EA.

$$\hat{y}_i = N_i\bar{y}_i \quad \text{.....(42)}$$

= total y-value for the i^{th} EA.

An unbiased estimator for the District total is

$$\hat{t}_y = M.\frac{\sum_{i=1}^{m}\hat{y}_i}{m} = M.\frac{\sum_{i=1}^{m}N_i\bar{y}_i}{m} \quad \text{.....(43)}$$

Calculate the precision of the estimated yield as follows:

$$\widehat{var}(\hat{t}_y) = M(M-m)\frac{s_{uy}^2}{m} + \frac{M}{m}\sum_{i=1}^{m}N_i(N_i-n_i)\frac{s_{iy}^2}{n_i} \quad \text{.....(44)}$$

Where s_{uy}^2

is the sample variance among the EA totals, and s_{iy}^2

is the sample variance within the ith EA, and

$$s_{uy}^2 = \frac{1}{m-1}\sum_{i=1}^{m}\left(\hat{y}_i - \frac{\sum_{i=1}^{m}\hat{y}_i}{m}\right)^2, \text{ and } s_{iy}^2 = \frac{1}{n_i-1}\sum_{j=1}^{n_i}(y_{ij}-\bar{y}_i)^2 \quad \text{.....(45)}$$

To estimate the district yield $\mu = \tau / N$ the estimator and the estimated variance are:

$$\hat{\mu}_y = \frac{M}{N}.\frac{\sum_{i=1}^{m}\hat{y}_i}{m}, \text{ and } \widehat{var}(\hat{\mu}_y) = \frac{1}{N^2}\widehat{var}(\hat{t}_y) \quad \text{.....(46)}$$

Coefficient of Variation of $\hat{\mu}_y$, i.e.,

$$CV(\hat{\mu}_y) = \frac{\sqrt{\widehat{var}(\hat{\mu}_y)}}{\hat{\mu}_y}x100\% \quad \text{.....(47)}$$

3.2. by Two stages with PPS for the PSU and SRS for the SSU:

The estimates of the District yield is given by

$$\hat{\mu}_y = \frac{\sum_{i=1}^{m}\bar{y}_i}{m} \quad \text{.....(48)}$$

$$\widehat{var}(\hat{\mu}_y) = \frac{1}{m(m-1)}\sum_{i=1}^{m}(\bar{y}_i - \hat{\mu}_y)^2 \quad \text{.....(49)}$$

Coefficient of Variation of $\hat{\mu}$, i.e.,

$$CV(\hat{\mu}_y) = \frac{\sqrt{\widehat{var}(\hat{\mu}_y)}}{\hat{\mu}_y}x100\% \quad \text{.....(50)}$$

The final (adjusted) yield of the District is calculated as follows

$$\bar{y}_f = [\bar{y}(1-r_l)(1-r_u)]x10 \quad \text{.....(51)}$$

Tons / ha

Where:

$1\text{-}r_l$ = adjusting factor for harvesting loss

$1\text{-}r_u$ = adjusting factor for uncultivated area

The average estimated yield for the region/country can be obtained from the following Formula:

$$\bar{y}_c = \frac{1}{A}\sum_{i=1}^{n} A_i \bar{y}_{f_i} \quad \text{.....(52)}$$

Where:

$\bar{y}_c$ = average yield of the region / country

A_i = planted / harvested area of the ith province

A = planted / harvested area of the region / country $(\sum_{i}^{n} A_i)$

n = number of province

The estimate variance for the region / country can be calculated from the following Formula:

$$s^2_{\bar{y}} = \frac{1}{A^2}\sum_{n} \frac{A_p^2 s_p^2}{m_p}$$

Where:

s_p^2 = the estimate variance of the "p" province

A_p = the planted /harvested area of the "p" province

A = the total planted / harvested area of the region/country

$$(\sum_{i=1}^{n} A_i)$$

m_p = the number of the sample villages in the "p" province

$s^2_{\bar{y}}$ = the estimated variance of the average yield of the region / country

The precision of the yield average for the region / country is obtain by the following Formula

$$CV(\bar{y}) = \sqrt{s^2_{\bar{y}}} / \bar{y}_c \; x \; 100 \quad \text{.....(54)}$$

Appendix

Form A - 1

List of EAs for PPS sampling

Page_____ / _____

District:	Code:			

Note :

- If space is not enough to record all the Enumeration Areas(EAs), the same form will be used to record all the rest of the EAs as needed.
- Check √ for the selected EA.
- Size could be in rice area planted or number of households.

No. (1)	EA Name (2)	EA Code (3)		Size (4)	Cumulative 0Size (5)	Selected EAs (√) (6)
1					0	
2					0	
3					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	

Form A - 2

List of EAs for SRS sampling

Page_____ / _____

District:	Code:			

Note :

- If space is not enough to record all the Enumeration Areas(EAs) the same form will be used to record all the rest of the EAs as needed.

- Check √ for the selected EA.

No. (1)	EA Name (2)	EA Code (3)		Selected EAs (√) (6)
1				
2				
3				

Form B

List of households

Page_____ / _____

District:	Code:	Village:

District		County		Enumeration Area		Village		

Note :

- If space is not enough to record all the Enumeration Areas(EAs) the same form will be used to record all the rest of the EAs as needed.

- Check √ for the selected EA.

No. of Household in the Village (1)	Name of Household (2)	Contact Address (3)	Check √ for Rice Cultivation HHs (4)	Put running number (Code of HHs for survey) (5)
1				
2				
3				

Fill appropriate value/description in blocks enclosed by bold lines.

ENUMERATOR

Name:
Signature

List of households

Form C

District:	Code:	Village:

District		County		Enumeration Area		Village		

Last number of the "Code of HHs for survey" in FORM A (Total of Rice HHs)

1. Random Number Table for Selecting Sample H.H.

Total of Rice HHs (1)	Sample H.H. No.			Total of Rice HHs (1)	Sample H.H. No.			Total of Rice HHs (1)	Sample H.H. No.		
	1st (2)	2nd (3)	3rd (4)		1st (2)	2nd (3)	3rd (4)		1st (2)	2nd (3)	3rd (4)
1 - 5	1(4)	2(5)	3	51 - 55	11(12)	28(29)	45(46)	101 - 105	21(22)	58(59)	95(96)
6 - 10	2(3)	4(5)	6(7)	56 - 60	12(13)	31(32)	50(51)	106 - 110	22(23)	62(63)	102(101)
11 - 15	3(4)	7(8)	11(12)	61 - 65	13(14)	34(35)	55(56)	111 - 115	23(24)	65(66)	107(108)
16 - 20	4(5)	9(10)	14(15)	66 - 70	14(15)	38(19)	66(67)	116 - 120	24(25)	68(69)	112(113)
21 - 25	5(6)	11(12)	17(13)	71 - 75	15(16)	42(43)	69(70)	121 - 125	25(26)	72(73)	119(120)
26 - 30	6(7)	14(15)	22(16)	76 - 80	16(17)	46(47)	76(77)	126 - 130	26(27)	75(76)	124(125)
31 - 35	7(8)	17(18)	27(28)	81 - 85	17(18)	48(49)	79(80)	131 - 135	27(28)	78(79)	129(130)
36 - 40	8(9)	20(21)	32(31)	86 - 90	18(19)	51(52)	84(85)	136 - 140	28(29)	80(81)	132(133)
41 - 45	9(10)	23(24)	37(38)	91 - 95	19(20)	54(55)	87(88)	141 - 145	29(30)	82(83)	135(136)
46 - 50	10(11)	26(27)	42(43)	96 - 100	20(21)	56(57)	92(91)	146 - 160	31(32)	84(85)	138(139)

Remark : The number in ( ) indicate the alternative sample households.

2. Selected sample households for the survey

	Sample H.H. No. (1)	Name of Sample H.H. (2)	Contact Address (3)	Remark (4)
1				
2				
3				
4				Alternative Sample Household
5				Alternative Sample Household
6				Alternative Sample Household

Fill appropriate value/description in blocks enclosed by bold lines.

ENUMERATOR

Name:			
Signature			
Date of Work:			

Questionnaire

Form D

Interview to sample household

1. Identification of sample household

Name of Household:									Tel Number:				
District:				County:					Village:				
District		County		Enumeration Area		Village			Household			Coordinaters	
												E	N

2. Farming situation

Total Farming Plots (plots) (1)	Total Farming Area (ha) (2)	Rice Crop during this growing season (estimated)		
		Total Harvested Plots (number) (3)	Total Harvested Plots (ha) (4)	Production (expected) (Kg) (5)

3. Rice farming situation

Crop Season	Farming Date		Planting Method	Ecosystem	Variety	Growing Conditions
1st Season=1, 2nd Season=2 (6)	Planted (7)	Harvested (8)	Transplanting=1 Broadscasting=2 (9)	Irrigated=1, Rainfed=2, Upland=3 (10)	Hybrid = 1 Inbred -Certified = 2, Farmer's /Good Seeds = 3, Traditional/Native = 4 (11)	very bad = 1, bad=2, normal = 3, good = 4, very good = 5 (12)

Fill appropriate value/description in blocks enclosed by bold lines.

Field survey note

Form E - 1

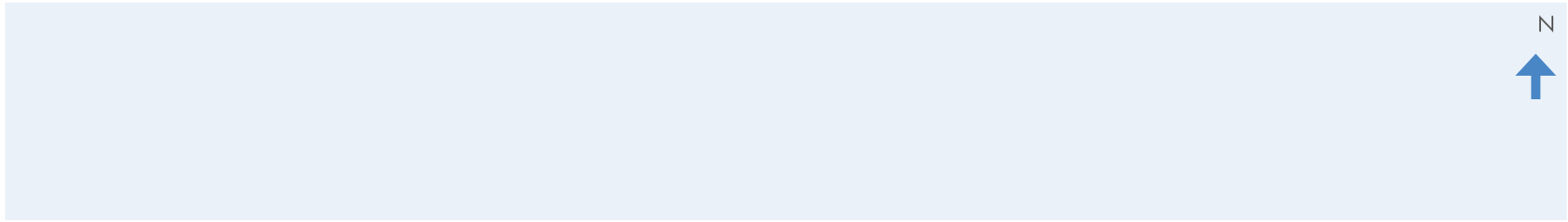
Identification of rice plots for crop cutting & area measurement by tape measure

Page 1 / ____

1. Identification of sample household

Name of Household:									Tel Number:				
District:				County:					Village:				
District		County		Enumeration Area		Village			Household			Coordinaters	
												E	N

2. Location of the rice plots



Note:

- Sketch the location of the sample househpld and all his/her rice plots, and put running numbers.
- Plot: The cultivated area bounded by clear dyke, road/foot-passes and canal/drain with same cultivation in terms of period, variety and planting method.

