

CROP ESTIMATION SURVEYS (STATE SERIES)

REPORT ON TYPE-2 STUDY ON WHEAT
UTTAR PRADESH, 1964-65

SERIES

A. 3

No. 13

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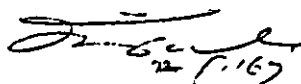
DIRECTORATE OF NATIONAL SAMPLE SURVEY
(Agricultural Statistics Division)

1965

FOREWORD

Official estimates of production of cereals are framed on the basis of crop estimation surveys carried out by the State Governments under the technical guidance of the Agricultural Statistics Division in the Directorate of National Sample Survey. Independent estimates of cereal production are also available since 1957-58, through crop surveys carried out as an integral part of the Socio-economic rounds of the Directorate of National Sample Survey. As wide divergences were noticed in the estimates of production based on the two series of surveys, it was felt that the reasons for such divergences should be further scrutinized. On the recommendation of a Technical Committee set up by the Planning Commission, type studies designated as "Type 2 Studies" were organised on maize in Bihar and on paddy in Andhra Pradesh during 1963-64 as well as on wheat in Uttar Pradesh during 1964-65. The present report deals with the results of the study carried out on wheat in Uttar Pradesh.

New Delhi
January, 1967


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Report on Type-2 Studies on wheat
in Uttar Pradesh Rabi 1964-65

1. Introduction

1.1 The present report deals with the results of type-2 studies carried out on wheat crop during rabi 1964-65 in Uttar Pradesh. It is the third report prepared by the Directorate of National Sample Survey, New Delhi on type-2 studies. The earlier two reports dealt with similar studies conducted on maize in Bihar and on paddy in Andhra Pradesh during 1963-64.

1.2 The statistics of area, yield rates, and production of cereal crops are, in recent times, available from two sources. The regular source of Agricultural Statistics including the estimates of food production is the State Governments. They furnish the figures to the Ministry of Food and Agriculture who in turn compile the all-India estimates. These are called the "official estimates". The second source is the National Sample Survey which carries out multipurpose sample surveys under the technical guidance of Indian Statistical Institute. The NSS series of food production are referred to as NSS-ISI estimates in this report. These two sets of estimates differ very widely. The type-2 scheme envisages joint crop cutting experiments by the State and NSS under normal field conditions with the provision for supervision existing in the field at present and it is mainly designed to study the effect of shape and size of sample cuts on the estimates of yield rates of cereal crops.

1.3 Official estimates of production of crops are obtained for each State as a product of the acreage under the crop and corresponding average yield rates. The acreage under the crop is mostly obtained through complete field enumeration by the village patwaris of the Revenue Department while average yield rates are obtained through crop cutting experiments on the basis of random sampling technique originally developed by the Indian Council of Agricultural Research. The field work of these crop cutting surveys is carried out by the staff of State Departments like Agriculture and/or Revenue as part of the normal departmental activities. The responsibility for providing technical guidance for the conduct of the surveys was originally with the ICAR and from the beginning of January, 1953 this responsibility was transferred to the Directorate of National Sample Survey. The Agricultural Statistics Division of the Directorate of NSS has been providing technical guidance to the State Governments for organizing the crop estimation surveys since 1953. These surveys which were initiated first in 1943-44 on a pilot basis on rice and wheat, now cover all the principal food and non-food crops in all the major States.

1.4 Since 1957-58 the NSS has been making independent estimates of production of important crops for the whole of India. The ISI which is the Technical Wing of the NSS has the entire technical responsibility of the survey while the field Directorate of NSS is in charge of the field work. The crop surveys of the NSS are an integral

part of the Socio-economic surveys and are carried out by well trained full time investigators adopting uniform concepts, definitions and procedures. The NSS-ISI crop surveys cover seven cereal crops viz: (1) rice, (2) wheat, (3) jowar, (4) bajra, (5) ragi, (6) maize and (7) barley.

1.5 The official and NSS-ISI estimates of production of the seven cereal crops have differed as may be seen in the Annexure I of the report. The NSS-ISI estimates of production of the seven crops have been higher than the corresponding official estimates for the period 1957-58 to 1960-61. Since then the divergence between the two estimates has narrowed. The differences between the estimates of the two agencies may be due to differences in the estimates of area or yield or both.

2. Background of the type-2 studies

2.1 The Central Statistical Organisation set up a working group in 1959 to examine critically the divergence of these two sets of estimates. This working group in its second meeting held on 6th August, 1960 had recommended that joint studies should be immediately undertaken to compare the yield rates obtained from circular cuts as adopted in the NSS and rectangular/triangular cuts as adopted by the State Governments for crop estimation surveys. Later on the work relating to the examination of these two sets of estimates was taken over by a Technical Committee set up by the Planning Commission in 1963. The Technical Committee recommended among other things the

following types of studies which were earlier suggested by the Central Statistical Organisation.

Type 1: Joint crop cutting experiments by both techniques under very close and joint supervision of the two agencies, work being somewhat analogous to experiments conducted under laboratory conditions;

Type 2: Joint experiments by both techniques conducted under normal field conditions with provision for supervision as existing in the field at present; and

Type 3: Full scale sample survey to determine the area, rate of yield per acre and production of crops.

Type 1 Study: Type 1 studies were organised during 1960-61 on Jowar in Bundi (Rajasthan) and on wheat in Barh (Bihar). The results of the studies showed that under laboratory conditions yield rates of crops obtained by the two techniques did not differ statistically.

Type 2 Studies: The Technical Committee recommended organisation of the type 2 studies alongwith the extended crop survey of 18th round of NSS (1963-64), on one crop in each of the following States :-

| <u>State</u> | <u>Crop</u> |
|-------------------|-------------|
| 1. Andhra Pradesh | Paddy |
| 2. Bihar | Maize |
| 3. Madhya Pradesh | Jowar |

| <u>State</u> | <u>Crop</u> |
|------------------|-------------|
| 4. Maharashtra | Bajra |
| 5. Uttar Pradesh | Wheat |

2.2 The Technical Committee outlined the major objective of the type 2 studies as finding out the effect of the circular cuts of small size as adopted in the NSS-ISI technique and rectangular/triangular cuts of larger size adopted by Official State Agency, on yield rates of a number of cereal crops. For this purpose the Committee recommended that it would be necessary to have at the State level paired comparison of the yield rates on the NSS and State cuts in about 150 fields for paddy and wheat and about 250 to 300 fields for jowar, bajra and maize. In respect of the whole-field harvest, although it would be essential to have arrangements made for complete harvesting of all the fields selected for paired comparison, the Committee felt that the whole-field harvest need not be insisted in districts or tracts where labour shortage or other serious organisational difficulties are likely to be experienced.

2.3 The Committee further recommended that from the operational point of view it would be preferable to select the villages falling in the NSS sample for type-2 studies and the selection of the fields for NSS/State cuts might be done according to the State procedures. Since the number of NSS sample villages was proportionally smaller

*han corresponding State sample, the Committee felt that NSS sample villages could be treated as an integral part of the State crop survey. This meant that the results of the rectangular/triangular cuts in the selected villages for the type-2 studies would be utilised by the State agencies in building up their production estimates.

