THE REPUBLIC OF UGANDA

REPORT

ON

UGANDA NATIONAL CENSUS

OF

AGRICULTURE AND LIVESTOCK

(1987 - 1992)

VOLUME I. METHODOLOGY OF THE CENSUS

MINISTRY OF AGRICULTURE,
ANIMAL INDUSTRY AND FISHERIES
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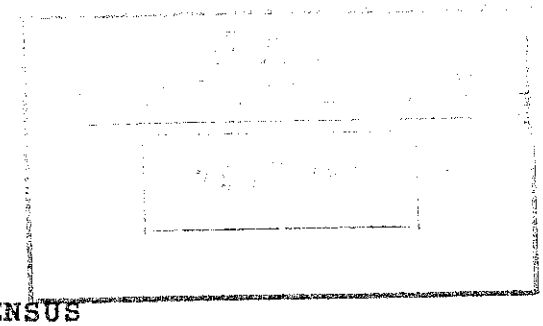

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Ministry of Agriculture, Animal Industry and Fisheries

January, 1992

FOREWORD

The last census of Agriculture in Uganda was conducted between 1963 and 1965 with the assistance of the United Nations Development Programme (UNDP) and the Food and Agriculture Organisation of the United Nations (FAO). It would have been desirable to conduct follow-up decennial census in 1973 and 1983 but due to the prevailing circumstances then, this was not possible. In April, 1987, the National Census of Agriculture and Livestock Project was started with the main objective of undertaking, to the extent possible, a nation-wide census of agriculture to provide a wide range of much needed data e.g. holdings and their characteristics, livestock numbers, crop areas, agricultural labour as well as agricultural implements and machinery. The actual census field work was effectively launched in 26 districts in March, 1990 and completed in April, 1991.

This report outlines the methodology adopted with regard to sample design, enumeration plan, data processing and analysis. It is therefore appropriate that it precedes the other substantive reports to be published later. The information contained in this report is particularly useful to data users and researchers as it will accord them a fuller understanding of the ensuing tabulations and reports. Quite often, data from censuses and surveys is rendered useless for planning purposes if the data users are not sufficiently educated about the methodological approach, concepts and definitions underlying the results.

The National Census of Agriculture and Livestock has been undertaken as a joint effort between the Government of Uganda, UNDP as the funding agency and FAO as the executing agency. The Ministry of Agriculture, Animal Industry and Fisheries is grateful to UNDP for financial assistance and to FAO for providing technical assistance in the form of a Chief Technical Adviser and a Data Processing Expert who were involved in the design and execution of the census. Similar gratitude is extended to the large number of national staff comprising statisticians, supervisors, enumerators and other support staff who, under the able guidance of the National Project Director, formed an effective counterpart team. Our gratitude also goes to the numerous farmers and local leaders who greatly facilitated data collection in the selected sample areas in the 26 districts where the census was successfully conducted.

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Minister of Agriculture, Animal Industry and Fisheries

Date: 2-01-92

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Chapter 1.
INTRODUCTION

Background

1.1 Uganda last undertook a Census of Agriculture between 1963-1965, nearly thirty years ago. At that time, the Uganda Government was assisted by FAO and the Department of Technical Co-operation of the United Kingdom both of which provided international staff and Census equipment to a varying degree. The country continued to use the 1963/65 Census data which were obviously out-of-date and could not be used for any meaningful planning. In the absence of Census data, the Ministry of Agriculture in particular and, the country in general, depended on two main sources of agricultural statistics.

1.2 The first source was sample surveys. As a result of a recommendation by FAO at the end of the 1963-1965 Census of agriculture, the Statistics Section of the Ministry of Agriculture organised follow-up small-scale agricultural sample surveys to obtain estimates on crop acreages and yields between 1967 and 1975. These estimates were however, not collected from 1976 onwards because the necessary financial resources and logistical support were lacking.

1.3 The second source of agricultural statistics was the reporting system by the Department of Agriculture. The method entailed undertaking small scale surveys to determine mean plot sizes for different crops as well as estimates of number of plots planted for each crop as reported by local Chiefs. It is clear that the estimates thus obtained were subject to wide margins of error and resulted in inconsistent time series of crop area and production data.