3. Select 1 Sample plot for crop cutting using the random number table

Total number of rice plots	1	2	3	4	5	7	8	9	10	11	12	13	14	15
Random No.	1	2	2	3	4	6	7	7	8	9	10	11	12	14
											Selected Rice Plot for Crop Cutting			

4.Total rice rrea of the sample household

Plot No. (1)	Harvested area [T(A)] (2)	Un-cultivated area		Plot No. (1)	Harvested area [T(A)] (2)	Un-cultivated area		Plot No. (1)	Harvested area [T(A)] (2)	Un-cultivated area	
		N1 (3)	N2 (4)			N1 (3)	N2 (4)			N1 (3)	N2 (4)
1				6				11			
2				7				12			
3				8				13			
4				9				14			
5				19				15			
								TOTAL			

- Fill appropriate value/description in blocks enclosed by bold lines.
- Shaded blocks are parts for statistical officers, enumerators are not required to fill in.
- Harvested Area mesurement is applicable for all sample households.
- Un-cultivated area mesurement is applicable only for same sample plot of Crop Cutting in3rd sample household

This page should be prepaerd for every plot owned by sample household

5. Sketch the rice plot and divide into triangle shapes

Plot No	

N

Note:

- Sketch the shape of rice plot with vicinity
- Divide the plot of of selected household into triangle shape as many as necessary

6. Harvested area of rice plot for each triangle, measure the length of each side unit: m^2

Triangle No.	a (1)	b (2)	c (3)	s (4)	AREA (A) (5)
A - 1					
A - 2					
A - 3					
A - 4					
TOTAL : T(A)					

For secton 7 and 8, un-cultivated area is applicable only for same sample plot of Crop Cutting in 3rd sample household

7. Un-Cultivated area measurement of the plot (outside of the plot as like dyke) unit: m^2

Dyke No.	Width of Dyke at point (metres)			Average width (4)=[(1)+(2)+(3)]/6	Length of Dyke (metres)	Total Dyke Area (6) = (4)x(5)
	No.1 (1)	No.1 (2)	No.1 (3)	(4)	(5)	(6)

	(1)	(2)	(3)	(4)	(5)	(6)
D - 1						
D - 2						
D - 3						
D - 4						
D - 5						
D - 6						
TOTAL: (N1)						

8. Un-Cultivated area measurement of the plot (intside of the plot) unit: m^2

Trees (1)	Rest Area (2)	Well (3)	Ditchs (4)	Road (5)	Others (6)	Total: (N2) (7)

9. Total planted area of the sample households unit: m^2

Plot No. (1)	Harvested area T(A) (2)	Un-Cultivated area (N1 + N2) (3)	Outside (N1) (4)	Inside (N2) (5)

ENUMERATOR

Name:			
Signature			
Date of Work:			

Field survey note

Form F - 1

Identification of rice plots for crop cutting & area measurement by GPS receiver

Page 1 / ____

1. Identification of sample household

Name of Household:									Tel Number:				
District:				County:					Village:				
District		County		Enumeration Area		Village			Household			Coordinaters	
												E	N

2. Location of the rice plots

N

Instruction:

- Map the location of sample household's residence and all its rice fields and plots, and number the plots.
- Plot: The cultivated area clearly defined by a dyke, a road or paths , canal or a drain, and having homogeneous cultures in terms of season, variety and planting method.

3. Select 1 Sample plot for crop cutting using the random number table

Total number of rice plots	1	2	3	4	5	7	8	9	10	11	12	13	14	15
Random No.	1	2	2	3	4	6	7	7	8	9	10	11	12	14
											Selected Rice Plot for Crop Cutting			

4.Total rice area of the sample household

Plot No. (1)	Harvested area [T(A)] (2)	Un-cultivated area		Plot No. (1)	Harvested area [T(A)] (2)	Un-cultivated area		Plot No. (1)	Harvested area [T(A)] (2)	Un-cultivated area	
		N1 (3)	N2 (4)			N1 (3)	N2 (4)			N1 (3)	N2 (4)
1				6				11			
2				7				12			
3				8				13			
4				9				14			
5				19				15			
								TOTAL			

- Fill appropriate value/description in blocks enclosed by bold lines.
- Shaded blocks are parts for statistical officers, enumerators are not required to fill in.
- Harvested Area mesurement is applicable for all sample households.
- Un-cultivated area mesurement is applicable only for same sample plot of Crop Cutting in3rd sample household

Form F2

This page should be prepared for every plot owned by sample household

Page _____ / _____

5. Sketch the rice plot

Plot No	

N

Harvested Area of the Rice Plot Measured by GPS Receiver T(A): m^2

Note:

- Sketch the shape of rice plot with vicinity
- Measure theharvested area of the plot without vicinity

6. Un-Cultivated Area Measurement of the Plot (outside of the plot as like dyke)

Instruction:

- Measure the width of the dyke in three different parts on each side of the plot.
- Measure the length of each dyke.
- The length and width of the dyke can be determined using a tape measure.

unit: m^2

Dyke No.	Width of Dyke at point (metres)			Average width (4)=[(1)+(2)+(3)]/6 (4)	Length of Dyke (metres) (5)	Total Dyke Area (6) = (4)x(5) (6)
	No.1 (1)	No.1 (2)	No.1 (3)			
D - 1						
D - 2						
D - 3						

D - 4						
D - 5						
D - 6						
TOTAL: (N1)						

Note: Width and Length of Dyke can be measured bu tape

For secton 7 and 8, un-cultivated area is applicable only for same sample plot of Crop Cutting in 3rd sample household

7. Un-Cultivated area measurement of the plot (inside of the plot) unit: m^2

Trees (1)	Rest Area (2)	Well (3)	Ditchs (4)	Road (5)	Others (6)	Total: (N2) (7)

Note: Width and Length of Dyke can be measured bu tape

8. Total Planted area of the sample households unit: m^2

Plot No. (1)	Harvested area T(A) (2)	Un-Cultivated area (N1 + N2) (3)	Outside (N1) (4)	Inside (N2) (5)

ENUMERATOR

Name:			
Signature			
Date of Work:			

Field survey note

Crop cutting

Form G

Identification of rice plots for crop cutting & area measurement by GPS receiver

1. Identification of sample household

Name of Household:									Tel Number:				
District:				County:					Village:				
District		County		Enumeration Area		Village			Household			Coordinaters	
												E	N

2. Sketch the shape of sample plot and locate the 2 Sample Units for Crop Cutting.

2.1 Choose a starting point (any angle of the sample plot) and along the dyke on your right by counting not more than 30 steps, then turn inward the sample plot by counting back 30 steps (at most). The end point is the location of the Sample Unit No. 1.

2.2 Starting from the opposite angle to the previous sample in the same plot, proceed the same way to determine the location of the Sample Unit No. 2.

2.3 Where each square spot is located, file (or assemble) as part of the crop cutting frame (1m x 1m) by putting an iron rod at two of its opposite angles. The crop cutting frame must be stable during the cutting of rice stalks with mature grains."

N

3. Cut all panicle and pick grains in each sample unit.

When complete each items please check (√) in the block

3.1 Cut all of the panicles and collect all the left seeds on the ground, then put into each mesh bag

3.2 Mark each of the mesh bags with ID tag

4. Send all the sample to the designated Statistical Officer

Fill appropriate value/description in blocks enclosed by bold lines.

Sample Unit No.1 (check √)	Sample Unit No.1 (check √)

ENUMERATOR

Name:			
Signature			
Date of Work:			

Field survey note

for harvesting loss survey

Form H

1. Identification of sample household

Name of Household:									Tel Number:				
District:				County:					Village:				
District		County		Enumeration Area		Village			Household			Coordinaters	
												E	N

2. Sketch the shape of sample plot and locate the 2 sample units for harvesting loss count.

Determine the location of the two (2) sampling units for Harvesting Loss Survey by following the same procedure as for locating the sampling units of Crop Cutting Survey . Whenever possible, carry out the study on the plot assigned to the Crop Cutting Survey. Otherwise, choose the next plot of the same sample household.

N

3. Pick all the remaining grains in both sample units of harvesting loss survey, separately.
When complete each items please check (√) in the block
3.1. Pick all left seeds on the ground and put the grains into the bag
3.2. Mark the bags with ID tag

4. Send all bags to the designated Statistical Officer
Fill appropriate value/description in blocks enclosed by bold lines.

Sample Unit No.1 (check √)	Sample Unit No.1 (check √)

ENUMERATOR

Name:			
Signature			
Date of Work:			

Field survey note

Laboratory work for crop cutting

Form I

1. Identification of sample household

Name of Household:									Tel Number:				
District:				County:					Village:				
District		County		Enumeration Area		Village			Household			Coordinaters	
												E	N

2. Please make sure all grains are dried, If it is too wet, sun dry it for a short period.

	Measurement unit	Sample unit No. 1	Sample unit No. 2
1. Weight of threshed and clean grains	grams		
2. Moisture content of threshed grains	%		
3. Weight of dry grains[Using Table 1(conversion factor)]	grams/m^2		
4. Convert items 3 to kilograms per hectare (x 10)	kgs/ha		

3. Yield measurement of Harvest Loss units

Please make sure all grains are dried, If it is too wet, sun dry it for a short period.