2.4 The Technical Committee at its meeting held on 13th and 14th August, 1963 discussed the conceptual and operational details of the type-2 studies with particular emphasis to the concept of whole-field harvest and laid down guide lines for the proper conduct of the field work so that there should not be any controversy on the acceptability of the data thrown up by the survey. It was also decided that the analysis and tabulation of the data would be done independently by the ISI, IARS and the Directorate of NSS at New Delhi. The type-2 study returns should be sent to the three organisations for this purpose.

2.5 Although the recommendation of the Technical Committee was to carry out the type-2 study in 5 States on 5 crops during 1963-64, it could, however, be undertaken in that year only in two States viz; Bihar and Andhra Pradesh. By the time arrangements were made in Uttar Pradesh for type-2 study in 1963, harvesting of wheat had already started in some of the districts and subsequently the study was postponed for 1964-65.

3. Technical details of the type-2 studies on wheat conducted in U.P. during Rabi 1964-65

3.1 It has been stated earlier that villages for type-2 study should be selected from NSS samples and they should also form an integral part of the sample of the State crop estimation surveys. The designs of the two surveys are briefly mentioned below.

3.2 NSS designs: The sample design in the NSS is a stratified two stage one for the land utilisation survey, villages being the first stage unit and cluster of plots - the second stage unit. For crop yield survey, the design is a four stage one with villages, clusters of plots, sub-plots growing specified cereal crops and circular cuts as the first, second, third and fourth stage units respectively. The first and second stage units for crop yield survey are a sub-sample of those chosen for the land utilisation survey.

3.3 Within a State, contiguous tehsils or part of contiguous tehsils fairly homogeneous with respect to the population density and crop pattern are grouped together to form compact strata as far as possible such that the size of stratum is exactly equal, the size being 1951-1961 census population. The country is divided into a number of strata and within each stratum, 24 villages, 4 sub-samples of 6 villages each, are selected circular systematically with probability proportional to size.

3.4 State series - design: The planning of crop cutting experiments in the State series of Uttar Pradesh is done separately for each crop. The sampling design is a stratified multistage one with tehsils as strata and villages as primary units. Allocation over strata for a crop is made roughly in proportion to the acreage under the crop. The villages are selected with equal probability. The other stages of selection are a survey number growing the crop, a sub-number, a field and an equilateral triangle of side 10 metres.

3.5 Type 2 study: The type- 2 study on wheat in Uttar Pradesh 1964-65 consisted of two parts:-

- a) Taking two types of cuts viz; NSS-ISI circular cuts and triangular cuts as adopted by Uttar Pradesh State in a set of common fields.
- b) The whole-field harvest in a sub-sample of villages selected from (a).

3.6 Selection of villages: Uttar Pradesh State has been stratified into 44 strata in the NSS-ISI design of crop survey. The State is also participating in the NSS programme by taking up a matching sample of equal size. The number of sample villages for land utilisation and crop cutting surveys in Uttar Pradesh for NSS central and NSS-State (matching sample) for the 19th round is given below:

Table 3.1: Number of villages selected - NSS L.U.S. and crop yield survey 19th round

| | <u>No. of villages for L.U.S. survey</u> | <u>No. of villages for crop yield survey</u> |
|-------------|--|--|
| NSS-Central | 1056 | 264 |
| NSS-State | 1056 | 264 |
| | <u>2112</u> | <u>528</u> |

3.7 The sample villages for the type-2 study on wheat rabi 1964-65 were selected from the NSS crop cutting villages of the 19th round. The villages with sampling serial number 1 of sub-sample 1 of both central and State sample from each of the 44 strata, excluding strata 30, 31 and 32 comprising the hilly regions were chosen. Thus 82 villages were selected altogether; 41 each from the central and State samples. In all these villages both the NSS-ISI and State cuts were to be taken for paired comparison. Out of these 82 villages, 50 villages (25 from the central and 25 from the State samples) were randomly selected for whole-field harvest.

3.8 Concept of wheat crop: For the purpose of State series, all fields in the selected villages growing wheat pure and wheat-gram mixture as defined in the State Land Record system formed the population (universe) at the village level. Fields growing wheat-barley mixture were excluded from the population. On the other hand fields growing wheat mixed with other crops such as oil seeds but no gram or barley were taken as wheat provided wheat was the predominant crop in the mixture. Similarly all fields growing wheat-gram mixture alongwith other crops were shown under wheat-gram provided wheat-gram was the predominant constituent in the mixture. As a corollary a field with wheat-gram-barley mixture was shown under wheat-gram if wheat-gram constituent was predominant and as wheat-barley if this was predominant.

3.9 Selection of sample fields:- Two fields growing wheat as defined above were selected randomly from each sample village according to the state official procedure of crop estimation surveys. The method of selection was, first to select a survey number growing the crop, then a sub-number, in case the survey number had sub-divisions and finally a field growing the crop within a survey/sub-number.

3.10 Number of cuts:- From each sample field one triangular cut (equilateral triangle of side 10 metres) was taken by the State official (series) agencies and one circular cut of 4' radius if the field was under pure wheat and 2 circular cuts if the field was under mixed crops by the Central/State NSS staff were taken. The circular cut consisted of two concentric circles of radii 2'-3" and 4' respectively.

3.11 Location and marking of cuts:- The location and marking of the triangular and circular cuts were done according to the respective state official and NSS-ISI methods. Since both types of cuts were to be located in the same selected field, the following procedure was laid down.

- i) In the first field in each village the circular cut would be located first and then the triangular cut. Similarly, in the second field, the triangular cut was first to be located and then the circular cut;

(11)

- ii) Over-lapping of the two types of cuts was to be avoided by selecting fresh pairs of random numbers;
- iii) In case the two cuts could not be accommodated independently, the field should be substituted by another field according to the State procedure.

3.12 Harvesting, threshing, weighing and driage: These operations were done according to the respective practices followed by the two agencies. The produce from 2' - 3" circle was stored for driage according to the National Sample Survey practice while the entire produce of the triangular cut was taken for driage by the State agency.

3.13 Whole fieldharvest: The harvesting of the crop was to be done only when the crop was fully mature. The whole-field harvesting was to be started only after taking the sample cuts. It was to be ensured that no damage was done to the residual portion while taking the two types of cuts. The field workers were instructed to take special care to see that no grain was lost in the field at the time of whole-field harvest. The plants should be cut from the bottom. Harvested plants should be spread for a couple of hours on a tarpaulin or hession cloth in a place as close as possible to the selected field. After completing the harvesting operation, earheads/ grains lying on the ground in the field should be collected.

3.14 After threshing and cleaning, the weight of the

green crop was taken. The produce along with the produce of the annular portion of the circular cut was stored for drying. Elaborate procedures were prescribed for drying the produce of the whole field harvest and recording the weight of dried grain.

3.15 The area of the fields selected for whole-field harvest, was measured by the primary workers taking the assistance of trained survey and settlement staff. This was to be done on the day of harvest or next day. A sketch map of the field with measurements was also to be provided.