1.4 The situation with regard to livestock data, was similar to that of crop statistics. The 1963-1965 Census aimed at collecting data on livestock numbers and their characteristics. However, the main livestock area of Karamoja was not covered then. Coincidentally, the same area was not covered in the Census just concluded. Subsequent to the 1963-65 Census, a number of surveys and studies were undertaken such as the East African Livestock Survey 1967, surveys of milk distribution and

consumption in Uganda between 1972-1975 and the 1986/87 Agricultural Sector Survey whose main objective was to obtain a quick count of livestock in the country. The surveys were limited both in scope and coverage and like crop statistics, the estimates derived therefrom were of doubtful reliability.

1.5 The need for Uganda to undertake a National Census of Agriculture and Livestock to fill the gap in data became obvious. A proposal was made in 1984 for a Preparatory Assistance Census Project funded by UNDP and executed by FAO. This Project commenced in April 1987 as UGA/84/011 and entered into the main Phase Project in July 1988 as UGA/88/002.

Objectives

1.6 The immediate objective of the Uganda National Census of Agriculture and Livestock (UNCAL) was to undertake, to the extent possible, a nation-wide sample Census of agriculture and livestock. The outputs expected from the Census were:

(a) Baseline data on the structure of agriculture in Uganda e.g. holding sizes and their distribution, livestock numbers and composition, agricultural machinery and implements, input use and agricultural labour.

(b) Crop areas, yields and hence crop production estimates for major food and cash crops for both the traditional small and medium scale farms and the large or modern farm sector comprising Government, parastatal, co-operatives and institutional farms.

1.7 The long-term objective of UNCAL was the creation of an institutional framework upon which to build a sound permanent system of agricultural statistics utilising the frame created by the Census to conduct annual agricultural surveys.

Scope and Coverage

1.8 It was borne in mind that the Census was a major statistical undertaking in a country where no significant statistical activity had been taking place for the previous 20 years and in a background of extremely meagre resources and infrastructural support. Maximum benefit was therefore, to be derived from collecting essential data which could be collected, processed and analysed efficiently and expeditiously.

1.9 The Census was therefore planned to collect data on various structural characteristics of the agricultural holding, e.g. number and size of holdings, land tenure system, demographic characteristics of the holder and his household, use of agricultural labour, machinery, etc. In addition, data on crop areas and yields as well as the numbers and composition of livestock were collected. For important tree crops such as coffee and fruit trees, counts were made of the number of trees.

1.10 As stated in Section 1.6 on Objectives, the Census was planned to be national i.e. covering all districts in the country. It was to cover both smallholders and large-scale and institutional farms. At the early stages of planning in 1987, consideration was given to coverage of both rural and urban areas but Census coverage in urban areas was later discarded owing to the problems of lack of a good sampling frame for these areas. The map at the end of this report shows the operational districts where the Census took place.

Chapter 2
CENSUS ORGANISATION AND PREPARATION

Legal Basis

2.1 The Census was undertaken under the provisions of the Statistics Act, 1964 which empowered the Chief Government Statistician (CGS) of the Ministry of Planning and Economic Development, to collect statistical information from all inhabitants of Uganda. For the Census, the CGS entrusted the Ministry of Agriculture with the collection, analysis and publication of agricultural statistics. A Gazette notification was first issued on 20th February, 1987 which announced the launching of the Census. This general notice was later amended on 22nd September, 1989 to reflect the composition and functions of the Census Committees.

Organisational Structure

2.2 The Government set up the National Agricultural Census Office (NACO) and appointed as its head, a National Project Director. The following committees were established:

(i) The Steering Committee was entrusted with the overall policy formulation, monitoring and implementation of the Census activities. It co-ordinated and integrated the activities of all Government, donor and executing agencies and other organisations connected with the Census.

(ii) The Technical Committee was set up to advise on technical aspects such as questionnaire design, methodology, planning, operations, analysis and presentation of Census results.

2.3 NACO was composed of four functional units at headquarters, namely:

(a) Field Operations Unit. This unit was responsible for recruitment and training of enumerators and supervisors. It distributed and retrieved the Census questionnaires and other field work forms to the Census Office and generally monitored and supervised field work.