	Measurement unit	Sample unit No. 1	Sample unit No. 2
1. Weight of threshed and clean grains	grams		
2. Moisture content of threshed grains.	%		
3. Weight of dry grains [Using Table 1 (conversion factor)]	grams/m^2		
4. Convert items 3 to kilograms per hectare (x 10)	kgs/ha		

OPERATOR OF LABORATORY WORK

Name:			
Signature			
Date of Work:			

Table 1 : Conversion factor from wet grains to dry grains at 14% moisture content.

Moisture of Wet Grain (1)	Conversion Factor (2)	Moisture of Wet Grain (1)	Conversion Factor (2)	Moisture of Wet Grain (1)	Conversion Factor (2)	Moisture of Wet Grain (1)	Conversion Factor (2)
350	7.558	329	7.802	308	8.047	287	8.291
349	7.570	328	7.814	307	8.058	286	8.302
348	7.581	327	7.826	306	8.070	285	8.314
347	7.593	326	7.837	305	8.081	284	8.326
346	7.605	325	7.849	304	8.093	283	8.337
345	7.616	324	7.860	303	8.105	282	8.349
344	7.628	323	7.872	302	8.116	281	8.360
343	7.640	322	7.880	301	8.128	280	8.372
342	7.651	321	7.891	300	8.140	279	8.384
341	7.663	320	7.903	299	8.151	278	8.395
340	7.674	319	7.915	298	8.163	277	8.407
339	7.686	318	7.926	297	8.174	276	8.419
338	7.698	317	7.938	296	8.186	275	8.430
337	7.709	316	7.950	295	8.198	274	8.442
336	7.721	315	7.961	294	8.209	273	8.453
335	7.733	314	7.979	293	8.221	272	8.465
334	7.744	313	7.984	292	8.233	271	8.477
333	7.756	312	8.002	291	8.244	270	8.488
332	7.767	311	8.008	290	8.256	269	8.500
331	7.779	310	8.023	289	8.267	268	8.512
330	7.791	309	8.035	288	8.279	267	8.523

Note : dry weight = wet weight x conversion factor

Moisture of Wet Grain (1)	Conversion Factor (2)	Moisture of Wet Grain (1)	Conversion Factor (2)	Moisture of Wet Grain (1)	Conversion Factor (2)	Moisture of Wet Grain (1)	Conversion Factor (2)
266	8.535	246	8.767	226	9.000	206	9.233
265	8.547	245	8.779	225	9.012	205	9.244
264	8.558	244	8.791	224	9.023	204	9.256
263	8.570	243	8.802	223	9.035	203	9.267
262	8.581	242	8.814	222	9.047	202	9.279
261	8.593	241	8.826	221	9.058	201	9.291
260	8.605	240	8.837	220	9.070	200	9.302
259	8.616	239	8.849	219	9.081	199	9.314
258	8.628	238	8.860	218	9.093	198	9.326
257	8.640	237	8.872	217	9.105	197	9.337
256	8.651	236	8.884	216	9.116	196	9.349
255	8.663	235	8.895	215	9.128	195	9.360
254	8.674	234	8.907	214	9.140	194	9.372
253	8.686	233	8.919	213	9.151	193	9.384
252	8.698	232	8.930	212	9.163	192	9.395
251	8.709	231	8.942	211	9.174	191	9.407
250	8.721	230	8.953	210	9.186	190	9.419
249	8.733	229	8.965	209	9.198	189	9.430
248	8.744	228	8.977	208	9.209	188	9.442
247	8.756	227	8.988	207	9.221	187	9.453
186	9.465	166	9.698	146	9.930	126	10.163

Moisture of Wet Grain (1)	Conversion Factor (2)	Moisture of Wet Grain (1)	Conversion Factor (2)	Moisture of Wet Grain (1)	Conversion Factor (2)	Moisture of Wet Grain (1)	Conversion Factor (2)
185	9.477	165	9.709	145	9.942	125	10.174
184	9.488	164	9.721	144	9.953	124	10.186
183	9.500	163	9.733	143	9.965	123	10.198
182	9.512	162	9.744	142	9.977	122	10.209
181	9.523	161	9.756	141	9.988	121	10.221
180	9.535	160	9.767	140	10.000	120	10.233
179	9.547	159	9.779	139	10.012	119	10.244
178	9.558	158	9.791	138	10.023	118	10.256
177	9.570	157	9.802	137	10.035	117	10.267
176	9.581	156	9.814	136	10.047	116	10.279
175	9.593	155	9.826	135	10.058	115	10.291
174	9.605	154	9.837	134	10.070	114	10.302
173	9.616	153	9.849	133	10.081	113	10.314
172	9.628	152	9.860	132	10.093	112	10.326
171	9.640	151	9.872	131	10.105	111	10.337
170	9.651	150	9.884	130	10.116	110	10.349
169	9.663	149	9.895	129	10.128	109	10.360
168	9.674	148	9.907	128	10.140	108	10.372
167	9.686	147	9.919	127	10.151	107	10.384

Table 2 : Raw data from the survey

No. (1)	Identification of Sample Household								
	District (Code) (2)	County (Code) (3)	EA (Code) (4)	Villag (Code) (5)	Household No. (Code) (6)	Total Farming Plots (plts) (7)	Total Farming Area (ha) (8)	Rice Farming	
								Total Harvested Plots (Plot) (9)	Ha Ar

From Form D								
Rice Farming Situation								
in this Crop Season		Crop Season (Code) (12)	Farming Date		Planting Method (Date) (15)	Ecosytem (Code) (16)	Variety (Code) (17)	Growing Conditions (Code) (18)
Total arvested rea (ha) (10)	Production (expected) (ton) (11)		Planted (Date) (13)	Harvested (Date) (14)				

		From For
Harvested Area [T(A)] (m^2) (19)	Rice Farmin	
	T(N1)+T(N2) (m^2) (20)	Dyke Area (m (2

rm E or F		
ng Situation		Proportion of Uncultivated Area (m^2) (23)
as [T(N1)]) (m^2) 1)	Other Uncultivated Areas [T(N2)] (m^2) (22)	

From

Crop Cutting unit 1				Crop Cutting unit 2			
Weight of threshed and clean grains (grams) (24)	Moisture content of threshed grains (%) (25)	Weight of dry grains (grams/m^2) (26)	Convert to kilograms per hectare (x 10) (kgs/ha) (27)	Weight of threshed and clean grains (grams) (28)	Moisture content of threshed grains (%) (29)	Weight of dry grains (grams/m^2) (30)	Convert to kilograms per hectare (x 10) (kgs/ha) (31)

Form I

Harvesting Loss unit 1				Harvesting Loss unit 2			
Weight of threshed and clean grains (grams) (32)	Moisture content of threshered grains (%) (33)	Weight of dry grains (grams/m^2) (34)	Convert to kilograms per hectare (x 10) (kgs/ha) (35)	Weight of threshed and clean grains (grams) (36)	Moisture content of threshered grains (%) (37)	Weight of dry grains (grams/m^2) (38)	Convert to kilograms per hectare (x 10) (kgs/ha) (39)

Rice production statistic survey using the dot sampling method and Google earth

How to estimate the planted area and yield per ha in a country

FAO South-South Cooperation project

Strengthening agricultural statistics and food security information in CARD countries through South-South Cooperation (GCP/INT/161/JPN)

1 Introduction

1.1. Background

In the framework of the project entitled "Improving Food Security Information in Africa", AfricaRice and the Ministry of Agriculture, Forestry and Fisheries, Japan introduce in Africa the concept of the rice production statistic survey which is called "the dot sampling method".

The manual shows how to carry out the rice production survey which consists of planted area survey and yield survey using the new survey method.

1.2. Package of rice production survey

The package of rice production survey which is shown in the paper consists of three components. The first component of the package is the method of estimating rice production.

The method of estimating rice production is based on the calculating formula that "the average yield times the planted area".

the average yield of rice in the target region	X	the planted area of rice in the target region	=	Rice Production

Note-1: Target region is an estimation unit and is usually nation or its administrative subdivision.

Note-2: Planted area is almost as same as cultivated area, when you check planted area at the time of harvesting.

Note-3: In this package, planted area does not include dyke. So the yield must be calculated without dyke. Therefore if area includes dyke, you cannot follow this package, as in that case the yield must be calculated with dyke.

The second component of the package is yield survey. As for yield survey, the average yield is estimated by actual measurement weighing the rice reaped from sample lots selected by probability proportional to area during harvest season. The method is called crop cutting.

The third component of the package is planted area survey. The dot sampling method is used for estimating planted area of rice. You multiply rice's share by the total area of the target region using rice's share of the total number of sample dots which you put in the target region.

The manual is compiled based on the three components. In this concept and survey method, the dot sampling method from binomial distribution and Google Earth[1] which is a Web site to provide a kind of digital maps play very important role to carry out the new survey which is based on the three components.

1.3. Characteristic of the manual

Based on the idea which is shown above, the manual describes how to conduct the rice planted area survey and the rice crop cutting survey in order that you can carry out those surveys in your countries from the view point of the technical crop statistics procedure, although, it is important issue how to prepare budget, labor force, organization, etc., the manual never refer to those issues.

This manual for the pilot survey might be a text book rather than a manual. You might have to modify this manual in order to carry out the rice production survey effectively in your country considering such issues which are mentioned above. It is expected that the manual will be improved based on the experience of the pilot survey.

[1] Please search on Google web site, and download it. Without the Google Earth, it is impossible to carry out this survey. The URL is shown here. http://www.google.com/earth/index.html

2. Rice planted area survey using the dot sampling method

2.1. Basic idea and method

You are going to estimate reliable rice planted area in your target region based on the statistical manner, namely the dot sampling method using Google Earth. This chapter explains the method and procedure to carry out the survey.

When you estimate it based on the method, the formula is shown as follows:

$$\hat{T} = W \times \hat{p}$$

$\hat{T}$ is the rice planted area in the target region.

W is the total area of the target region. It is obtained from government office.

$\hat{p} = n_1/n$ is the rice's share of the total number of sample dots in the target region.

n is sample size and

n_1 is the number of sample dots which fall on the rice planted area.