4. Organisation of field work and supervision

4.1 The field work of the type-2 scheme consisting of circular cut, triangular cut and whole-field harvest was done by different set of primary staff. The circular cuts were taken by the central and State NSS investigators in their respective samples. The official State crop estimation surveys were being carried out by the supervisor kanungos under the technical guidance of the Joint Director of Agriculture (Statistics) Uttar Pradesh. The same supervisor kanungos conducted the triangular cuts under the type-2 scheme. The administrative and operational responsibility for arranging the whole-field harvest in connection with the type-2 study was assigned to the Joint Director of Agriculture (Statistics) Uttar Pradesh. In addition to that, the Government of Uttar

Pradesh had appointed him in over-all charge of the type-2 scheme.

4.2 The operational details of the type-2 study, such as instructions for the field work, schedules, training, supervision etc. were first discussed in a meeting held at Lucknow on November 4 and 5, 1963, which was attended by the representatives of ISI, SSB Uttar Pradesh, Department of Agriculture (Statistics) Uttar Pradesh, CSO and Directorate of National Sample Survey. Even though the I.S.I. had suggested that the scheme for U.P. should provide I.P.N.S. arrangements, in view of the administrative and other considerations involved, it was decided at this meeting that the principles of IPNS need not be followed in the case of Uttar Pradesh study which was a departure from the earlier studies conducted in Bihar and Andhra Pradesh. As the type-2 study could not be carried out during Rabi 1963-64 due to unavoidable reasons, the decisions of Lucknow meeting were reviewed on the basis of a note prepared by the Joint Director of Agriculture (Statistics) Uttar Pradesh at a meeting held in C.S.O. on 27th October, 1964. It was agreed to make arrangements for transferring the equipment lying with the SSB, Bihar in connection with the type-2 study undertaken by them to the Joint Director of Agriculture (Statistics) Uttar Pradesh. The officers of National Sample Survey Directorate met the Joint Director of Agriculture (Statistics) U.P. at Lucknow on 10th and 11th November and discussed certain

further details of the scheme. A further meeting of the representatives of ISI, SSB, U.P., Joint Director of Agriculture (Statistics) Uttar Pradesh, NSS and CSO was held on 6th February, 1965 at Lucknow and finalised all operational details of the programme.

4.3 For facilitating the organisation of the survey, it was decided to collect information regarding the availability in the selected villages of wheat crop and storage and labour facilities, approach to sample village, facilities for stay in or near the villages etc. A proforma was prescribed for this purpose and the information was collected by the Assistant Director, NSS (Lucknow) in respect of the central samples and by the Director, SSB, Uttar Pradesh for the State samples.

4.4 It was envisaged for the proper conduct of field work to set up a control room in the office of the Joint Director of Agriculture (Statistics) Uttar Pradesh, with map indicating the sample points with different marks for various stages of field work, charts showing the village-wise dates of harvest, cards for each village showing the name of the primary worker, the stage of field-work, the supply of equipment, arrangements for storage, details of harvest etc.

4.5 For whole-field harvest operations, 50 whole time special supervisor kanungos, 50 chain men and 20 Naib Tehsildars were appointed on adhoc basis. The scheme also provided for the appointment of 4 Field officers, one Statistician and one Statistical Assistant at Headquarters

and necessary clerical and other assistance. One village was assigned to each of the special supervisor kanungos for the whole-field harvesting and subsequent operations of threshing, weighing and drriage in accordance with the instruction laid down. The Naib Tehsildars were required to supervise the work of the supervisor kanungos.

4.6 Training was given to the primary and supervisory staff at two levels by the Joint Director of Agriculture (Statistics) or by his senior Statistician. In the first phase, the Naib Tehsildars, Assistant Superintendents of National Sample Survey and District Statistical Officer of the SSB were trained at three centres viz. Bareilly, Allahabad and Lucknow. This programme was completed by 12th February, 1965. The second phase of programme was conducted between 18th and 28th February, 1965 at the District Headquarters where the concerned Lekhpals and regular supervisor kanungos, field officers, special supervisor kanungos appointed under the type-2 study scheme and the investigators of NSS were given training.

4.7 Supervision: The field work of the type-2 studies lasted for about three months commencing from 15th February, 1965. During this period close liaison was maintained between the supervisory staff of the Directorate of National Sample Survey, District Statistical Staff of the SSB and the staff of the Joint Director of Agriculture (Statistics). In the case of whole-field harvest it was envisaged that one representative each of NSS (Central or State) and official state series should be

present at the various stages of operation such as demarcation of crop area, harvesting, threshing, drriage, recording the weight of the grain and measurement of the area of the field. Besides there was intensive supervision by the higher level officers of all the organisations involved in the joint study. The number of villages visited at harvest stage by the different agencies are shown below:-

Table 4.1: Number of villages visited at harvest stage by different agencies.

| Agency | No. of villages visited at harvest stage | | |
|--|--|----------------|-------------|
| | Circular cut | Triangular cut | Whole-field |
| 1 | 2 | 3 | 4 |
| 1. State Statistical Bureau, Uttar Pradesh | 69 | 63 | 50 |
| 2. Joint Director Agriculture (Statistics) | - | 6 | 50 |
| 3. Indian Statistical Institute | - | - | 26 |
| 4. Directorate of National Sample Survey | 16 | 16 | 14 |

The Director, Central Statistical Organisation and the Chief Director, National Sample Survey visited one whole-field harvest village in Banaras District and observed the harvesting, threshing and weighment operations of the circular cut, triangular cut and whole-field harvest. Another village was visited by the Joint Director, C.S.O. at harvest stage in Saharanpur District. Although the

type-2 studies envisaged only that much supervision normally exercised by the two agencies, the introduction of whole-field harvest in 50 out of 82 villages with provision to inspect all the 50 villages at all the stages of operation had considerably increased the quantum of supervision of the two types of cuts also. Further the primary workers of the two agencies were fully aware of the involvement of many agencies and the great importance attached to the type-2 studies. In the circumstances the normal field condition contemplated in the study could not be said to have prevailed.

4.8 The inspection reports of the NSS officers showed that necessary items of equipment were supplied to the field workers in villages visited by them and the work was done satisfactorily according to the prescribed procedure. All possible efforts were made to carry out all the operations with great accuracy and adequate supervision. Even then, in a few villages, harvesting, threshing and cleaning of the produce from whole-fields could not be completed on the same day due to either the harvested crop was very heavy or the weather was not good. However, such departures from the instructions are unavoidable and they are not likely to affect the results seriously.

4.9 Six copies of each of the prescribed forms relating to State triangular cut, NSS-ISI circular cut and the whole-field harvest were prepared by the field staff and

five were mailed to the following agencies:-

- i) Indian Statistical Institute, Calcutta.
- ii) Board of Revenue (Land Reforms) Uttar Pradesh, Lucknow.
- iii) The Bureau of Economic Intelligence and Statistics, Uttar Pradesh, Lucknow.
- iv) The Directorate of National Sample Survey, New Delhi.
- v) Institute of Agricultural Research Statistics, Ministry of Food & Agriculture, New Delhi.

The receipt of forms in the Directorate of National Sample Survey was spread over a period of 4 months from 24.2.65 to 30.6.65. All forms were received in respect of triangular and circular cuts. But, in the case of whole-field harvest form 'F' for one village was not received in the National Sample Survey Directorate.

