

STATISTICS FOR AGRICULTURAL PLANNING*

Developments in Agricultural Statistics during the last 15 years

BY P. V. SUKHATME

THE first concerted action for developing India's agricultural statistics was initiated during 1943 when in the midst of World War II and the Bengal Famine the country urgently needed accurate statistics of food for internal distribution and for policy decisions in regard to imports from outside. The action was principally aimed at placing on a sound statistical basis the methods of collecting statistics of acreage and yield of foodgrain crops in vogue in the States (then provinces). Thus in the temporarily settled parts of the country crop inspection records would continue to be maintained by the Patwaris as the basis of collecting area statistics but measures based on modern methods of sampling were planned with a view to rationalising his work and to strengthening supervision over it in a way so as to obtain improved and timely forecasts and greater accuracy in his returns. Likewise, in respect of yield statistics, the principle of random sampling was to be introduced in selecting plots and fields for crop-cutting experiments so as to give an objective basis to the estimates of yield-rates based thereon. The role of the Centre in these improvements was to conduct research for devising appropriate methods of random sampling for improving acreage and yield statistics within the framework of the machinery already in existence in the States, to train the State statisticians and the field staff engaged in the collection of agricultural statistics in these methods, to assist the States in implementing these methods as a part of their normal routine for collection of statistics and lastly to exercise independent supervision so as to keep under continuous review the problems at the field level involved in improving statistics. The aim was all along to bring about improvements *at the source* so that statistics of improved accuracy could continue to be available to the States and to the Centre at all levels, village, tehsil, district and States.

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The improvements brought about as a result of this concerted action have been many and far reaching. The principal among them are:

- (1) The coverage for reporting areas was increased from 570 to about 720 million acres leaving a little more than 10 per cent. of the total geographical area including Jammu and Kashmir as non-reporting by the end of 1955. There is, however, very little cultivation in most of these non-reporting areas outside Jammu and Kashmir being mainly covered by hills, forests and deserts. The coverage was thus well-nigh complete.
- (2) The coverage of crop forecasts was also very considerably increased; the number of crops in respect of which forecasts were issued being 26 in place of only 10 before 1945.
- (3) Steps were taken to establish suitable machinery in the princely State areas which were merged with the States and in the permanently settled areas, such as, Bihar and Orissa where no agency similar to Patwari Agency existed before. In other areas the Patwari Agency was reinforced so as to bring about reduction in the area under individual charge.
- (4) Patwari's inspection of the area under his charge was rationalized using the method of sampling in a way so as to provide objective and reliable estimates of the forecasts of different crops. Steps were also taken simultaneously using sampling to rationalize supervision over his work by departmental staff and staff from the Centre.
- (5) The most outstanding improvement was perhaps in respect of co-ordination of agricultural statistics all over the States brought about by introducing uniform and agreed concepts and definitions of land utilization, crop areas and other topics related therewith.

In respect of yield statistics, the improvements were even more far reaching. India is perhaps the first country to have introduced objective methods in sampling for the conduct of crop-cutting experiments on a nation-wide scale. So rapid was the advance that within less than five years the method of sampling was in use in most States on most of the food crops and estimates of rates of yield were based, not on the old annawari system, but on the results of the experiments conducted under this method. Equally outstanding was

the extension of the crop-cutting system to include simple experiments on cultivators fields to assess the response to the various agricultural improvement measures advocated under the GROW MORE FOOD CAMPAIGN.