In this method, the most important issues to obtain the estimate are how to put the sample dots at random on Google Earth, how to prepare for the field survey, how to conduct the field survey, and finally how to estimate reliable $\hat{p}$ used in the formula. Thus, you can obtain a reliable rice planted area in the target region effectively.

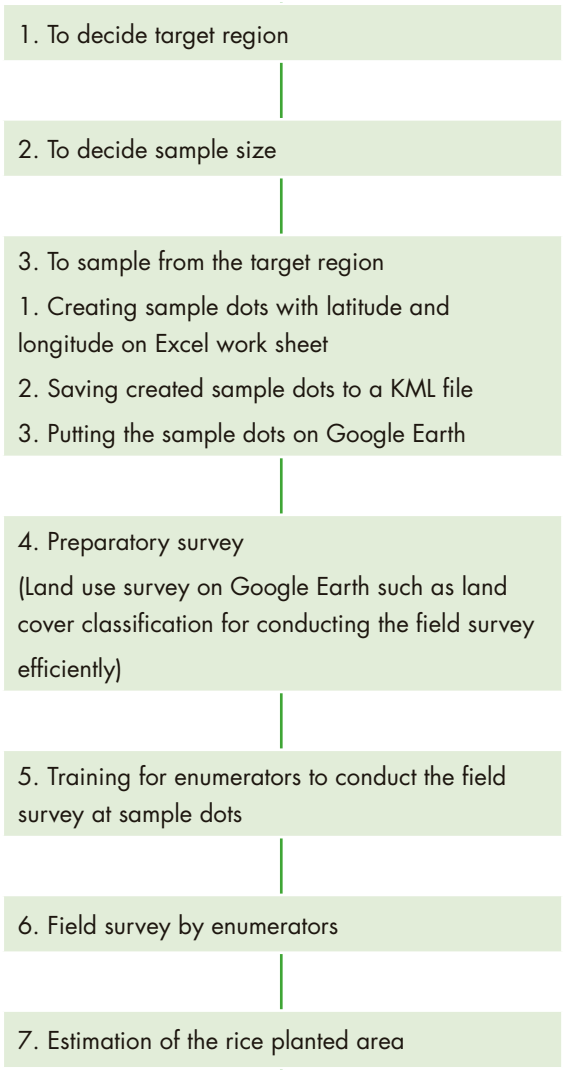
This is the basic concept and procedure of the rice planted area survey based on the dot sampling method.

2.2. General procedure of the survey

The general flowchart on the procedure of the dot sampling survey to estimate the rice planted area is shown below.

Fig-1 General flowchart of planted area survey using the dot sampling method

Details of procedure by step are explained below.



Details of procedure by step are explained below.

2.2.1. To decide target region

You decide the target region of the rice production survey. The target region is whole country for the pilot survey, as the purpose of the pilot survey is estimating rice production in your country.

2.2.2. To decide sample size

The number of sample dots is determined based on the rice's proportion of the target area obtained from existing information as well as on the aimed precision considering the policy requirement and available resource such as labor force.

From the view point of statistics, the number of sample dots is determined properly considering the value which is generated from the common formula. The formula is shown below as Note 1.

Table-1 will be convenience and help you decide the sample size, seeing rice's proportion and aimed precision in the target area.

Table-1 Necessary sample size computed from C and C.V.

Rice's proportion	Other's proportion	Variance	Standard deviation	Relative standard deviation	CV (Coef			
P	Q	PQ	√PQ	C=(√PQ)/P	0.01	0.02	0.03	0.0
0.01	0.99	0.0099	0.0995	9.9499	990 000	247 500	110 000	61
0.02	0.98	0.0196	0.1400	7.0000	490 000	122 500	54 444	30
0.03	0.97	0.0291	0.1706	5.6862	323 333	80 833	35 926	20
0.04	0.96	0.0384	0.1960	4.8990	240 000	60 000	26 667	15
0.05	0.95	0.0475	0.2179	4.3589	190 000	47 500	21 111	11
0.06	0.94	0.0564	0.2375	3.9581	156 667	39 167	17 407	9
0.07	0.93	0.0651	0.2551	3.6450	132 857	33 214	14 762	8
0.08	0.92	0.0736	0.2713	3.3912	115 000	28 750	12 778	7
0.09	0.91	0.0819	0.2862	3.1798	101 111	25 278	11 235	6
0.10	0.90	0.0900	0.3000	3.0000	90 000	22 500	10 000	5
0.11	0.89	0.0979	0.3129	2.8445	80 909	20 227	8 990	5
0.12	0.88	0.1056	0.3250	2.7080	73 333	18 333	8 148	4
0.15	0.85	0.1275	0.3571	2.3805	56 667	14 167	6 296	3
0.20	0.80	0.1600	0.4000	2.0000	40 000	10 000	4 444	2
0.25	0.75	0.1875	0.4330	1.7321	30 000	7 500	3 333	1
0.30	0.70	0.2100	0.4583	1.5275	23 333	5 833	2 593	1
0.40	0.60	0.2400	0.4899	1.2247	15 000	3 750	1 667	
0.50	0.50	0.2500	0.5000	1.0000	10 000	2 500	1 111	
0.60	0.40	0.2400	0.4899	0.8165	6 667	1 667	741	
0.70	0.30	0.2100	0.4583	0.6547	4 286	1 071	476	
0.80	0.20	0.1600	0.4000	0.5000	2 500	625	278	
0.90	0.10	0.0900	0.3000	0.3333	1 111	278	123	
1.00	0.00	0.0000	0.0000	0.0000	0	0	0	

ficient of variation of estimate(sample mean)), Aimed precision, permissive error

04	0.05	0.06	0.07	0.08	0.09	0.10	0.15	0.20
875	39 600	27 500	20 204	15 469	12 222	9 900	4 400	2 475
625	19 600	13 611	10 000	7 656	6 049	4 900	2 178	1 225
208	12 933	8 981	6 599	5 052	3 992	3 233	1 437	808
000	9 600	6 667	4 898	3 750	2 963	2 400	1 067	600
875	7 600	5 278	3 878	2 969	2 346	1 900	844	475
792	6 267	4 352	3 197	2 448	1 934	1 567	696	392
304	5 314	3 690	2 711	2 076	1 640	1 329	590	332
188	4 600	3 194	2 347	1 797	1 420	1 150	511	288
319	4 044	2 809	2 063	1 580	1 248	1 011	449	253
625	3 600	2 500	1 837	1 406	1 111	900	400	225
057	3 236	2 247	1 651	1 264	999	809	360	202
583	2 933	2 037	1 497	1 146	905	733	326	183
542	2 267	1 574	1 156	885	700	567	252	142
500	1 600	1 111	816	625	494	400	178	100
875	1 200	833	612	469	370	300	133	75
458	933	648	476	365	288	233	104	58
938	600	417	306	234	185	150	67	38
625	400	278	204	156	123	100	44	25
417	267	185	136	104	82	67	30	17
268	171	119	87	67	53	43	19	11
156	100	69	51	39	31	25	11	6
69	44	31	23	17	14	11	5	3
0	0	0	0	0	0	0	0	0

Note 1: The formula which is used to make the above table is shown below.

$$n = \frac{C^2}{C.V^2} = \frac{PQ}{d^2}$$

Where,

n sample size (number of sample dots)

$C = \frac{\sqrt{PQ}}{P}$ Coefficient of variation in population (target area)

P the rice's proportion of the target area

Q: $1 - P$

$C.V = \frac{d}{P}$ Coefficient of variation of estimate, relative standard error.

d aimed standard error (SE) of estimate (acceptable error, permissible error, allowance error)[2]

Note 2: It is seemed that the sample size should be around 10,000 sample dots, at least, 5,000 to generate reliable statistics.

2.2.3. To sample from the target region

The procedure of sampling from target region consists of three steps.

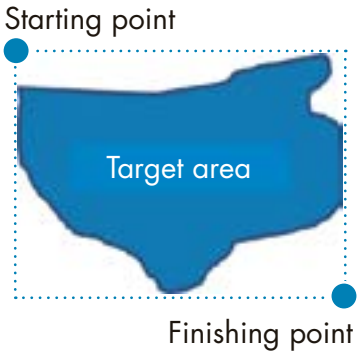
(1) First step : To create a table–Latitude and longitude Coordinates for Sample dots on Excel work sheet.

At the beginning, you open the "creating sample file"[3], which is Excel file. You click the file and a worksheet appears. The Excel worksheet which is shown below has two tables. One is T-1, another is T-2.

You input information about required in the T-1 table. Starting point is selected around the cross point of farthest north- west in the target area[4]. Putting mouse pointer on around the starting point on Google Earth, you will find the latitude and longitude coordinates.

Then the T-2 table which shows sample dots with longitudes and latitudes coordinates is created automatically.

Fig-2 Starting point and finishing point



Then, you check the T-2 table whether the sample dots are created enough to cover the whole target area or not seeing the farthest south-east point of the target area. When those are not crated enough, you expand the T-2 table dragging the table to right side or down side properly.

Finally, you save the file.

Table-2. Creating sample sheet for the dot sampling

[2] You can guess the aimed standard error of estimate using the formula $d = \sqrt{PQ/n}$.

[3] It is to generate sample dots combining latitude and longitude coordinate to be square-grid.

[4] Do not be serious about this matter. If you point out around the place with your random selecting using mouse pointer, the latitude and longitude are shown. You can use them as the starting point.

T-1 Basic data to generate sample dots

Target area	Size of the target area km^2	Sample size	Starting point (latitude)	Starting point (longitude)	Interval in km (depend on (3))
(1)	(2)	(3)	(4)	(5)	(6)= √((2)/(3))
Benin	112 622	5 000	12 405	0.747	4.745987779

T-2 Sample dots

	Name of Longitude → Latitude ↓	0	1	2	3	4
0	B0,	12.405,0.747	12.405,0.790653078665057	12.405,0.834306157330114	12.405,0.877959235995172	12.405,0.921612314660229
1	B1,	12.362222639900 5,0.747	12.362222639900 5,0.790645913866 72	12.362222639900 5,0.834291846573344	12.362222639900 5,0.877937769860017	12.362222639900 5,0.921583693146685
2	B2,	12.319445279801 1,0.747	12.319445279801 1,0.790387945748 03	12.319445279801 1,0.834277589143605	12.319445279801 1,0.877916383724408	12.319445279801 1,0.921555178299321
3	B3,	12.276667919701 6,0.747	12.276667919701 6,0.790316925084 39	12.276667919701 6,0.834263385016977	12.276667919701 6,0.877895077525316	12.276667919701 6,0.921526770033755
4	B4,	12.233889059602 2,0.747	12.233889059602 2,0.790246170666 57	12.233889059602 2,0.834249234133315	12.233889059602 2,0.877873051199372	12.233889059602 2,0.921498469166632
5	B5,	12.191111319950 27,0.747	12.191111319950 27,0.790175692286 22	12.191111319950 27,0.834135126457245	12.191111319950 27,0.877852704605867	12.191111319950 27,0.921470279149
6	B6,	12.148333839403 3,0.747	12.148333839403 3,0.790105459735 83	12.148333839403 3,0.834221091947167	12.148333839403 3,0.877831637920 75	12.148333839403 3,0.921442183894333
7	B7,	12.105555479303 8,0.747	12.105555479303 8,0.790035502808 76	12.105555479303 8,0.834207100561753	12.105555479303 8,0.877810650842629	12.105555479303 8,0.921414201123505
8	B8,	12.062781119204 4,0.747	12.062781119204 4,0.789965811299 23	12.062781119204 4,0.834193162259846	12.062781119204 4,0.877789743389769	12.062781119204 4,0.921386324519693
9	B9,	12.020000375910 49,0.747	12.020000375910 49,0.789896385002 32	12.020000375910 49,0.834179277000464	12.020000375910 49,0.877769915500696	12.020000375910 49,0.921358554000929

(2) Second step: To save the sample dots which are generated on the Excel work sheet (T-2) into KML file.

You open both of the files, "macro program file"[5] and "creating sample file" which is mentioned above. But, you do not need to operate anything on the macro program file.

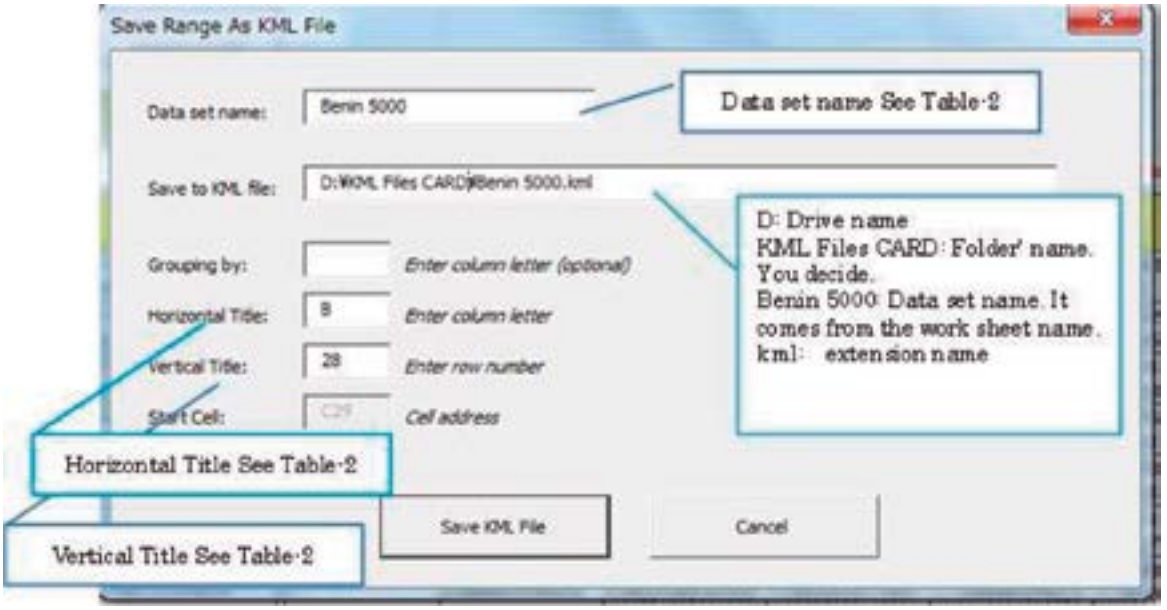
You make operations only on the T-2 table in the "creating sample file". The procedure of the operations is shown below.

- **I. Select the first cell containing data (top-left cell(C: 29) which is filled with starting latitude and longitude coordinates) in the table T-2.**
- **II. From the View Menu on the Excel work sheet, select Macros.**
- **III. Select "SaveRangeAsKML"**
- **IV. Click Run**
- **V. Dialog box of "Save Range as KML File" which is shown below appears. Fill in necessary data and click "Save KML File" button. The KML file[6] is saved in the hard disk drive which you appoint.**

(3) Third step: To open KML file to put sample dots in the target area on Google Earth.

You double-click the KLM file which is saved in the hard disk drive, and the locations of sample dots whose shape is pin are displayed on Google Earth. The pins appear on sample dots. You check that whether the sample dots are distributed completely over the whole target area or not.

Fig-3 Dialog table



[5] The macro program was made by Mr. Hakan Yuksel, who is a JICA expert and international consultant.

[6] The KML file can be sent to local office by e-mail. It is a convenient function.

Fig-4 Map in Benin on Google Earth which is put sample dots

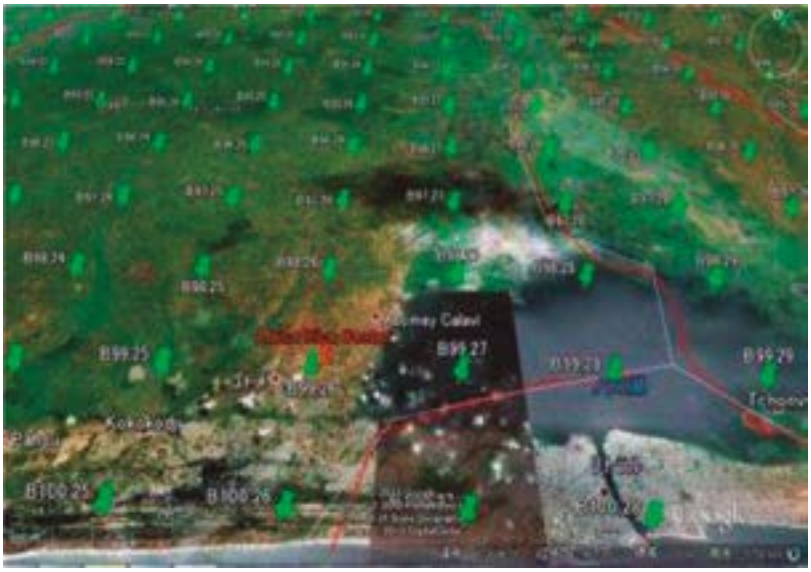


Fig-5 Map in Benin on Google Earth in which is zoomed

2.2.4. Preparatory survey

You make Google Earth active, and you check the land use category at sample dots one by one displaying each location of the sample dots. Checking the category, you record the category codes in the preparatory survey form for the rice planted area survey.

The land use category for the rice planted area survey on Google Earth is shown below. The definition of the each category is shown later (See2.2.8.).

This work is expected to be conducted once a year or at least every two or three years to reflect the results of the updating maps. Table-3 Land use category for

Photos: ©FAO

the rice planted area survey on Google Earth

Category	Code
Non-cultivated land	1
Cultivated land (real planting area)	2
Dyke (to keep back water in rice field), tree, rock, ant-hill, cottage, parking space, border tree, etc in cultivated land	3
Tentative Reserve	8
Low resolution	9

Note: The "Tentative Reserve" is a tentative category. When you are checking land use category on Google Earth, you might often meet some sample dots which you cannot decide the category quickly.

In such cases, the category is useful for you. You can decide it later

The preparatory survey form for the rice planted area survey is shown below.

First, you record the results on the form, after that you enter the results on the form into the Excel work sheet.

Table -4 Preparatory survey form for the rice planted area survey

Name of Latitude / Longitude	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
B0,																					
B1,																					
B2,																					
B3,																					
B4,																					
B5,																					
B6,																					
B7,																					
B8,																					
B9,																					
B10,																					

Note: The number of cell on the table should be increased or decreased considering the sample size.

You count the number of each land use category using Excel functions "FREQUENCY" or "COUNTIF".

The example of the result of the survey is shown below.

Table-5 Share of land use by category estimated through the preparatory survey on Google Earth

Category	Code	Number (frequency distribution)	Share
Non-cultivated land	1	7 200	0.720
Cultivated land (real planting area)	2	2 640	0.264
Dyke (to keep back water in rice field), tree, rock, ant-hill, cottage, parking space, border tree, etc in cultivated land	3	160	0.016
Tentative Reserve	8	0	0.000
Low resolution	9	0	0.000
Total		10 000	1.000
Special calculation (Rate of Dyke)			0.057
Rate of Dyke =(Dyke,etc)/{Cultivated land (real planting area)+(Dyke,etc)}			

Note1: One of the most important significance is to count the number of sample dots which you should go to for the field survey. It makes your survey efficient. The categories which you have to conduct the field survey of are "Cultivated land", "Dyke, etc." and "Tentative reserve".

Note2: The special calculation (Rate of Dyke) will be used as a factor to adjust yield which includes the effect of dyke.

2.2.5. Training for enumerators to conduct the field survey at sample dots.

1. Points of the training

Before conducting the field sampling survey for rice planted area, you hold an instruction meeting for the enumerators, in order to conduct the area survey in the field.

The points which you instruct to enumerators are shown below.

(1) The responsibility of an enumerator

- **The sample dots are assigned to each enumerator.**
- **The enumerator has to complete the field survey at the sample dots.**

(2) What an enumerator has to do at the sample dot

- **To check land use at the sample dot based on the survey form in the field using a guide map.**
- **How to read and use the guide maps.**
- **How to fill in the survey form.**
- **The definitions of the category to be used for the survey.**

(3) Schedule of the survey

- **When the survey should be conducted. How many times the survey should be conducted for a year.**
- **When the survey form should be reported to the office.**

2 Basic materials for the training.

(1) Field survey form for rice planted area survey.

The field survey form is shown below.

Table-6 Field survey form for rice planted area survey[7]

<table>
<tr><td colspan="2">Name of local office</td><td colspan="2"></td></tr>
<tr><td colspan="2">Adress, Tel</td><td colspan="2"></td></tr>
<tr><td colspan="2">Contact personel</td><td colspan="2"></td></tr>
<tr><td colspan="3">Survey time(season):</td><td>Survey date:</td></tr>
<tr><td>Sample Name</td><td colspan="2">Category for the preparatory survey</td><td colspan="2">Category for the field survey</td></tr>
<tr><td rowspan="6"></td><td rowspan="6">1. Non-cultivated land,
2. Cultivated land (real planting area)
3. Dyke (to keep back water in rice field), tree, rock, ant-hill, cottage, parking space, border tree, etc in cultivated land
8: (Tentative reserve)
9: Low resolution</td><td colspan="2">11. Rice</td></tr>
<tr><td rowspan="5">In case of non rice</td><td>1. Non-cultivated land,</td></tr>
<tr><td>2. Cultivated land (real planting area)</td></tr>
<tr><td>3. Dyke (to keep back water in rice field), tree, rock, ant-hill, cottage, parking space, border tree, etc in cultivated land</td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
<tr><td colspan="2">Enumerator's Name</td><td colspan="2"></td></tr>
<tr><td colspan="2">Adress, Tel</td><td colspan="2"></td></tr>
</table>

[7] [Developmental suggestions] you can estimate not only rice planted area but also other crops planted area by adding categories for other crops.

(2) Photos for learning how to decide land use category

Next photos are useful to learn how to read Google Earth and to how to decide land use category for the survey.

Fig-6 Field survey for the planted area

Fig-7 Land use on Google Earth (Tanzania)

Photos: ©FAO

Fig-8 Land use in Thailand (from airplane)

(3) Guide map for field survey

You need two kinds of guide maps, one is for guiding you to the sample field and the other is for showing you the exact place of the sample dot.

(4) Time schedule of the survey

The rice planted area survey usually should be carried out rice growing season near harvesting time. Some of you might have survey seasons two or three times in a year. In those cases, you need to carry out the field survey two or three times in a year.

Table -7 Field survey plan (Time table)

Field survey season	Field survey month (MMYY)	Reporting date (DDMMYY)
Survey season (1)		
Survey season (2)		
Survey season (3)		

2.2.6. Field survey by enumerators

Enumerators conduct the rice planted area survey based on the training for enumerators.

2.2.7. Estimation of the rice planted area

Before starting the estimate, you check whether you have received all results of the survey from enumerators or not. After that, you check that the field survey forms are filled in completely. Next you create a table in the Excel worksheet to summarize the results of the survey, then begin to enter the data in the table. Next you calculate the rice's share of sample dots. Finally you multiply the rice share by the total area of the target region.

When you calculate to estimate the rice's share of sample dots, you can overwrite the preparatory survey form (Table-4) by inputting the results of the field survey.

Photos: ©FAO

Estimation formula is shown as follows.

$$\hat{T} = \frac{n_1}{n} W = \hat{p} W$$

Where,

$\hat{T}$: Estimation of planted area

W : Whole area of target region.

n : Number of sample dots

n_1 : Number of sample dots which are on rice field

Standard error (SE) for calculating accuracy is given by $\sqrt{\hat{p}\hat{q}/n}$

Coefficient of Variance of Standard Error (CV) is calculated as. $\mathrm{SE}/\hat{p}$.

And $\hat{p}$ and $\hat{q}$ are calculated as n_1/n and $(1-\hat{p})$ respectively.

The sample dots which you cannot identify the land use category at the sample dot are excluded from sample dots. The formula is shown below.

$$\hat{T}' = \frac{n_1}{n'} W = \hat{p}' W$$

Where

W : Whole area of target region. (You do not have to revise).

n' : $n' = n - n_{low-resolution}$

: Number of sample dots excluded low resolution sample dots in the target area.

2.2.8. Definition of the categories for the dot sampling survey

Non-cultivated land: Land which is not cultivated, such as mountain, forest, wood, grass, lake, river, road, residence, park, factory, etc.

Cultivated land (real planting area): Remaining cultivated land which excludes dyke, etc. in cultivated land.

Dyke, etc.: Dyke (to keep back water in rice field), tree, rock, ant-hill, cottage, parking space, border tree, etc. in cultivated land.

Tentative Reserve: Category to reserve deciding sample dot's category on the operation of the preparatory survey on a tentative basis. It is one of the measurements to go along smoothly.

Low resolution: Low quality of satellite image of maps or obstacles such as cloud on Google Earth which makes you impossible to identify the land use category.

2.2.9. Treatment of mixed cropping

In the case of mixed cropping which is growing of two or more crops simultaneously on the same piece of land, you categorize it as rice, when one of crops is rice.

2.3. Attached files for the rice planted area survey

The list of attached files for the rice planted area survey is shown below. Those files are sent to trainees by e-mail.

Table-8 List of attached files for the rice planted area survey

	Name	Type of File
1	creating sample file	Excel (Sheet1)
2	macro program file	Excel
3	Preparatory survey form for the rice planted area survey	Excel (Sheet2)
4	Estimation form for rice planted area	Excel (Sheet3)

3 Rice yield survey using crop cutting survey method

3.1. Basic idea and method

You are going to estimate reliable rice yield per ha in the whole rice planted area in your country based on objective method, namely crop cutting method and on the statistical manner.

This chapter explains the crop cutting method and procedures to carry out the survey.

When you estimate it based on the method, the formula is

$$\bar{X} = \frac{\sum X_i}{n}$$

$\bar{X}$ shown below.

X_i : Estimate of yield per ha in a target region.

n : Yield per ha in a th sample farm.

: Number of sample farm

The essence of the crop cutting survey is to select sample at random, and to measure the rice which is reaped at the sample spots using small frame.

In the survey, you use the results of the rice planted area survey, therefore you do not have to try sampling for the crop cutting. You do not have to consider the size of field because the sample dots are selected with probability proportional to the rice planted area[8].

Special issue is that the yield which is estimated from the crop cutting survey is not included the area of dyke, etc. The issue is explained later (See 3.6,).

3.2. Procedure of the rice crop cutting survey

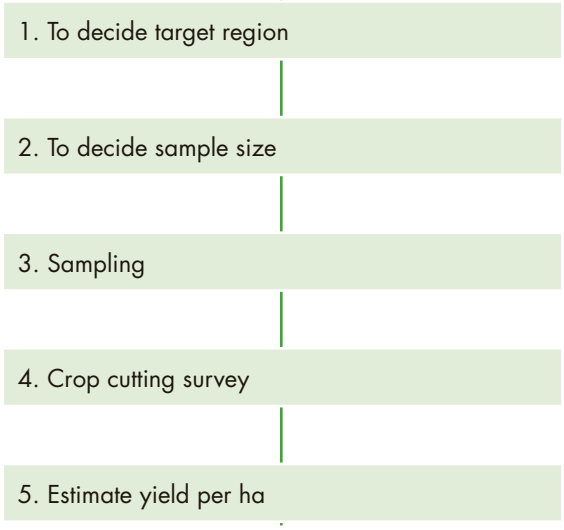
The basic procedure of rice crop cutting survey is shown below.

However, when you conduct the crop cutting survey on the same sample as

the rice planted area survey, the second and third step can be neglected.

[8] [Developmental suggestions] Using dot sampling, every crop are selected based on the probability proportional sampling to the size of the planted area automatically. It is a great advantage of the dot sampling method.

Fig-9 General flowchart of the crop cutting survey



3.3. Sampling design

It is better to use the result of rice planted area survey, when you select samples for rice crop cutting survey. If when it is thought that the number of sample dots which fall in the rice field is too much to complete the crop cutting survey, you can reduce the sample size, considering the aimed precision and the coefficient of variation of the population. Systematic sampling method on the rice sample dots for planted area survey should be used to reduce the number of sample. The table will help you decide actual sample size for the crop cutting survey.

Table-9 Necessary sample size computed from C and C.V.

		CV (Aimed precision)						
		0.02	0.03	0.05	0.08	0.10	0.15	0.20
C (Coeficient of variation in the population)	0.10	25	11	4	2	1	0	0
	0.20	100	44	16	6	4	2	1
	0.30	225	100	36	14	9	4	2
	0.40	400	178	64	25	16	7	4
	0.50	625	278	100	39	25	11	6
	0.60	900	400	144	56	36	16	9
	0.70	1 225	544	196	77	49	22	12
	0.80	1 600	711	256	100	64	28	16
	0.90	2 025	900	324	127	81	36	20
	1.00	2 500	1 111	400	156	100	44	25
	1.10	3 025	1 344	484	189	121	54	30
	1.20	3 600	1 600	576	225	144	64	36

Note 1: The formula which is used to make the above table is shown below.

$$n = \frac{C^2}{CV^2}$$

Where,

n : sample size (number of sample dots)

$C = \frac{\sigma}{\mu}$: Coefficient of variation in population (target area)

μ : Average yield in the target area

σ_x : Standard deviation of yield in the target area

$C.V = \frac{\sigma_{\bar{x}}}{\mu}$: Coefficient of variation of estimate, relative standard error.

$d = \sigma_{\bar{x}} = \sqrt{\sigma_x^2/n}$: Aimed standard error (SE) of estimate (acceptable error, permissible error, allowance error)[9]

Note 2: It is thought that crop cutting survey does not require big sample size to obtain

reliable estimate.

Note 3: About classification: In general, it is often that the classification for the crop cutting survey is conducted, however, you do not have to classificatory for the crop cutting survey. It is not expected to obtain remarkable efficient survey from the classification.

3.4. Formulas to estimate yield per ha

You conduct rice crop cutting survey at the sample fields where rice are planted and sample dots fall.