(b) Methodology and Analysis Unit. This unit was responsible for the overall formulation of the Census methodology and dealt with all technical matters on the sample design, planning, analysis and presentation of the results.

(c) Publicity and Documentation. In view of the need for proper documentation of the essential processes involved in an agricultural Census, this unit was formed to handle all Census documents from printing questionnaires and other field documents to preparation of reports, manuals and minutes of meetings. In addition, this unit was charged with the overall responsibility of publicity of the Census activities.

(d) Data Processing Unit (DPU). The Data Processing Unit constituted an important building block for the permanent system for food and agriculture statistics. Three national experts: a Computer Manager and two System Analysts were recruited to man this unit and to train national counterpart staff. To further strengthen the unit, an internationally recruited Data Processing Expert joined the unit in May 1989.

Census Materials and Equipment

2.5 The following equipment and materials together with allied stationary, were provided to each enumerator for use during the Census :

Prismatic compass and measuring tape for area measurement;
Salter weighing scale for weighing harvested crop;
Canvas bag for carrying equipment;
Click counter for counting trees, plants/stools;
Clinometers for area measurement in hilly areas and Gumboots.

The supervisors had each a programmable calculator for area calculation of the measured parcels and plots. For data processing, there were 16 IBM Personal Computers. Vehicles that were used included:

13	4x4 Toyota Landcruiser Station Wagons
1	Toyota Landcruiser Pick-up
2	Toyota Corona Saloons
1	26-seater Toyota Coaster (Minibus)
2	4x4 Suzuki vehicles
100	Honda and Yamaha motorcyles
550	Bicycles

Preparatory Phase

2.6 The 15-month period from 1 April 1987 to 30 June 1988 was for preparation of the Census, setting up of the institutional framework and the elaboration of the Census methodology. During this period,a review of the relevant literature on agricultural statistics in Uganda was made and the preliminary ideas for the methodology for Census taking were discussed by the technical committee. Prior to the launching of the Census, it became necessary to make extensive consultations with agricultural data users and producers with a view to identifying the variables for which data were to be collected in addition to the usual items included in a census of agriculture.

2.7 A workshop between agricultural data users and producers was held in November, 1987. The main aim of the workshop was to discuss the data requirements by the various agricultural data users. The outcome of the workshop was the drawing up of a list of variables which formed the basis of the Census questionnaire design. This approach was adopted because of

the expressed need to collect relevant data for Uganda and at the same time, conform to general FAO guidelines for conducting agricultural censuses.

2.8 The Pilot Census and the Pretest. The Pilot Census constituted the first Census activity whose objectives were:

(a) To test the suitability of the questionnaire forms.
(b) To detect likely problems of a technical, administrative and logistical nature.
(c) To assess the quality of training of both enumerators and supervisors.
(d) To determine workloads and give indications to the Census planners on the likely enumeration plan and,
(e) To test the Census equipment e.g. compasses as well as the objective area measurement methods.

2.9 Training of field staff for the Pilot Census was conducted in July, 1988 for two weeks during which period, definitions and concepts were introduced. The field activities of the Pilot Census were reviewed about mid-October and a decision was taken to carry out a full-scale Pretest in one district in November 1988.

2.10 Luwero district, which is fairly close to the Ministry headquarters Entebbe, was selected for the Pretest. It was felt that subsequent supervision could be done without incurring unnecessarily high costs. The basic sampling design was the same as that used in the Pilot Census and the same enumeration areas were used. The main aims of this Pretest were to determine the time required for training field staff. The enumerator's ability to get various data from the respondents in area measurement and calculations was also tested while at the same time, questions for which it was difficult to obtain clear responses were identified.

2.11 The training for the Pretest was done for one week in November, 1988. Since the enumerators had already had a two weeks training in July of that year, this training was mainly to

introduce them to new procedures in the use of the measuring tape and compass for area measurement as well as on the crop-cutting techniques for yield estimation.