5. Scrutiny and analysis

5.1 The forms received from the field staff were scrutinised in the NSS Directorate and discrepancies if any were pointed out to them for clarification. It was observed that the dried weights reported in respect of the two triangular cuts for Prathapur-Kamaicha village in Sultanpur District were more than the green weights of produce. As the explanation given by the field worker was not satisfactory, the two experiments were rejected. Consequently the results of circular cuts as well as the whole-field harvest for the village could not be made use of. Scrutiny also revealed that the results of whole-field

harvest in Amkhera village in Jalaun District - were of doubtful accuracy because of appreciable loss in the produce during the various operations. Areas of both fields were large and from the remarks of the supervisory officials it was gathered that there was heavy rain on the day of harvest and the produce was drenched. The results of whole-field harvest in the two fields of Amkhera village were therefore rejected. However the yield data relating to circular and triangular cuts for the village were accepted for analysis.

5.2 The number of villages where type-2 experiments were planned, conducted and analysed is given in table 5.1.

Table 5.1: No. of villages where type-2 study was planned, conducted and analysed.

| N.S.S. Sample | Total No. of villages where experiments were planned | | Total No. of villages where experiments were conducted | | Total No. of villages for which experiments were analysed. | |
|---------------|--|---------------------|--|---------------------|--|---------------------|
| | All sample cuts | Whole-field harvest | All sample | Whole-field harvest | All sample | Whole-field harvest |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Central | 41 | 25 | 40 | 24 | 40 | 23 |
| State | 41 | 25 | 41 | 25 | 41 | 24 |
| Total | 82 | 50 | 81 | 49 | 81 | 47 |

Footnote:- In each village under each category 2 cuts/whole-field harvest were conducted.

5.3 The scrutiny of the forms showed that only 17.9 per cent of the fields selected for the type-2 study were sown pure. The distribution of fields according to the nature of sowing given in the returns of State cuts is shown below:-

Table 5.2: Distribution of fields according to the nature of sowing

| Pure/mixed crop | No. of fields selected | Percentage |
|------------------------------|------------------------|------------|
| 1 | 2 | 3 |
| 1. Wheat pure | 29 | 17.9 |
| 2. Wheat + Gram | 25 | 15.4 |
| 3. Wheat + Mustard | 63 | 39.0 |
| 4. Wheat + Gram + Mustard | 20 | 12.3 |
| 5. Wheat + Gram + Linseed | 6 | 3.7 |
| 6. Wheat + Mustard + Linseed | 6 | 3.7 |
| 7. Wheat + Linseed | 6 | 3.7 |
| 8. Wheat + Others | 7 | 4.3 |
| | 162 | 100.0 |

But according to the returns relating to circular cuts the Investigators of the Central and State NSS had conducted 2 experiments each in 147 out of the 162 fields since they were sown mixed.

5.4 Before taking up the analysis, the data transferred from the various forms in the National Sample Survey Directorate were compared with that of the ISI by deputing an officer of the Directorate. The office of the Joint Director of Agriculture (Statistics) U.P.

was also visited to satisfy the accuracy of the data accepted for analysis.

5.5 Analysis: The analysis has been done on the basis of dried grain. For circular cuts, the ratio of dried grain to green wheat was obtained in respect of produce from circular cuts of radius 2'-3". This ratio was applied to the produce from each circular cut of radius 4' for obtaining the weight of the dried grain. In the case of the triangular cut, and whole field harvest the produce from every cut/field was dried and hence it did not involve any estimation process. Before making comparisons individual plot yield was reduced to Kilograms per acre using appropriate conversion factors. In the case of whole field, the area under crop excluding the area under ails or bunds was considered. The conversion to per acre yield is done in the following manner:-

$$Y_i' \quad (\text{circular cut}) = \frac{Y_i}{\pi \times 4^2} \times 43560$$

Where Y_i is the yield in Kilograms of i th circular cut and Y_i' is the yield per acre in kg. for the i th circular cut.

$$X_i' \quad (\text{triangular cut}) = \frac{X_i}{0.0107}$$

Where X_i is the yield in Kilograms of the i th triangular cut and X_i' is the yield in kg. per acre of the i th triangular cut.

$$Z_i' \quad (\text{whole-field}) = \frac{Z_i}{a_i}$$

Where Z_i is the yield in kgs. and a_i is the area of the i th whole field in acre Z_i' is the yield per acre of i th whole-field.

In the case of mixed fields where two circular cuts were taken, the average of the per acre yield from the two circular cuts was worked out.

5.6 For purpose of analysis the sample villages were grouped into three categories viz; (i) All sample villages, (ii) whole-field villages and (iii) paired sample villages where whole-field harvest was not done. Analysis was done in the following manner.

1. Whole field sample

- a) Simple mean yield per acre and sampling error in respect of whole-fields, triangular cuts and circular cuts were worked out for central and state samples separately and for the combined samples.
- b) Mean difference in yield between whole-field and triangular cuts, whole-field and circular cuts and triangular and circular cuts and also the sampling errors were calculated. The significance of the difference in the yield rates between the different cuts and whole-field was tested by student's 't' test.

2. All sample and paired sample (where whole-field harvest was not done).

Simple mean yield in kgs. per acre of triangular cuts, circular cuts, mean difference between triangular and circular cuts, and sampling

error were worked out. The significance of the difference in the yield rates of triangular and circular cuts was tested by Student's 't' test.

3. Frequency distributions of positive, negative and zero differences of the per acre yield of the following categories were studied;

- i) Whole-field minus triangular cut
- ii) Whole-field minus circular cut
- iii) Triangular cut minus circular cut for
 - a) whole-field sample;
 - b) all sample;
 - c) paired sample (where whole-field harvest was not done).

5.7 In the State official crop estimation surveys yield data from mixed fields are inflated so as to relate to pure crops. But in the case of type-2 studies, no such adjustment was made for mixed crop and all comparisons have been made on un-adjusted yield rates as obtained from the sample cuts/fields. The per acre yield of wheat given in this report are therefore not comparable with the yield rate estimated by the official state agency in connection with the regular crop estimation surveys.

6. Results

6.1 The unadjusted mean yield rate of wheat as obtained from the whole-field, triangular cut and circular cut for the three categories of sample

villages are given below:-

Table 6.1: Mean yield of wheat (unadjusted) per acre

| Category of sample | Whole-field | Triangular cut | Kgs/acre |
|---|-------------|----------------|--------------|
| | | | Circular cut |
| 1 | 2 | 3 | 4 |
| 1. Whole-field sample | 466.57 | 490.69 | 483.08 |
| 2. All sample | - | 466.21 | 466.52 |
| 3. Paired sample (where whole-field harvest was not done) | - | 432.37 | 443.65 |

In the case of whole-field villages, the average yield from the traingular cuts is more by 5.2 per cent and that from the circular cut by 3.5 per cent than the whole field average. The yield rate of triangular cut is more or less the same as that of circular cut when all sample is considered. In the case of paired cuts where whole-field harvest was not done, the yield rate from circular cut is observed to be 26 per cent more than the triangular cut.

6.2 The average yield rates of wheat with sampling errors for whole-field villages by categories of experiments and by sub-samples are shown in table 6.2.

Table 6.2: Mean yield rates (un-adjusted) of wheat with sampling errors for whole-field, triangular and circular cuts.

| <u>Whole-field sample</u> | | | | |
|---------------------------|---|------------------------------|-----------------|------------------|
| Sub-sample | Sample size (No. of cuts/ fields) | Average yield kgs/acre | Sampling error | |
| | | | In kgs/ acre | Per - centage |
| 1 | 2 | 3 | 4 | 5 |
| <u>Whole-field</u> | | | | |
| Central | 46 | 465.81 | 43.46 | 9.3 |
| State | 48 | 467.30 | 45.81 | 9.8 |
| Combined | 94 | 466.57 | 31.45 | 6.7 |
| <u>Triangular cut</u> | | | | |
| Central | 46 | 496.34 | 46.06 | 9.3 |
| State | 48 | 485.28 | 50.50 | 10.4 |
| Combined | 94 | 490.69 | 34.08 | 6.9 |
| <u>Circular cut</u> | | | | |
| Central | 46 | 477.32 | 43.61 | 9.1 |
| State | 48 | 488.59 | 48.35 | 9.9 |
| Combined | 94 | 483.08 | 32.46 | 6.7 |

6.3 The percentage sampling errors for the combined sample for the two types of cuts and the whole-field harvest are more or less of the same order. It may be seen that even at the sub-sample level yield rates of triangular cut and circular cuts are higher than the yield rate of whole fields.

6.4 Individual differences between yield rates of whole-field and triangular cuts, whole-field and circular

cuts and triangular and circular cuts were analysed for the whole-field villages and the results shown in table 6.3. The table gives sampling errors of the mean differences, and also the values of Student's 't'.

Table 6.3: Mean yield of wheat (un-adjusted) from whole-field, triangular cut and circular cut with sampling errors of difference in yield rates and value of Students't'.

(Whole-field harvest villages)

| Sub-sam-ple | No. of fields | Average yield (simple) Kgs/acre | | | Mean difference \pm S.E. | | | Students' 't' | | | | |
|-------------|---------------|---------------------------------|----------------|--------------|----------------------------|--------------------|--------------------|---------------|-------------|----------------|----|----|
| | | whole field | triangular cut | circular cut | whole-field | whole-field | Triangular cut | Whole field | Whole field | Triangular cut | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Central | 46 | 465.81 | 496.34 | 477.32 | -30.54 \pm 16.16 | -11.52 \pm 16.10 | +19.01 \pm 19.79 | 1.89 | 0.72 | 0.96 | | |
| State | 48 | 467.30 | 485.28 | 488.59 | -17.97 \pm 13.35 | -21.29 \pm 17.57 | -3.31 \pm 21.23 | 0.98 | 1.21 | 0.16 | | |
| Combined | 94 | 466.57 | 490.69 | 483.08 | -24.12 \pm 12.21 | -16.51 \pm 11.88 | +7.61 \pm 14.53 | 1.98 | 1.39 | 0.52 | | |

6.5 It is seen that mean difference is not statistically significant in respect of any of the comparisons. It leads to the inference that differences in yield rates between whole-field and triangular cuts, whole-field and circular cuts and triangular and circular cuts can be attributed to sampling fluctuations. In other words, the results indicate that under the operational conditions obtained for the type-2 studies in Uttar Pradesh both types of cuts are suitable for yield estimation and there is no

6.7 The difference in yield rates between the triangular cut and circular cut in the case of all sample is only 0.32 kgs. It is also not appreciable in respect of central and state sub-samples. The estimates of yield rates of triangular and circular cuts for the paired sample where the whole-field harvest was not done, also do not differ appreciably. The values of 't' for the central and state sub-samples of the two groups indicate that the differences in yield rates are not statistically significant in respect of all the comparisons made in the above table. It confirms the earlier conclusion that there is no evidence that one type of cut is better than the other for estimating yield of wheat crop.

6.8 It is also interesting to study the magnitude and direction of the differences between various types of cuts at individual field level. Five tables giving the frequency distribution of sample fields according to the differences of unadjusted yield rates of wheat are appended. The number of positive and negative differences between different types of cuts is presented below in table 6.5 for whole-field harvest villages and in table 6.6 for all sample and paired sample where whole-field harvest was not done.

Table 6.5: Count of positive and negative differences of yield rates; whole field-triangular cuts and whole field-circular cuts.

Whole-field villages

| Sub-sample | Whole field - triangular cut | | | | Whole field-circular cut | | | |
|------------|------------------------------|---------------|---------------|-------|--------------------------|---------------|---------------|-------|
| | Zero | posi- tive | nega- tive | Total | Zero | posi- tive | nega- tive | Total |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Central | - | 23 | 23 | 46 | - | 20 | 26 | 46 |
| State | - | 20 | 28 | 48 | - | 19 | 29 | 48 |
| Total | - | 43 | 51 | 94 | - | 39 | 55 | 94 |

Table 6.6: Count of positive and negative differences in yield between triangular and circular cuts in respect of whole field sample, paired sample where whole field harvest was not done and all sample.

| Sub-sample | Count of positive and negative differences (triangular - circular) cuts | | | | | | | | | | | |
|---------------|--|---------------|---------------|-------|---------------|---------------|---------------|-------|------------|---------------|---------------|-------|
| | Whole field sample | | | | Paired sample | | | | All sample | | | |
| | Zero | posi- tive | nega- tive | Total | Zero | posi- tive | nega- tive | Total | Zero | posi- tive | nega- tive | Total |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Central | - | 24 | 22 | 46 | - | 16 | 18 | 34 | - | 40 | 40 | 80 |
| State | - | 20 | 28 | 48 | - | 16 | 18 | 34 | - | 36 | 46 | 82 |
| comb- ined | - | 44 | 50 | 94 | - | 32 | 36 | 68 | - | 76 | 86 | 162 |

6.9 Comparison of whole-field with triangular and circular cuts shows that the number of negative differences is more than the positive differences in all cases excepting the triangular cuts of the central sub-sample. The negative differences are far more greater in the case of whole-field comparison with circular cuts. The same pattern is observed at the sub-sample level also. In the case of differences between the triangular and circular cuts it may be seen that out of the 9 comparisons made in Table 6.6, the number of negative differences exceeds the number of positive differences in seven cases.

7. Conclusion

7.1 The type-2 study on wheat in Uttar Pradesh suggests that under the operational conditions which prevailed for the study, the differences between the yield rates obtained from whole-field harvest, triangular cuts and circular cuts are not statistically significant. In other words, it means that both types of cuts are suitable for crop yield estimation and there is no evidence to say that one type of cut is better than the other. The field conditions obtained for the type-2 study may be specially noted. One essential requirement of the type-2 study, as laid down by the Technical Committee, was that it should be carried out under normal field conditions which however could not be secured in practice in view of the organisation of

whole-field harvest in 50 out of 82 villages with provision to supervise at all stages of whole-field harvest operations. These were conflicting requirements and both of them could not be achieved at the same time. Even in the case of remaining villages, the field staff were fully aware of the great importance attached to the type-2 study and the active participation of many agencies of central and State Governments. This awareness in turn could have resulted in better field work than what would have been obtained otherwise under normal field conditions. Nonetheless the conclusion emerged from the study is valid and important in the sense that under identical controlled field conditions both types of cuts are equally suitable for crop yield estimation surveys.