Good as these improvements were, it was realized that they were not adequate. A Five-Year Scheme was, therefore, prepared in 1949 which while enabling the States to complete the tasks set to them under the above measures would also enable them to make a beginning with the collection of what may be called basic statistics in respect of the number of farms and their characteristics like the tenure, land utilization, farm employment, machinery, inputs and the pattern of cultivation. This was sought to be done through participation in 1950 FAO World Agricultural Census. It was hoped that the participation in a decennial census coupled with the use of sampling in the intervening years would not only enable India to extend the scope of its agricultural statistics to the topics needed for it to formulate its agricultural planning but would also help in improving the accuracy of its current statistics in keeping with the needs. However, a different and a somewhat unexpected development took place about this time, namely, the establishment of a National Sample Survey Organization which was to have its own independent agency manned by the Centre for the collection of all statistics. It was felt that an independent agency well trained in statistics would not only provide returns superior to those normally collected by the Patwaris but would at the same time, help the Centre in collecting statistics at the national level and possibly regional also, on a host of other topics more quickly and reliably than would be available through the earlier plan of action. The introduction of the national sample survey was undoubtedly a far-reaching and welcome step in that it obviated the need to work through the States to fill the gaps for obtaining statistics at a national level. The surveys conducted by the agency on topics such as the expenditure and consumption patterns of the population, holdings and their tenure characteristics, have furnished a wealth of information which have been of great help in the formulation of agricultural plan. However, the setting up of the N.S.S. had an adverse effect on the development of statistics at the source in that it tended to discourage implementation of measures under the earlier plan of action. The result was that agricultural statistics at the State and district level while continuing to be based upon Patwaris' records lacked the support and confidence of those concerned. We thus find ourselves in a situation where we have no alternative but to continue collecting annual statistics based on land

records maintained by the Patwaris but without any assurance that these are reliable enough to meet our needs, while the national sample survey continues to supply on an *ad hoc* basis statistics at the national and regional levels only. The confusing situation is best illustrated with reference to the two estimates of national production of foodgrains given by the N.S.S., the first on the basis of its survey conducted during 1951, when it came out with an estimate of 69 million tons as against an estimate of 49 million tons based on State estimates collected through normal channels (Sukhatme, 1954) and the second only recently for 1957-58 which it is understood is large enough to make India one of the principal foodgrains exporting countries of the world. In the circumstances, it is not surprising that the public is confused not having any means of knowing whether agricultural production has increased as planned and whether in fact the targets of production set under the plan and the method of arriving at them have any validity.

PLANNING AND THE CASE FOR STATISTICS BY SMALL AREAS

In this situation it becomes pertinent to ask:

What are the statistics needed for agricultural planning and at what level? The answer will, of course, depend upon the type of planning. At the one extreme the planning may take the form of setting out production targets for each farm to be implemented by the farmers concerned as in U.S.S.R. or China. In this type of planning, the farmers are directed individually to fulfil the targets assigned to them. Statistics needed to meet the requirements of such planning go beyond what can ordinarily be obtained through a complete enumeration census. Statistics essentially deals with aggregates and distributions and not with accounts of individuals. Nothing short of continuous progress reports month by month from each individual farmer can satisfy the needs of such planning. In the type of planning with which we in India are concerned, the individual farmers are not assigned any quotas with obligations to fulfil them. The production targets are fixed for relatively large and homogeneous areas and set up after taking into account the resources already available to the areas and the programmes and incentives to be made available under the plan. The programmes in this type of planning concern the introduction of improved agricultural practices such as irrigation, fertilizers, improved seeds, plant protection measures and so on. The incentives are the price incentives so set up as to influence the crop pattern in the way envisaged under the product on targets. Advice is made available

under the plan to appraise the farmers of the goals for their areas and of the measures and incentives available to fulfil them.

In line with the above, the Second Five-Year Plan sets out the targets of production for the different crops at the national and State levels. It also sets out targets for the programmes for achieving production, namely, those for irrigation, fertilizers, improved seeds, area to be reclaimed and number of national extension blocks. The targets of production, while known to be figures negotiated with the States are based on the contributions expected in accordance with the known regional or national yardsticks by adopting the various agricultural practices. Thus it is assumed that every acre of irrigation potential will add 1/5 of a ton of foodgrains or that fertilizers would be allocated in a specified ratio as between foodgrains and cash crops and would contribute a specified quantity per acre by way of increased production and so on.

This is perhaps as far as one can go with the statistics available in the country but the breakdown of targets thus formed by the various extension blocks, called hereafter planning units, can hardly be realistic. It is, of course, true that the targets in the very nature of things can only be tentative working estimates, since agricultural production depends upon so many factors but even so they have to be more meaningful and based on a detailed technical examination if they have to have any value for purposes of holding up as goals before the farmers in a planned development of agriculture. Thus, the soil, the rainfall and the terrain and the practices of farming may vary so considerably within a small area that to work out production goals for individual blocks by applying average uniform yardsticks for the region can not be in keeping with facts. Equally, even if the programmes for achieving production took into account the irrigation potential and other resources within blocks, the actual implementation of the programmes within blocks may differ quite considerably from that envisaged under the plan. Thus, many of the subsistence farmers even if irrigation facilities were available to them may not have the means to take full advantage thereof; again others may use the irrigation and fertilizer supplies in a manner different from that intended under the plan. In fact, farmers everywhere will endeavour to use their resources and the programmes made available under the plan in a manner best suited to their own needs and in consequence the achievements for a planning unit will differ from those anticipated. How large such difference can be is best illustrated by the wide gap between the anticipated

production and achievements during the First Five-Year Plan period. Of the increase of some 8 million tons anticipated during this plan period, it was thought that rice would account for about a half, wheat about a quarter and gram and pulses $1/8$ each. Actually the expectation in respect of rice relative to the total target was far from fulfilled and the total targeted increase was made up by increases in millets and other cereals. The gaps are bound to be much wider and even wide of the mark when such comparisons are instituted for the individual planning units. To say under these conditions that the achievements were planned can be only partially true. The essence of a planned effort requires that the various programmes will be made available to the farmers in right amounts and in proper time to enable them collectively to fulfil the production targets. This is not easy to accomplish in agriculture where the number of producer units is large without laying down in plan clear techniques for implementing the production targets.

How loose or unrealistic is planning under the present system can be judged from the report that when the State targets for increase in production added up to only 15%, the National Development Council subsequent to the finalization of the plan decided outright to raise the targets for additional production to 24% and asked the States to recast their plan accordingly. Under these conditions, the plan cannot but leave the impression that the programmes made available under it are not being used fully and efficiently. The fact of the matter is that under the plan the national extension agency is just not equipped with the necessary means to enable it develop an effective plan of action to get the farmers with different resources, type of farms and patterns of farming to adopt the improved practices in the best possible manner. This absence of the link between the targets of production for individual planning units and the programmes for their implementation by farmers is strange, since while professedly the interest in our type of planning is in the area as a whole and not directed towards individual farmers, the plan of action presumes and indeed calls for individual approach and individual assistance and advice by the extension staff.

If national extension staff for advising the farmers was numerous enough to ensure direct contact with the individual farmers and their problems and if goals were available for areas so small as villages and for individual farms within them, then there would be a large probability that the farmers would be influenced into action along the lines proposed in the plan. It seems, however, impossible that we could ever aim at

setting up goals for individual villages and farms and providing specialist extension staff on a scale large enough to ensure individual assistance and advice. In the present context of development of the national extension agency in India the specialist extension staff have to cover about 100 villages on the average and it seems necessary that in order that this agency be put in a position to advise the farmers effectively it should have a clear statistical picture of the number and type of farms in individual blocks and of the planning techniques best suited to various farm types. I can recall here with advantage the example mentioned by Dr. Rajendra Prasad in the address which he gave to this Society three years ago to illustrate my point:

“The resources ordinarily available to a farmer are his land; his own labour and that of his family and some capital. The alternatives open to him for using his resources are many. He can grow one or more crops and choose a smaller or a larger acreage for each, keeping in view all the while the investment that he will have to make and return that he is likely to get. He may decide to devote a part of the area to *rabi* crops and a part to *kharif* crops, having regard to the limited labour that he and his family can put into the land at any one time. If he were to use all his land for growing *rabi* crops, he may have to use a part of his working capital for hiring labour, at the same time keeping his own and his family's labour idle during the other season, both of which he can avoid if he distributed the cropping between the two seasons. Even after deciding which crops to grow: various alternatives are open to our farmer in using his limited capital for providing irrigation, fertilizer, improved seed, special cultivation, etc., to his crops. His basic problem in allocating his resources is to secure the maximum return from them. To be able to solve this problem, the farmer clearly needs to know not only the exact resources at his command; but also the output per unit of these resources, or, to state it the other way, the resources required for securing a unit output. Assuming for illustration that the land is capable of growing both cotton and wheat he would have to figure out what amount of land is required for securing a unit return in terms of value or money from cotton alone and wheat alone. He would also have to figure out what capital is necessary to secure this return from the two crops and its breakup among the different items of cultivation.”

The extension of this example to national development planning would similarly mean that we have to use the resources available

in the various planning units for the optimum advantage. If this is to be done, then we have to have on the one hand information detailed enough to build up realistic targets for the various national extension blocks and on the other equally detailed information on the number of farms within each block classified by type and the planning techniques appropriate for each. Only then would the extension staff be in a position to advise the farmers effectively in the fulfilment of the targets. Thus the farms may be classified by size, by pattern of land use according as growing predominantly cash crops, foodgrain crops or devoted to animal husbandry, irrigated or dry, by resources in human, animal and mechanical power, capital, etc., and specific proposals regarding planning techniques for each farm type given in the plan. Even this will not be adequate. A breakdown of the production targets for each planning unit by farm types and their contributions to the total target will be needed if fuller and efficient use of the programmes made available under the plan is to be assured. There is no mention in the plan of the need to gear the targets for individual planning units to the actual conditions and resources of the farmers within them. As an example, let us suppose that a great majority of the farmers in a given block are subsistence farmers with little or no resources to pay for fertilizers and other practices while, only a small minority have relatively large farms. Clearly, it would be prudent to bestow only limited attention on the small farms and instead concentrate the main effort on the big farms, in line with the planning techniques suited best to the types they represent which are known to be promising for further development as judged by their land use, availability of irrigation and other factors. Unless action is taken along the above lines and the price incentives are suitably set up, it is impossible to ensure the success of crop planning, although the total targets might perhaps be achieved by ensuring that all the input resources made available under the plan are put into the field. While the broad approach used in the First and the Second Five-Year Plans of making available the different agricultural programmes and of enthusing the cultivators to take to these programmes were perhaps adequate, we have now reached a stage where we must endeavour to use the programmes and resources more fully and efficiently than in the past. This, however, necessitates a change of approach to the collection of agricultural statistics in a manner consistent with the requirements of detailed and realistic planning and its implementation for each of the ultimate planning units. Nothing short of a census of farms in line with the F.A.O. 1960 World Census of Agriculture would appear to meet this need. Indeed the

scope of the agricultural census may have to be more ambitious at places than the F.A.O. Programme in order that the data so collected may serve adequately the purposes of planning and at the same time serve as bench-marks for current evaluation of the progress of the plan. With the approaching reorganization of agriculture under which an appreciable agricultural area is expected to be made over to co-operatives of landless labour alone, the case for basic statistics by small areas and hence for an agricultural census becomes irresistible. An agricultural census to meet these needs will undoubtedly be an enormous undertaking but would not appear to be too difficult or expensive for the country to handle.

AGRICULTURAL CENSUS: EXPERIENCE OF THE PARTICIPATING COUNTRIES

Having seen that the needs of agricultural planning call for data for each planning unit, we shall examine whether a periodical census of farms is feasible under the conditions in India and can provide data reliable enough to serve the purposes of planning. I propose to examine this question on the background of the experience of countries which participated in the 1950 World Census of Agriculture.

Over 100 countries and territories participated in the 1950 World Census of Agriculture sponsored by F.A.O. and a good many of them, especially the economically developed countries, took it by the method of complete enumeration and presented tabulations by small administrative units. That these countries were able to take a complete enumeration census successfully is due to several reasons. Firstly, most of these countries have a long tradition in agricultural census extending over several decades when the only method of collecting statistics was complete enumeration. The experience collected over all these years has helped them to overcome the difficulties of organization, administration and enumeration techniques in census taking. Secondly, most of them have a census law requiring farmers to make a census return on the census day. Thirdly, the farmers have learnt to appreciate the value of census information for the development of agriculture in their areas and to render willing co-operation to the census authorities. Fourthly, the administration and supervision of census enumeration is vested in the commune and district authorities who are responsible for the appointment of enumerators and for the supervision over their work. It is their responsibility to ensure that the enumerators are given the facilities needed to canvass the households, that the enumeration is made according to the time schedule fixed for the purpose and

that the census returns are edited, processed and despatched to the respective census authorities in accordance with the procedures laid down for the purpose. In brief, the entire census enumeration is integrated into the administrative machinery of the country, so well established is the procedure for census taking that a sample enumeration might present more difficulties under the conditions in these countries than complete enumeration, even if a sample census was considered adequate to meet their needs.

It will be useful in this context if we explained the meaning of the two terms (i) a complete enumeration census and (ii) a sample census. A census in principle is visualized as complete enumeration of all holdings. Practical considerations, however, make it necessary to limit the enumeration to those holdings which conform to certain stated criteria and which fall above a given size. Again a complete enumeration census does not imply that every item on the questionnaire should be asked of every holder in the country. Not all items are of basic importance requiring tabulation by the smallest administrative unit in the country. It is therefore customary to use the method of sampling to broaden the scope of the census. A complete enumeration census means a census in which every holding conforming to the stated criteria is identified and in which items of basic importance are asked of every such holding. When the entire enquiry is confined to only a national sample of holdings it is called a sample census.

Fortunately India too has a long tradition in the collection of agricultural statistics. A census of plots is made annually in the temporarily settled parts of the country and a census of livestock; irrigation and implements is also made quinquennially in most States of India. The enumerators are usually the village Patwaris who are local officials responsible for the collection of land revenue and administration in the villages, know the local conditions and the people and command prestige with them. They have cadastral maps showing the survey numbers and the boundaries for the different fields in the villages under their charge and maintain land registers showing for each field the details regarding size, the ownership and the use of the land. Thus equipped, a Patwari has normally little difficulty in collecting information on most items of agricultural census. In brief, the entire collection of agricultural statistics is integrated into the administrative and revenue machinery of the country. The only difference from the conditions in the west is that whereas in the west, the farmers can read and write and are used over years to the census

terminology, in India the majority is illiterate and hardly know the precise answers to the census questions. Secondly, the unit of enumeration in India is not a holder's household for all the items. Any attempt to take an agricultural census of farms thus means that the statistics of area, land use and tenure maintained in Patwari's registers have either to be recast holding-wise or alternatively obtained by interview supplemented by sample checks and spot inspection where practicable.

In actual practice, there is considerable criticism of the Patwari's work. It is said that they neglect to make a rigorous inspection of the fields under their charge, that they are in fact over-burdened with other administrative work and have little time to devote to the collection of accurate statistics. A large section of well-informed people in the country are inclined to agree with this view and have produced evidence to substantiate it. Equally, evidence contradicting this view has also been produced. It thus becomes important to sift the available evidence before considering whether an agricultural census using the available administrative machinery in the country and supervised by an independent statistical agency can produce adequately reliable data. However, before proceeding to do this, we shall do well to examine the nature of errors influencing the data and the manner in which such errors can best be controlled in practice.

EFFECT OF ERRORS ON INFORMATION

The accuracy of information on any item say the acreage under crops asked of a farmer will depend upon the extent to which the farmer is familiar with the census terminology and can answer the questions put to him, his willingness to co-operate and the approach made by the enumerator. Figures reported by him under the impact of these influences will, therefore, invariably differ from the true values which in the case of area statistics might be obtained or approximated to from cadastral records and measurements on the ground. If the magnitude of the difference in the aggregate is small and within permissible margin of errors, the statistics can be said to be accurate.

Let x_i denote the true value of the character on the i -th unit in a simple random sample of h units and y_{ij} denote the value reported by the j -th enumerator on the i -th unit. We shall assume that m enumerators have participated in the survey with the j -th enumerator making n_{ij} (one or zero) observations on the i -th unit in the sample. The difference between the reported value and the true value (usually unknown) is the error of observation and for any given measurement

technique depends upon the enumerator reporting the value; the interaction of the enumerator with the true value of the unit and the mood and like causes at the time of reporting. The reported value may therefore be considered as being made up of three uncorrelated components, as follows:

$$y_{ij} = x_i + a_j + e_{ij} \quad (1)$$

where a_j represents the bias of the j -th enumerator in repeated observations and e_{ij} represents the deviation of $x_i + a_j$ from the reported value. We shall consider e_{ij} to be randomly distributed around zero with variance S_e^2 for all i and j , an assumption which experience shows is fairly well realised in practice.

Under this set up which is found to be general enough to cover conditions commonly met in censuses and surveys and assuming for simplicity that the sample or population is distributed equally among the enumerators, it is easy to see that the calculated mean will not give an unbiased estimate of the true population value but that it will be biased by an amount equal to the average of the enumerators biases in the population. Unless individual biases vary in such a way that the average over all the enumerators is zero the result will fail to provide a reliable guide to the information one is seeking.

Turning next to consideration of the precision of the estimate, it can be shown that the variance of the sample mean is given by:

$$\frac{S_y^2}{h} + S_a^2 \left(\frac{1}{m} - \frac{1}{h} \right) \quad (2)$$

where S_y^2 represents the variance of a single observation given by

$$S_y^2 = S_x^2 + S_a^2 + S_e^2$$

and S_a^2 is the variance among enumerators. The classical theory of sampling takes cognisance of only the first component of equation (2) and not the second. In any case, the first component vanishes in a complete census, but a part of the second remains. The error of an estimate in a census is thus entirely determined by the contribution made by the second component and this in its turn will depend upon the type of information sought, the technique of measurement and

For a detailed treatment of the topic dealt with in this section, reference may be made to the chapter on "Non-Sampling Errors" in the author's book on *Sampling Theory of Surveys with Applications* published by the Iowa State College Press, Ames, Iowa, U.S.A. and the Indian Society of Agricultural Statistics, New Delhi, 1954.

the conditions under which the census is taken. In general, it may be said that for characters for which it is difficult to obtain a precise answer like the input items, the contribution of this component may be very considerable. Indeed experience shows that the contribution of this component can be very large even in the case of simple characters and emphasises the need for adopting sound concepts and definitions, sound measurement techniques based, where possible, on the method of physical observations and provision of questions on the schedules which can help to check independently the answers given by the farmers.

Above all the method pre-supposes close acquaintance of the interviewers with the people and the farms. Only when all these conditions are met can one expect the estimates to be free from bias and the errors affecting the information can be said to be under control. Here precisely lies the merit of measuring on the ground the area under the crops by field enumerators in estimating the acreage under crops and of using crop-cutting methods to estimate the yield instead of the interview method of ascertaining answers from the farmers. Here lies the need for developing questionnaire with standard concepts and definitions which can be readily understood by the farmers and can provide unambiguous and correct answers. If such care is not taken in developing the census methodology, then, it can be seen from (2) that a complete census might give statistics worse than a sample survey. For, it must be recognized that a sample survey presents a distinctly greater possibility of controlling the magnitude of the variability among enumerators, not only because they are fewer and can be better trained and also better paid in a sample survey compared to that in a complete census but also because it is often possible to adopt objective measurement techniques. On the other hand, whenever a detailed and accurate frame is available, simple and objective method of enumeration can be followed, where supervision is adequate and completeness in enumeration can be ensured and where above all the enumerators are drawn locally and are familiar with the people and local conditions such as when statistics are collected in the course of normal administration, complete enumeration might be the appropriate method to adopt. Where, these conditions are not fulfilled the amount of effort and expenditure involved in the complete census might be better used in organizing a sample survey.

SAMPLE CHECKS ON ACREAGE STATISTICS

We are now in a position to determine whether information on any given item should be collected by the method of complete census.

Let us return to the area under crops. Since the area of fields has been cadastrally determined, all that a Patwari has to ascertain is the name or names of the crops grown on each field. A major part of this subjective element responsible for bias in obtaining information on acreage has thus been removed except in cases requiring the determination of the proportion of the area under different crops in the same field. Even granting that a Patwari neglects to make rigorous personal inspection of the different fields under his charge there would appear to be little difficulty for a person in his position to ascertain by enquiry the names of the crops grown by the different farmers. No formal interview is, in fact, needed, for cultivators usually gather together in the evenings on a common village site and this opportunity can be availed of in determining the names of the crops. The number of cultivators residing within a village is usually so small that any radical departure from the current pattern of cultivation is immediately noticed and reported upon. Under these conditions one should be surprised to find any large errors in the statistics of acreage under crops. However, the scientific method of determining whether acreage statistics collected by the Patwaris in the course of their normal work suffer from any appreciable errors is to organize sample checks through specially trained statistical agency. This was what was precisely done by the I.C.A.R. for a number of years in the different States in several hundred villages selected by the method of random sampling. A number of discrepancies were, of course, found in the course of these checks but nowhere the area estimates for the district as a whole were found to differ from those obtained by the sample method by more than *plus* or *minus* 3%. The conclusion from the sample check was that taken over large areas the Patwari records present an essentially reliable picture of crop acreages.

It is, however, necessary to add that evidence which contradicts these findings has also been produced. One of the first things which the National Sample Survey did on coming into existence was to organize an extensive sample check on Patwari statistics all over the country. The results were astounding in that the N.S.S. found that the acreage under food crops such as wheat was overestimated by the Patwaris to the extent up to 25% in the different States and acreage under cash crops like sugarcane, linseed and oilseeds were under-estimated even up to 50%. The results, if true, would have meant complete condemnation of the Patwari system. A careful examination of the results showed, however, that the discrepancies were due not to the

neglect of work on the part of the Patwaris in entering the names of the crops and the areas under them in their field registers but due to the differences in the concepts and definitions adopted by the National Sample Survey. Thus sugarcane although planted in the month of January–March is entered according to the instructions in the land records manual in the Patwari registers only at the time of his *Kharif* crop inspection during September–October. The N.S.S. investigator, on the other hand, noticing the crop in the field during his inspection in April and finding no entry in the crop register by the Patwari counted this as a mistake. Again linseed and other oilseeds grown mixed with wheat and other cereals are not recorded in the Patwari registers, according to instructions in the land records manual, the entire area being shown against the cereals. It is facts like these which account for the observed discrepancy in the acreage under wheat as well as oilseeds and not negligence of work on the part of Patwaris. The results only underline the principle that a sound knowledge of local agricultural practices and of administrative enumeration procedures is necessary in any critical assessment by a sample check of the annual census by the Patwaris.

ROLE OF SAMPLING AND OF PERMANENT LOCAL AGENCY IN THE CONDUCT OF CENSUS

It may be concluded that the Patwari system which has stood the test of the time works on the whole satisfactorily in providing acreage statistics. Nevertheless, sampling has an indispensable role to play in controlling and improving the fieldwork by Patwaris. If Patwari's work can be rationalised and regulated through the use of sampling, if area under his charge can be reduced and if adequate and effective supervision can be provided over his work, then, Patwari system can be built into a sound system comparable to any available in other countries for furnishing reliable agricultural statistics. My object in reopening the comparison between the Patwari system and the N.S.S. is neither to say that the former should be continued in its old form without rationalizing or strengthening it in the manner indicated earlier nor to criticise the National Sample Survey. As I said before, the latter is a step in the right direction, particularly for socio-economic survey but cannot fill the need of providing detailed agricultural statistics such as required for the ultimate planning units by the States. A permanent local agency is particularly appropriate for this purpose and also in obtaining information on items like the yield-rate

which experience has shown requires stationary agency and not moving investigators in order to ensure that sample harvesting in time corresponds to the harvesting of crops in actual practice. If a Patwari is burdened with a large number of multifarious duties, the solution would lie either in diminishing the charge of his beat or alternatively in supplementing this agency with other agencies such as the one now being set up under the Ministry of Community Development in the different extension blocks which appears well suited for the purpose. The appointment now under way of statistical assistants in each of the different national extension blocks and similarly the appointment of village-level workers in-charge of a group of villages under this Ministry promise to provide this additional machinery so urgently needed for collecting and improving agricultural statistics at the source. I am gratified to learn that steps in this direction have been already initiated by the Ministry of Community Development in co-operation with the States.

The remarks about the statistics of acreage do not necessarily hold in the case of the statistics of other items in a holdingwise census. The latter of necessity would involve a number of items on which information would have to be collected by interview with the farmers. It is, therefore, to be expected that a holdingwise census by interview may throw up statistics whose reliability cannot be assured unless special measures are taken for this purpose. In particular, it seems necessary to include questions, answers to which can be readily checked independently and spot inspection on a sampling basis is resorted to where necessary. Above all, it is necessary to ensure that the interview staff are locally drawn and are familiar with the local conditions. How important this latter consideration is can be best illustrated with the help of recent experience of collecting statistics on the size of holdings (Panse, 1957).* The relevant data collected are produced in the table given on next page.

Data in this table refer to the size of operational agricultural holdings in different parts of the country. The data in column 1 were obtained by interview by trained investigators in the course of single visits to the villages. In the method adopted in collecting data in

* Panse, V. G., "Some Comments on the 1960 World Census of Agriculture," read at the 1957 Session of the International Statistical Institute.

Sukhatme, P. V., "National Sample Survey—A Review," *Indian Economic Journal*, 1, 3, 1954.

Average size of holdings in acres

Region	Survey I	Survey II	Survey III
North ..	3.9	5.3	6.7
North-West	11.9	12.6	20.6
East ..	3.5	4.5	4.8
Central ..	10.9	12.2	14.6
West ..	11.1	12.3	14.9
South ..	3.8	4.5	6.2
All-India ..	6.1	7.5	8.9

column 2 the investigators were assigned several villages and periodical hounds of the same villages, possibly three or four times a year, were made for ascertaining by enquiry from the farmers of the selected holdings, the operations and transactions carried out since last visit and other details of inputs and outputs. The data in column 3 was collected by whole time investigators permanently stationed in villages for keeping a selected group of holdings under continuous observation in close contact with the farmers concerned. The results show how the data are affected with the increasing acquaintance of the interviewers with the local conditions and emphasises once again need for objective ascertainment of information and need for drawing enumerators familiar with the local conditions.

Time does not permit adding more examples. They show that, given adequate and effective preparation, checks and supervision and the interview agency is drawn from people familiar with the local conditions, there is no insuperable difficulty in obtaining agricultural census statistics through complete enumeration. It should be remembered in this connection that village officials have been used successfully in the conduct of the population census. In fact, permanent local agencies akin to Patwaris are used successfully in many countries for collecting statistics. I see no reason, therefore, why the land records agency, supplemented by the agency now being set up under the Ministry of Community Development, should fail to give the statistics that we

need for purposes of planning in different States. Human nature is the same the world over. What is required is a reasonable faith in our fellow village workers coupled with assurance that we give them conditions of work under which similiar agencies collect statistics in other countries of the world. I feel confident that now that so much spade work has already been put in, the strengthening of this agency coupled with faith and patience would go a long way in raising the level of agricultural statistics in the country.

Any drive to improve agricultural statistics can only come by the realization of the needs for such statistics. These needs in the context of agricultural planning are more for the States to realise than for the Centre. The role of the latter in matter pertaining to collection of statistics must of necessity be limited to co-ordination, promotion and at best to collection of statistics at the national level. The cost and the lack of trained personnel need not either stand in the way of a drive for improving statistics at the source. While I do not propose to go into the details of the cost of agricultural census, the estimates already worked out show that the cost of agricultural census spread over a quinquennium need not exceed the expenditure incurred annually on the National Sample Survey and indeed might be much less if close and effective co-operation is developed between the land revenue agency and the one under the Ministry of Community Development. There is no dearth of trained statisticians in the country either. Our States, in fact, can boast of some very excellent agricultural statisticians who, given opportunity and conditions of work comparable with those enjoyed by the statisticians at the Centre can be depended upon to take up the challenge posed by the agricultural census. Many of our State statisticians who have left this country to go abroad and have worked for international and other agencies have done a remarkable job in helping countries in different parts of the world to improve their systems of collecting agricultural statistics. I feel sure that if we can extend to them our confidence and assure them of suitable conditions of work, the State statisticians and the field agencies can give us the statistics we need for agricultural planning and its effective implementation.