2.12 Lessons learnt from Census Preparatory Phase. There is a stand-alone report on the Pilot Census and Pretest which details the procedures, problems encountered in implementation and how these were resolved. Both the Pilot Census and the Pretest provided very useful insights into the final planning of the main Census. A number of problems and weaknesses came to light during the training of the enumerators such as the need to reduce on the time-lag between training of enumerators and their deployment in the field. It was estimated that up to 17 weeks were required for field work. It was felt that there would be problems in making a second visit for area measurements and yield estimation in a single season.

2.13 Processing of the Pilot data proved to be a very useful experience for the subsequent exercise of processing the Census data. The first batch of operators had an opportunity to greatly improve on their key-board capability. Entry and tabulation programs made clear those areas that needed improvement. The suitability of file structures for easy production of the required tables was also tested. Procedures for maintaining error trails and for post-entry editing and verification were also tested.

Chapter 3

SAMPLING FRAME, DESIGN AND METHODOLOGICAL APPROACH

Sampling Frame

3.1 When sampling for the main Census was carried out, Uganda was administratively divided into the following geographical units:

Administrative unit	Number of units
District	33
County	146
Sub-county	693
Parish	3596
Sub-parish	7230

3.2 The above structure existed for both urban and rural areas. In urban areas the parish is called a ward. After the completion of Census field work, some districts had been further sub-divided to give five more districts bringing the total to 38. This report deals with the 33 districts that existed at the conception of the Census. However, as has been pointed out earlier on, in the end, because of insecurity in certain areas, the main Census took place in only 26 districts for which results are presented in the substantive volumes.

The Basic Design

3.3 Large Scale and Institutional Farms. The large or modern farms comprising government, parastatal, co-operative and institutional farms sector were covered on a complete enumeration basis in the 26 districts. These farms were expected to be few in number but with special characteristics such as a higher proportion of marketed output compared to holdings in the traditional sector, better organisation and higher level of mechanisation.

3.4 Small-scale Holders. The small (traditional) and medium scale agricultural holdings were covered on sample enumeration basis with the basic unit of enumeration as the agricultural holding. A Population Census had been conducted in 1980 for which provisional results were available by parish. The parishes were however not considered as ideal primary sampling units (PSU's) for the Census because the frame was thought to be out-of-date. Besides, the parishes were too large to be adequately covered by an enumerator and so sub-parishes were taken as enumeration areas (usually a parish is made up of 2 administrative sub-parishes).

3.5 The taxpayers list was used as measure of size. Since agriculture constitutes the main economic activity and is a major source of livelihood for the majority of the taxpayers in rural areas, it was felt that the number of taxpayers was positively correlated with the number of agricultural holdings. Before sample selection was carried out, all gazetted trading centres in the rural areas together with all urban centres with total population of more than 2000, were excluded.

3.6 At the district level, the design for characteristics other than crop yield was two-stage. The sub-parishes were selected systematically with probability proportional to the number of taxpayers in the district. The holdings within the selected sub-parishes were listed and at the second stage, a uniform number of thirty holdings were selected without replacement and with equal probability.

3.7 The Census covered all agricultural holdings within the selected sample units without limitation to size. However, as is often the case where the frame is based on holders rather than area units, agricultural holdings operated by absentee holders would fail to be included during listing. In addition to land holdings, those holdings which had livestock but with no land were included. Other factors that determined the choice of the design were the following:

(a) In the 26 districts where the sample enumeration was undertaken, a list of taxpayers for 1987 by sub-parish was available for 21 districts. This list was used to select 20 sub-parishes from each district as the primary sampling units.

(b) In 3 of the remaining 5 districts namely Bushenyi, Kasese, and Mpigi, the 1987 taxpayers list was available at the parish level. Hence a parish was selected and within the parish one subparish was selected with equal probability. Thus, if the parish was made up of k sub-parishes and if the number of taxpayers in the parish was x out of T taxpayers in the district, then the probability of selecting a sub-parish was x/kT.

(c) In the remaining 2 districts namely Arua and Moyo, the taxpayers list was not available. However, 1980 population census data were available and these were used as a measure of size at the parish level. For detailed listing of holders, one sub-parish was selected with equal probability, as in (b) above with total population replacing number of taxpayers.