The formulas to estimate yield per ha and precision are shown below.

$$\bar{X} = \frac{\Sigma X_i}{n}$$

$$s_X = \sqrt{\frac{\Sigma(X_i - \bar{X})^2}{n}} \qquad s_{\bar{X}}^2 = \frac{s_X^2}{n} \qquad CV_{\bar{X}} = \frac{s_{\bar{X}}}{\bar{X}}$$

Where,

$\bar{X}$: Estimate of yield per ha in a target area (Sample mean)

X_i : Yield per ha in a nth sample farm.

n : Number of sample farm of rice in the target area.

s_X : Standard deviation of yield per ha in the target area.

$s_{\bar{X}}^2$: Variance of yield per ha in the target area.

$CV_{\bar{X}}$: Coefficient of variation of estimate (precision)

3.5. Rice crop cutting method at a sample field

Rice crop cutting is conducted at sample fields where rice are planted and sample dots for the rice planted area survey fall.

The procedure of rice crop cutting survey at a sample field is shown below.

Fig-10 Procedure of rice crop cutting survey at a sample field

1. Go to a sample field
2. Find out the sample farm who cultivates the sample field
3. Get the permission of crop cutting and interview the sample farm
4. Conduct rice crop cutting at the sample field (Two spots)
5. Complete rice crop cutting survey form
6. Report the rice crop cutting survey form

[9] You can guess the aimed standard error of estimate using the formula,. $d = \sqrt{\sigma_x^2/n}$

The procedure and activities are explained in detail with photos below.

First, an enumerator goes to a sample field and conducts crop cutting in the sample field.

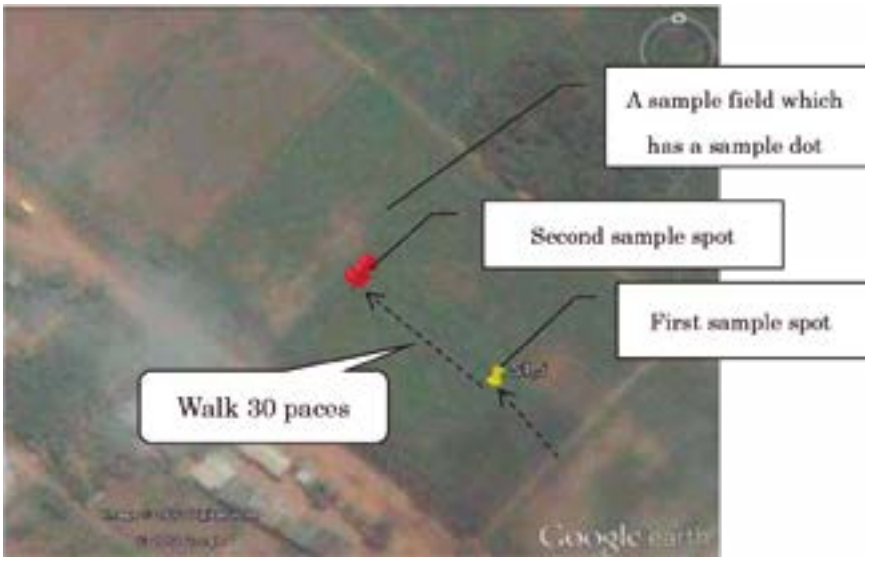
Crop cutting are carried out in the way usually conducted by the farmer.

Fig-11 Procedure and activities of the rice crop cutting in a sample field

1. Go to the first sample spot which sample dot falls, and conduct crop cutting there with 1m2 crop cutting frame.

2. Move to the second sample spot in the field, and conduct crop cutting there. The second sample spot is 30 paces for "North-West" side from the first sample spot.

Fig-11-1 Sample spots



Note 1: The reason to select two spots in a sample field is to make reducing the magnitude of standard deviation. It brings you a reliable estimate.

Note 2: When you find dyke or border on the way to second spot, in principle, you can turn right (North-East) side at the dyke.

Photos: ©FAO

Fig-11-2 Going to the first spot.

Fig-11-3 Reaping rice at the spot.

Fig-11-4 Moving to the second spot.

Fig-11-5 Finished reaping

Photos: ©FAO

3. Thresh the rice of each sample spot separately, and put the each sample rice with a label in a bag separately.

4. Bring the sample rice to your office.

5. Dry the sample rice.

6. Clean the sample rice

7. Weigh the sample rice on the scales.

8. Fill in the form for the survey.

Fig-11-6 Threshing

Fig-11-7 Drying under sunshine

Fig-11-8 Cleaning with winnow.

Photos: ©FAO

Fig-11-9 Weighing on the scales

Fig-11-10 Filling in the form

Fig-11-11 Basic equipment

The table which is shown below is a rice crop cutting survey form.

Table -10 Rice crop cutting survey form

Sample Name		Adress	Province	Prefecture	District	Village	Crop Season
							1, 2, 3
Date of survey					Enumerator		

1 Identity (1)

Name of Farmhousehold	

2 Interview Items

Total area of cultivated land (ha)	Total of rice lanted area (ha)	Area of sample field (ha)	Irrigation or rainfed	Planting Method
			1 Irrigation 2 Rainfed 3 Upland	1 Seeds Broadcasting 2 Transplanting 3 Upland planting

2 Interview Items (Continue)

Variety (1)	Variety (2) name	Glutinous or nonglutino us	Planting Time (DD:MM:YY)	Harvesting Time (DD:MM:YY)	Growing condition	Cause(in case of the growing condition is bad or very bad)	Quantity of seed per ha (kg)	Use of organic fertilizer
1 Short 2 Midium 3 Long		1 Glutinous 2 Nonglutino us			5,4,3,2,1	1Disease 2 Insect 3 Drought 4 Heavy rain 5 Others		1Yes 2 No

2 Interview items (Continue)

Use of chemical fertilizer	Use of pesticide	Cultivatin g Machine	Harvesting Machine	Purpose of growing (marketting)	Technical assistance from	Option 1	Option 2	Estimate yield per ha in this year (t)	Yield per ha in last year (t)
1Yes 2 No	1Yes 2 No	1Yes 2 No	1Yes 2 No	1Sale 2 Comsume					

3 Crop cutting yield survey

Item		Spot 1 (m^2)	Spot 2 (m^2)
Weigt of cleaned&dry rice (1m^2) g		(1)	(1)'
Cleaned&dry yield per ha t		(2)=(1)/100	(2)'=(1)'/100
Yield per ha at the sample field (Cleaned&dry)	t	(3)={(2)+(2)'}/2	

Memo

Table-11 Estimation form

Sample Name	Yield per ha (unit : t)		
	Spot-1	Spot-2	Average
Total $\sum X_i$			
Number of sample n			
Average $\bar{X} = \Sigma X_i / n$			
Analysis	Standard deviation $s_X = \sqrt{\Sigma (X_i - \bar{X})^2 / n}$		
	Standard error $s_{\bar{X}} = \sqrt{s_X^2 / n}$		
	Coefficient of variation of estimate $CV_{\bar{X}} = \frac{s_{\bar{X}}}{\bar{X}}$		

Note: Calculations can be computed using “function” on the Excel work sheet.

Table -12 Field survey plan (Time table)

Field survey season	Field survey for crop cutting (MMYY)	Reporting date (DDMMYY)
Survey season (1)		
Survey season (2)		
Survey season (3)		

3.6. Interview survey with sample farm around dot sample

If you cannot conduct the rice crop cutting survey at sample dots you can conduct the interview survey with sample farm who grows rice at the sample dot using a rice crop cutting survey form.

If the sample farm is absent, or he has already harvested the rice, you can select other farm as an alternative sample farm who lives around the sample field.

Even in this case, you can apply the simple estimate formula to estimation of yield per ha based on the interview survey in the target area.

However, it is thought that the yield per ha on interview survey includes the area of dyke, etc. as follows:

$$\bar{X}_{interview} = P/S_{includeddyke,etc}$$

Where

$\bar{X}_{interview}$: Estimated yield based on interview survey.

P : Production of rice

$S_{includeddyke,etc}$: Cultivated land including dyke etc.

But in this manual, yield is to be calculated without dykes etc. So you need to adjust the yield as follows:

$$\bar{X}_{adjusted} = \bar{X}_{interview}/(1-R)$$

Where

$\bar{X}_{adjusted}$: Adjusted yield to yield which does not include dyke, etc.

$\bar{X}_{interview}$: Estimated yield per ha based on interview survey

R : Rate of dyke (See table-5 Note-1)

3.7. Attached files for the rice crop cutting survey

There are not attached files. The forms which are needed for the rice

crop cutting survey are shown in this manual. Please use them.

Table-13 Forms for the rice crop cutting survey

	Name	Note
1	Rice Crop Cutting Survey Form	See: Enumerator's Manual for Rice Crop cutting Survey (2013/2014)
2	Estimation Form	See: Table-11 estimation form

3.8. List of necessary main equipment for rice crop cutting survey

The list of necessary main equipment for rice crop cutting survey is shown below.

- **(1) Crop cutting frame (1m^2): A crop cutting frame shows the crop cutting size and shape.**
- **(2) Balance: A balance is used for the weighing of rice.**
- **(3) Sickle: A sickle is used for rice cutting.**
- **(4) Sheet: A sheet is used for threshing.**
- **(5) Winnow or fan: A winnow or a fan is used for cleaning of rice.**
- **(6) Sample rice bags: Sample rice bags are used for bringing back the rice samples.**
- **(7) Labels: Labels are used for identifying the rice samples.**
- **(8) Questionnaire: The questionnaire is used for the crop cutting survey at the sample fields.**

3.9. Training for the enumerators

You conduct the training simultaneously for the rice crop cutting survey and the rice planted area survey.

3.10. Definition for the yield survey

Yield: Unhulled rice which is threshed, dried and winnowed properly on the normal farmers' attention basis, then it is calculated without dykes etc.

Note: Definitions for the yield survey should be decided by each country from the view point of how to avoid non-sampling errors (bias, etc.), for example, the necessary of introducing gleaning (harvesting loss) survey considering the spread of harvesting machines, the rate of moisture content also.

4 Estimate of rice production

You summarize the results of the rice planted area survey and the rice crop cutting survey using the formula which is shown below.

$$\hat{Y} = \bar{X} \times \hat{T}$$

Where

$\hat{Y}$: Rice Production

$\bar{X}$: The average yield of rice from the survey in the target region

$\hat{T}$: The estimated rice planted area from the survey in the target region

The precision of estimated total rice production (Planted area × Yield per ha) is calculated as follows.

$$C.V_{Total\ production} = \sqrt{C.V_{Yield}{}^2 + C.V_{Planted\ Area}{}^2}$$

Table -14 Rice Production Statistics based on the Dot sampling method

Name of target area	Planted area (ha)	Yield per ha (ton)	Production (ton)	Number of sample (total)	Number of sample (rice)	
					Planted area survey	Crop cutting survey
(1)	(2)	(3)	(4)=(3)*(2)	(5)	(6)	(7)

Consideration (discussion)

5 Year calendar of the rice production surveys

The table below shows an example of the general "Year calendar of the rice production surveys for rice.

Actually, the detailed schedule should be made considering the rice growing and harvesting season, situation of each country.

Month	Central office	Planted area survey	Crop cutting survey
	Planning & Designing Sampling Preparatory survey (Classification)		
		Training for enumerators	
		Field survey (1)	
			Crop cutting survey (1)
		Report to central office of the Government	
	Estimate of Rice Production		
		Field survey (2)	
			Crop cutting survey (2)
		Report to central office of the Government	
	Estimate of Rice Production		

Fig-12 Year calendar of the rice production surveys

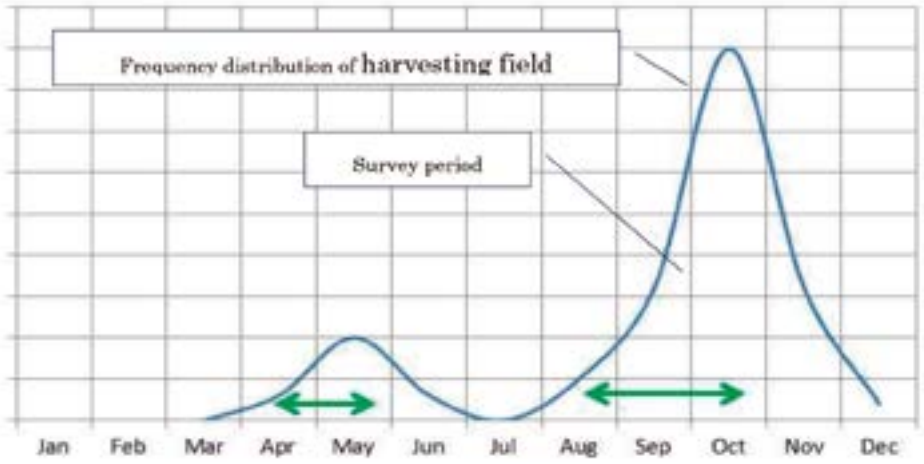
Based on the survey calendar and the table above, you make a work schedule for enumerators to obtain the results of survey.

The image of a table is shown below.

Table-15 Work calendar for enumerators

		Suitable Survey Period	Survey Date	Reporting Date
1	Planted area survey (1)			
	Yield survey (1)			
2	Planted area survey (2)			
	Yield survey (2)			
3	Planted area survey (3)			
	Yield survey (3)			

Fig-13. Frequency of the rice harvesting season and survey period (Example)



6 Enumerator's manual and Survey forms

Enumerator's manual and survey forms are shown below. These forms are tentative draft.

The first one is used for rice planted area survey. Second one is used for rice crop cutting survey.

It is expected for you to modify them to make appropriate manuals and survey forms for your country considering the situation, custom, etc. in your countries because enumerator`s manuals and survey forms are one of the essential materials for the survey to generate the reliable results.

6.1. Enumerator's manual for rice planted area survey

1. Instruction (Your Job)

You are one of the enumerators for planted area survey employed to obtain information from sample dot about planted area. The information you obtain will be use to estimate rice planted area by rice crop season.

Your job consists of three procedures. The first is that you are assigned to be an enumerator and to be trained to conduct the survey. The second is to conduct the field survey, that is, to visit the sample dot with the survey form and guide maps, to observe the point and fill the results in the survey form. You basically identify only whether rice is planted or not at the sample dot. Number of survey item is only one. It is quite simple job, however, you have to visit and check whether rice is planted or not exactly. The third is to send the result to your government office.

The field survey will be requested one or two or three times in a year.

2. Survey form

Name of local office	
Adress, Tel	
Contact personel	

Survey time(season) :			Survey date :
Sample Name	Category for the preparatory survey	Category for the field survey	
	1. Non-cultivated land, 2. Cultivated land (real planting area) 3. Dyke (to keep back water in rice field), tree, rock, ant-hill, cottage, parking space, border tree, etc in cultivated land 8: (Tentative reserve, maybe cultivated land) 9: Low resolution	11. Rice	
		In case of non rice	1. Non-cultivated land,
			2. Cultivated land (real planting area)
			3. Dyke (to keep back water in rice field), tree, rock, ant-hill, cottage, parking space, border tree, etc in cultivated land

Enumerator's Name	
Adress, Tel	

6.2. Enumerator's manual for rice crop cutting survey

1. Instruction (Your Job)

You are one of the enumerators for planted area survey employed to obtain information from sample dot about rice planted area. At the same time, you will be one of the enumerator for the rice crop cutting survey. The information you obtain will be used to estimate the yield of rice during the rice harvesting season.

Your job consists of three procedures. The first is that you are assigned to be enumerator and to be trained to conduct the survey. The second is to conduct the field survey for rice, that is, to visit the sample dot with the survey form and guide map which show where the sample dot is.

In this rice crop cutting survey, you have to find out the sample farm who cultivates the sample field where a sample dot falls. Before conducting rice crop cutting, you have to interview with the farm household based on the survey form. Next you conduct rice crop cutting at two sample spots in the sample field. The third is to send the result to your government office.

The field survey will be requested one or two or three times in a year.

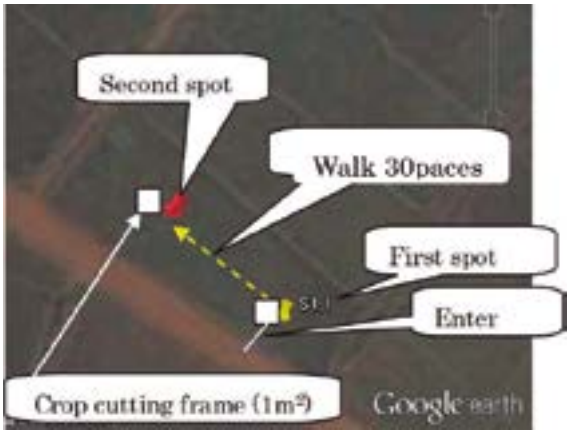
2. Crop cutting survey in the sample field.

The procedure of the crop cutting in a sample filed is shown below.

- **1. Go to the first sample spot which sample dot falls, and conduct crop cutting there with 1m2 crop cutting frame.**

- **2. Go to the first sample spot which sample dot falls, and conduct crop cutting there with 1m2 crop cutting frame. Move to the second sample spot in the field, and conduct crop cutting there. The second sample spot is 30 paces for "North-West" side from the first sample spot.**[10]
- **3. Thresh the rice of each sample spot separately, and put the each sample rice with a label in a bag separately.**
- **4. Bring the sample rice to your office.**
- **5. Dry the sample rice.**
- **6. Clean the sample rice**
- **7. Weigh the sample rice on the scales.**
- **8. Fill in the form for the survey.**

Crop cutting spots



The crop cutting should be conducted at the harvesting season. Do not miss the chance for the survey. When you conduct this survey, your first meeting with the farm household is very important. At first introduce yourself and explain the purpose of the crop cutting survey. His cooperation will be most helpful when you reap and thresh the rice.

If he is not at home, and he is not expected back during the survey period, you can conduct the crop cutting survey at alternative farm household's field near the sample field.

3. Survey form

[10] When you find dyke or border on the way to second spot, in principle, you can turn right (North- East) side at the dyke..

Photos: ©FAO

Sample Name		Adress	Province	Prefecture	District	Village	Crop Season
							1, 2, 3
Date of survey					Enumerator		

1 Identity (1)

Name of Farmhousehold	

2 Interview Items

Total area of cultivated land (ha)	Total of rice lanted area (ha)	Area of sample field (ha)	Irrigation or rainfed	Planting Method
			1 Irrigation 2 Rainfed 3 Upland	1 Seeds Broadcasting 2 Transplanting 3 Upland planting

2 Interview Items (Continue)

Variety (1)	Variety (2) name	Glutinous or nonglutino us	Planting Time (DD:MM:YY)	Harvesting Time (DD:MM:YY)	Growing condition	Cause(in case of the growing condition is bad or very bad)	Quantity of seed per ha (kg)	Use of organic fertilizer
1 Short 2 Midium 3 Long		1 Glutinous 2 Nonglutino us			5,4,3,2,1	1Disease 2 Insect 3 Drought 4 Heavy rain 5 Others		1Yes 2 No

2 Interview items (Continue)

Use of chemical fertilizer	Use of pesticide	Cultivatin g Machine	Harvesting Machine	Purpose of growing (marketting)	Technical assistance from	Option 1	Option 2	Estimate yield per ha in this year (t)	Yield per ha in last year (t)
1Yes 2 No	1Yes 2 No	1Yes 2 No	1Yes 2 No	1Sale 2 Comsume					

3 Crop cutting yield survey

Item		Spot 1 (m^2)	Spot 2 (m^2)
Weigt of cleaned&dry rice (1m^2) g		(1)	(1)'
Cleaned&dry yield per ha t		(2)=(1)/100	(2)'=(1)'/100
Yield per ha at the sample field (Cleaned&dry)	t	(3)={(2)+(2)'}/2	

Memo

7 References

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Interested partners are invited to get in touch with FAO for more information:

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