8. Summary

8.1 As recommended by the Technical Committee set up by Planning Commission, type-2 study on wheat was carried out in Uttar Pradesh during rabi 1964-65, under the over-all charge of the Joint Director of Agriculture (Statistics) Uttar Pradesh.

8.2 The objective of the type-2 study was to find out the effect of circular cuts of small size (4' radius) as adopted in the NSS-ISI technique and triangular cuts of large size (equilateral triangle of 10 metres) as adopted by Uttar Pradesh official State Agency, on the estimation of yield rate of wheat crop.

8.3 82 villages were selected from the list of sample villages for National Sample Survey 19th round (41 each from the central and state samples). Both triangular and circular cuts were taken in two fields each in all the 81 villages. Whole-field harvest was done in respect of a simple random sub-sample of 50 cut of the 82 villages in order to compare with the yield rates obtained from circular and triangular cuts.

8.4 The field work of the triangular cut was done by the regular supervisor kanungos. The circular cut in the central sample was taken by the investigators of the field Directorate of National Sample Survey and in the State sample by the State investigators under the charge of the Director, State Statistical Bureau, Uttar Pradesh. The whole-field harvest was done by whole-time supervisory kanungos specially appointed for the whole-field harvest operation.

8.5 The Indian Statistical Institute, Directorate of National Sample Survey, Central Statistical Organisation, State Statistical Bureau, Uttar Pradesh and the officials of the office of Joint Director of Agriculture (Statistics) Uttar Pradesh, participated in the organisation and supervision of field work. The reports of the National Sample Survey supervisory staff showed that the field work was carried out satisfactorily and according to instructions.

8.6 Although the average yield rates of what obtained from triangular and circular cuts for the combined from triangular and circular cuts for the combined sample are higher than that of the whole-field harvest by 5.2 per cent and 3.5 per-cent respectively, they are not statistically different. The yield rates obtained from triangular cut and circular cut in respect of all sample are almost the same.

8.7 't' test indicates that the differences between the yield rates obtained from the whole-field harvest triangular cuts and circular cuts are not significant. In other words, both types of cuts are suitable for crop yield estimation surveys and there is no evidence to suggest that one is better than the other.

8.8 It was envisaged to carry out the type-2 studies under normal field conditions. The normal field condition, however, could not be secured because of the organisation of whole-field harvest in 50 out of 82 villages with intensive supervision at all stages of whole field harvest operations in all the 50 villages.

Annexure - 1

Estimates of production of seven principal cereal crops
(Rice, Wheat, Jowar, Bajra, Ragi, Maize and Barley).

| Year | NSS-ISI (Million tons) | Official (Million tons) | $\frac{\text{NSS-ISI} - \text{Official} \times 100}{\text{Official}}$ |
|---------|------------------------------|-------------------------------|---|
| 1 | 2 | 3 | 4 |
| 1957-58 | 68.06 | 52.18 | 30.4 |
| 1958-59 | 82.28 | 60.84 | 35.3 |
| 1959-60 | 83.86 | 61.86 | 35.6 |
| 1960-61 | 90.47 | 65.30 | 38.6 |
| 1961-62 | 82.83 | 66.37 | 24.8 |
| 1962-63 | 72.78 | 64.12 | 13.5 |
| 1963-64 | 71.91 | 66.46 | 8.2 |

Note:- (1) 1957-58 estimates of NSS are based on a period of 8 months, which comprised a part of Autumn (August-October), the whole of Winter (November-January), the whole of Spring (February-April), and a part of Summer (May-June) Seasons.

(2) NSS estimates for the year from 1958-59 to 1961-62 do not include summer season.

(3) Official estimates for the year 1957-58 to 1962-63 and NSS estimates for the year 1963-64 have been converted from tonnes to tons by using 0.9842 as multiplier.

Source: Official Estimates: (i) Area and Production of Principal Crops in India (Summary Tables) issued by the Directorate of Economics & Statistics (1963).

(ii) All-India final estimates of various crops, issued by the Dte. of Economics & Statistics during 1964.

National Sample Survey Estimates:-

(i) NSS reports of various rounds.

(ii) Preliminary estimates for the year 1963-64 supplied by the Indian Statistical Institute.

Table A.1

Frequency distribution of the sample fields by sub-sample according to the differences of unadjusted yield rates of wheat-Rabi 1964-65 in Uttar Pradesh

Whole-field villages

Whole field - Triangular cut

| Class interval of differences in kgs/acre | Central sample | | State sample | | Total | | Total |
|---|----------------|----------|--------------|----------|----------|----------|-------|
| | Positive | Negative | Positive | Negative | Positive | Negative | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| < 25 | 5 | 3 | 8 | 8 | 13 | 11 | 24 |
| < 50 | 8 | - | 3 | 5 | 11 | 5 | 16 |
| < 75 | 2 | 4 | 3 | 4 | 5 | 8 | 13 |
| < 100 | 6 | 4 | - | 2 | 6 | 6 | 12 |
| < 125 | 1 | 4 | - | 1 | 1 | 5 | 6 |
| < 150 | - | 1 | 2 | 3 | 2 | 4 | 6 |
| < 175 | - | - | 2 | - | 2 | - | 2 |
| < 200 | 1 | 2 | 1 | 3 | 2 | 5 | 7 |
| < 225 | - | 3 | - | - | - | 3 | 3 |
| < 250 | - | 1 | - | - | - | 1 | 1 |
| < 275 | - | - | - | - | - | - | - |
| < 300 | - | - | - | - | - | - | - |
| < 325 | - | 1 | - | 1 | - | 2 | 2 |
| < 350 | - | - | - | - | - | - | - |
| < 375 | - | - | - | 1 | - | 1 | 1 |
| < 400 | - | - | - | - | - | - | - |
| < 425 | - | - | - | - | - | - | - |
| < 450 | - | - | - | - | - | - | - |
| ≥ 450 | - | - | 1 | - | 1 | - | 1 |
| Total | 23 | 23 | 20 | 28 | 43 | 51 | 94 |

Table A.2

Frequency distribution of the sample fields by sub-samples according to the differences of un-adjusted yield rates of wheat- Rabi 1964-65 in Uttar Pradesh

Whole-field villagesWhole field - circular cut

| Class interval of differences in kgs/acre | Central sample | | State sample | | Total | | Total |
|---|----------------|----------|--------------|----------|----------|----------|-------|
| | Positive | Negative | Positive | Negative | Positive | Negative | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| < 25 | 5 | 8 | 8 | 4 | 13 | 12 | 25 |
| < 50 | 2 | 5 | 1 | 9 | 3 | 14 | 17 |
| < 75 | 5 | 6 | 1 | 4 | 6 | 10 | 16 |
| < 100 | 3 | 2 | 2 | 2 | 5 | 4 | 9 |
| < 125 | 2 | 2 | 2 | 2 | 4 | 4 | 8 |
| < 150 | 2 | - | 1 | 1 | 3 | 1 | 4 |
| < 175 | - | - | - | 1 | - | 1 | 1 |
| < 200 | - | - | 2 | 2 | 2 | 2 | 4 |
| < 225 | - | - | - | 1 | - | 1 | 1 |
| < 250 | 1 | - | 1 | 1 | 2 | 1 | 3 |
| < 275 | - | 1 | - | 1 | - | 2 | 2 |
| < 300 | - | 1 | - | 1 | - | 2 | 2 |
| < 325 | - | - | - | - | - | - | - |
| < 350 | - | - | - | - | - | - | - |
| < 375 | - | - | 1 | - | 1 | - | 1 |
| < 400 | - | 1 | - | - | - | 1 | 1 |
| < 425 | - | - | - | - | - | - | - |
| < 450 | - | - | - | - | - | - | - |
| ≥ 450 | - | - | - | - | - | - | - |
| Total | 20 | 26 | 19 | 29 | 39 | 55 | 94 |

Table A.3

Frequency distribution of the sample fields by sub-samples according to the differences of un-adjusted yield rates of wheat- Rabi 1964-65 in Uttar Pradesh

Whole-field villagesTriangular cut - circular cut

| Class interval of differences in kgs/acre | Central sample | | State sample | | Total | | Total |
|---|----------------|-----------|--------------|-----------|-----------|-----------|-----------|
| | Positive | Negative | Positive | Negative | Positive | Negative | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| < 25 | 4 | 3 | 3 | 4 | 7 | 7 | 14 |
| < 50 | 4 | 1 | 6 | 7 | 10 | 8 | 18 |
| < 75 | 3 | 5 | 1 | 5 | 4 | 10 | 14 |
| < 100 | 3 | 6 | 2 | 2 | 5 | 8 | 13 |
| < 125 | - | 1 | 1 | 2 | 1 | 3 | 4 |
| < 150 | 2 | 3 | 1 | 2 | 3 | 5 | 8 |
| < 175 | 3 | 1 | - | - | 3 | 1 | 4 |
| < 200 | 1 | 2 | 1 | 3 | 2 | 5 | 7 |
| < 225 | 1 | - | 1 | - | 2 | - | 2 |
| < 250 | 1 | - | - | 2 | 1 | 2 | 3 |
| < 275 | - | - | - | - | - | - | - |
| < 300 | - | - | 1 | - | 1 | - | 1 |
| < 325 | 1 | - | 1 | - | 2 | - | 2 |
| < 350 | - | - | - | 1 | - | 1 | 1 |
| < 375 | - | - | 2 | - | 2 | - | 2 |
| < 400 | - | - | - | - | - | - | - |
| < 425 | - | - | - | - | - | - | - |
| < 450 | 1 | - | - | - | 1 | - | 1 |
| ≥ 450 | - | - | - | - | - | - | - |
| Total | 24 | 22 | 20 | 28 | 44 | 50 | 94 |

Table A.4

Frequency distribution of the sample fields by sub-samples according to the differences of un-adjusted yield rates of wheat- Rabi 1964-65 in Uttar Pradesh

Villages where whole-field harvest was not done

Triangular cut - circular cut

| Class interval of differences in kgs./acre | Central sample | | State sample | | Total | | Total |
|--|----------------|-----------|--------------|-----------|-----------|-----------|-----------|
| | Positive | Negative | Positive | Negative | Positive | Negative | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| < 25 | - | 5 | 5 | 3 | 5 | 8 | 13 |
| < 50 | 3 | 4 | 2 | 1 | 5 | 5 | 10 |
| < 75 | 2 | - | 1 | 3 | 3 | 3 | 6 |
| < 100 | 2 | 3 | - | 4 | 2 | 7 | 9 |
| < 125 | 3 | 1 | 2 | - | 5 | 1 | 6 |
| < 150 | 1 | - | 2 | 2 | 3 | 2 | 5 |
| < 175 | 2 | - | 1 | - | 3 | - | 3 |
| < 200 | - | 1 | - | 1 | - | 2 | 2 |
| < 225 | 1 | 1 | 1 | 2 | 2 | 3 | 5 |
| < 250 | - | 1 | - | - | - | 1 | 1 |
| < 275 | - | - | 1 | 1 | 1 | 1 | 2 |
| < 300 | - | - | 1 | - | 1 | - | 1 |
| < 325 | - | 1 | - | - | - | 1 | 1 |
| < 350 | - | - | - | - | - | - | - |
| < 375 | - | - | - | - | - | - | - |
| < 400 | 2 | - | - | - | 2 | - | 2 |
| < 425 | - | - | - | 1 | - | 1 | 1 |
| < 450 | - | - | - | - | - | - | - |
| ≥ 450 | - | 1 | - | - | - | 1 | 1 |
| Total | 16 | 18 | 16 | 18 | 32 | 36 | 68 |

(39)

Table A.5

Frequency distribution of the sample fields by sub-samples according to the differences of un-adjusted Yield rates of wheat- Rabi 1964-65 in Uttar Pradesh

All Samples

Triangular cut - Circular cut

| Class interval of difference in kgs/acre | Central sample | | State sample | | Total | | Total |
|--|----------------|-----------|--------------|-----------|-----------|-----------|------------|
| | Positive | Negative | Positive | Negative | Positive | Negative | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| < 25 | 4 | 8 | 8 | 7 | 12 | 15 | 27 |
| < 50 | 7 | 5 | 8 | 8 | 15 | 13 | 28 |
| < 75 | 5 | 5 | 2 | 8 | 7 | 13 | 20 |
| < 100 | 5 | 9 | 2 | 6 | 7 | 15 | 22 |
| < 125 | 3 | 2 | 3 | 2 | 6 | 4 | 10 |
| < 150 | 3 | 3 | 3 | 4 | 6 | 7 | 13 |
| < 175 | 5 | 1 | 1 | - | 6 | 1 | 7 |
| < 200 | 1 | 3 | 1 | 4 | 2 | 7 | 9 |
| < 225 | 2 | 1 | 2 | 2 | 4 | 3 | 7 |
| < 250 | 1 | 1 | - | 2 | 1 | 3 | 4 |
| < 275 | - | - | 1 | 1 | 1 | 1 | 2 |
| < 300 | - | - | 2 | - | 2 | - | 2 |
| < 325 | 1 | 1 | 1 | - | 2 | 1 | 3 |
| < 350 | - | - | - | 1 | - | 1 | 1 |
| < 375 | - | - | 2 | - | 2 | - | 2 |
| < 400 | 2 | - | - | - | 2 | - | 2 |
| < 425 | - | - | - | 1 | - | 1 | 1 |
| < 450 | 1 | - | - | - | 1 | - | 1 |
| ≥ 450 | - | 1 | - | - | - | 1 | 1 |
| Total | 40 | 40 | 36 | 46 | 76 | 86 | 162 |

B. Surveys for Estimation of Crop Areas

B.1. *Sample surveys for pre-harvest (advance) estimates of crop acreages*

- B.1.1 . . . Report on the sample surveys for pre-harvest (advance) estimates of crop acreages, 1955-56.
- B.1.2. . . . Report on the sample surveys for pre-harvest (advance) estimates of crop acreages, 1956-57 and 1957-58.
- B.1.3. . . . Report on the sample check of field work of the sample survey for pre-harvest (advance) estimates of crop acreages, 1957-58.
- B.1.4. . . . Report on the sample survey for pre-harvest (advance) estimates of crop acreages, 1958-59.
- B.1.5. . . . Review of sample surveys for pre-harvest (advance) estimates of crop acreages, 1953-54 to 1959-60.

B.2. *Studies on crop areas*

- B.2.1. . . . Report on some aspects of enumeration and compilation of crop areas in the States.

C. Surveys in Development Areas

C.1. *Crop estimation surveys*

- C.1.1. . . . Report on the crop estimation survey in development areas, Rabi, 1954-55.
- C.1.2. . . . Report on the crop estimation survey in development areas, 1955-56.
- C.1.3. . . . Report on the crop estimation survey in development areas, 1956-57.
- C.1.4. . . . Report on the crop estimation survey in development areas, 1957-58.
- C.1.5. . . . Report on the crop estimation survey in development areas, Kharif, 1958-59.
- C.1.6. . . . Report on the crop estimation survey in development areas, Rabi, 1958-59.
- C.1.7. . . . Report on the crop estimation survey in development areas, 1959-60.
- C.1.8. . . . Review of crop estimation surveys in development areas, 1955-56 to 1959-60.

C.2. *Estimation of area brought under improved agricultural practices*

- C.2.1. . . . Report on the pilot survey for estimation of area brought under improved agricultural practices, Andhra Pradesh, Kharif, 1958-59.
- C.2.2. . . . Report on the pilot survey for estimation of area brought under improved agricultural practices, Uttar Pradesh, Rabi 1958-59.
- C.2.3. . . . Consolidated results of surveys for estimation of areas brought under improved agricultural practices, 1961-62.

D. Surveys for Estimating Benefits of Irrigation

D.1. *Area benefited by minor irrigation works*

- D.1.1. . . . Review of minor irrigation assessment surveys, 1951-52 to 1959-60.
- D.1.2. . . . Report on the sample survey for the assessment of the utilisation of tubewells, 1957-58.
- D.1.3. . . . Report on the sample check of new wells (G.M.F.) Rajasthan, 1959.
- D.1.4. . . . Report on the check of minor irrigation works in development areas, Rajasthan, 1959.
- D.1.5. . . . Report on the check of minor irrigation works in development areas, Bihar, 1959.

E. In-service Training of Staff

- E.1. . . . Note on the in-service training of staff.
- E.2. . . . Report on stage II training, Poona, 1961.
- E.3. . . . Report on stage II training, Delhi, 1961.
- E.4. . . . Report on stage III training, Delhi, 1961.
- E.5. . . . Report on stage II training, Delhi, 1962.
- E.6. . . . Report on stage III training, Delhi, 1963.
- E.7. . . . Report on stage II training, Bangalore, 1965.

F. Sample Surveys for the Estimation of Fish Catch

- F.1. . . . Review of the sample surveys for estimating the catch of marine fish, 1950 to 1956.
- F.2. . . . Report on the pilot survey of inland fisheries, Orissa, 1962-63.

M. Miscellaneous

- M.1. . . . Report on the surveys for assessment of additional yield from land reclaimed by Central Tractor Organisation, 1951-52 to 1954-55.

DIRECTORATE OF NATIONAL SAMPLE SURVEY
(Agricultural Statistics Division)

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List of Publications

A. Crop Estimation Surveys (State Series)

A.1. Annual results

- A.1.1. . . . Consolidated results of crop estimation surveys on principal food crops, 1955-56.
- A.1.2. . . . Consolidated results of crop estimation surveys on principal food crops, 1956-57.
- A.1.3. . . . Consolidated results of crop estimation surveys on principal food crops, 1957-58.
- A.1.4. . . . Consolidated results of crop estimation surveys on principal non-food crops, 1957-58.
- A.1.5. . . . Consolidated results of crop estimation surveys on principal food crops, 1958-59.
- A.1.6. . . . Consolidated results of crop estimation surveys on principal non-food crops, 1958-59.
- A.1.7. . . . Consolidated results of crop estimation surveys on principal food crops, 1959-60.
- A.1.8. . . . Consolidated results of crop estimation surveys on principal non-food crops, 1959-60.
- A.1.9. . . . Consolidated results of crop estimation surveys on principal food crops, 1960-61.
- A.1.10. . . . Consolidated results of crop estimation surveys on principal non-food crops, 1960-61.
- A.1.11. . . . Consolidated results of crop estimation surveys on principal food crops, 1961-62.
- A.1.12. . . . Consolidated results of crop estimation surveys on principal non-food crops, 1961-62.
- A.1.13. . . . Consolidated results of crop estimation surveys on principal food crops, 1949-50 to 1960-61.
- A.1.14. . . . Consolidated results of crop estimation surveys on principal food crops, 1962-63.
- A.1.15. . . . Consolidated results of crop estimation surveys on principal non-food crops, 1962-63.
- A.1.16. . . . Consolidated results of crop estimation surveys on principal crops, 1963-64.

A.2. Supervision of crop cutting experiments

- A.2.1. . . . Report on the inspection of crop cutting experiments at harvest stage on a randomised basis, Kharif, 1960-61.
- A.2.2. . . . Report on the inspection of crop cutting experiments at harvest stage on a randomised basis, Rabi, 1960-61.
- A.2.3. . . . Report on the inspection of crop cutting experiments at harvest stage on a randomised basis, 1961-62.
- A.2.4. . . . Report on the inspection of crop cutting experiments at harvest stage on a randomised basis, 1962-63.
- A.2.5. . . . Report on the inspection of crop cutting experiments at harvest stage on a randomised basis, 1963-64.
- A.2.6. . . . Report on the inspection of crop cutting experiments at harvest stage on a randomised basis, 1964-65.

A.3. Special studies

- A.3.1. . . . Report on Central driage experiments, 1960-61.
- A.3.2. . . . Report on the joint crop cutting studies at Bundi (Rajasthan), Kharif, 1960-61.
- A.3.3. . . . Report on the joint crop cutting studies at Barh (Bihar), Rabi, 1960-61.
- A.3.4. . . . Report on Central driage experiments, 1961-62.
- A.3.5. . . . Report on circular cuts conducted by the NSS supervisory staff in the Agricultural Statistics Division, 1960-61 and 1961-62.
- A.3.6. . . . Report on Central driage experiments, 1962-63.
- A.3.7. . . . Report on circular cuts conducted by the NSS supervisory staff in the Agricultural Statistics Division, 1962-63.
- A.3.8. . . . Report on Central driage experiments, 1963-64.
- A.3.9. . . . Report on circular cuts conducted by the NSS supervisory staff in the Agricultural Statistics Division, 1963-64.
- A.3.10. . . . Report on Central driage experiments at NSS block offices, 1962-63.
- A.3.11. . . . Report on Type-2 study on maize, Bihar, 1963-64.
- A.3.12. . . . Report on Type-2 study on paddy, Andhra Pradesh, 1963-64.
- A.3.13. . . . Report on Type-2 study on wheat, Uttar Pradesh, 1964-65.
- A.3.14. . . . Report on circular cuts conducted by the NSS supervisory staff in the Agricultural Statistics Division, 1964-65.
- A.3.15. . . . Report on Central driage experiments, 1964-65.

(contd. on inner cover)