3.8 It should be noted that in (b) and (c) above, practical considerations precluded detailed listing or quick counts at the parish level to determine the relative sizes of the sub-parishes within. Further, for the determination of sub-parish selection probabilities, a correction factor $^1/_k$ was applied to the selection probability for the parish where k was the number of sub-parishes within the parish. The purpose of this correction factor was to take account of the additional pseudo-stage introduced by the selection method adopted in the five districts mentioned in (b) and (c) above.

3.9 Choice of Sampling Units and Sample Size. During the Pilot Census, a subparish was seen to have on average 300-400 holders. Cost consideration indicated that 20 was about the right number of enumerators per district. In the 26 districts, the sample size became 26 x 20 x 30 = 15,600 holders. It was also recognised that there would be a high clustering effect within

the sub-parish with regard to cropping and general farming systems with the result that no significant gain in precision of estimates could have been obtained by having a sample take of more than 30 holders. The ultimate sample size represented nearly one percent of agricultural holders in the country.

3.10 In order to achieve a more robust sample design, it would have been desirable to have had details of costs and variances from a recent survey to enable the determination of sample sizes for the sample census. Unfortunately, no such survey had been undertaken. The results of the Pilot and Pretest exercises were not analysed in detail due to a number of practical problems. Hopefully, that would have yielded the required data to determine optimal sample sizes before sample selection for the main Census.

Estimation Procedure

3.11 Except for yield estimation, the basic two-stage design described above was used to compute estimates of such characteristics as the area under the crop by district, livestock numbers, etc. Based on the sample design adopted, the annotations and formulae used for the district total 'Y' were as follows:

Let n= number of EAs (sub-parishes) selected in the district; in our case $n = 20$;

T= the total number of taxpayers in the district;

T_i= the number of taxpayers in the i^{th} selected EA; ($i = 1, 2, \ldots, 20$).

H_i= the number of holders listed in the i^{th} selected EA;

h_i= the number of holders selected in the i^{th} selected EA; in our case, h_i was 30;

y_{ij}= the value of the characteristic 'y' for the j^{th} selected holder in the i^{th} selected sub-parish

Defining the i^{th} sub-parish inclusion probability as $p_i = nT_i/T$ and the j^{th} holder's selection probability in the i^{th} sub-parish as the conditional probability $p_{(j/i)} = h_i/H_i$ gives the overall inclusion probability for a holder as:

$$p_{ij} = p_i \times p_{(j/i)} = nT_ih_i/TH_i$$

An unbiased estimator of the district total Y is given by:

$$\hat{Y} = T/n \sum_{i=1}^{n} H_iy_i/T_ih_i = \sum_{i=1}^{n} w_iy_i \qquad (1)$$

where $y_i = \sum_{j=1}^{h_i} y_{ij}$ and $w_i = {}^1/_n . T/T_i . H_i/h_i$

is the weight attached to (or expansion factor for) the i^{th} EA. The variance of the estimator (1) is given by:

$$V_{tot}(\hat{Y}) = {}^1/_{n(n-1)} . \sum_{i=1}^{n} (\hat{Y}_i - \hat{Y})^2 \qquad (2)$$

where $\hat{Y}_i = T/T_i \; . \; H/H_i \; . \; y_i$

3.12 The above estimator (2), gives the combined variance i.e.. between and within PSU's. For further analysis such as for sample size considerations for the permanent system, decomposition of the two components of variance were made as follows; the within EA variance estimator is given by:

$$\hat{V}_{wit}(Y) = {}^1/_{n^2} . \sum_{i=1}^{n} (T/T_i)^2 . H_i/h_i . (H_i-h_i) . s_i{}^2{}_{wit} \qquad (3)$$

where $s_i{}^2{}_{wit} = (\Sigma_j y^2{}_{ij} - (\Sigma_j y_i)^2)/h_i - 1$; Σ_j denotes summation over the h_i holders and the estimate of between EA variance, $Vbet(\hat{Y})$ is obtained by subtracting (3) from (2).

The total number of holders (or holdings), X in the district is estimated at PSU level by:

$$\hat{X} = T/n \sum_{i=1}^{n} H_i/T_i \qquad (4)$$

and the variance of the estimator (4) can be obtained similarly as in (2).

Ratio estimators R, such as average plot area per holding for a given crop are given by: