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# An Appraisal of Interview Procedures in Farm Surveys

By Raymond E. Vickery

*As part of an expanded research program begun about 2 years ago by the Agricultural Estimates Division, Agricultural Marketing Service, pilot interview farm surveys were conducted in 10 Southern States during June 1954 and June 1955, and will be continued, in an effort to develop an improved crop and livestock estimating system. These surveys are somewhat unusual in that their main purpose is not to grind out estimates on a variety of agricultural items, but to study the operational and statistical problems that arise. Although emphasis is on research, the surveys are conducted under simulated operating conditions so that the transition from "research" to an operating program should be a natural development as the work progresses. This paper discusses technical aspects of the surveys.*

**D**URING the last 15 to 20 years, the Agricultural Estimates Division, Agricultural Marketing Service, in common with other statistical agencies, has acquired considerable experience with modern sample survey techniques as they apply to interviewing samples of farmers and computing estimates from the data collected. Most of this experience was acquired as a by-product in the main task of collecting data to be used in regular operating programs. The usual procedure in planning a survey is to make use of as much pertinent information as can be gleaned from previous surveys, together with a generous sprinkling of personal judgment, whenever a choice needs to be made between alternative approaches. However pleased one may be with the results after a survey is completed, one usually is left with the feeling that some things could have been done better. Little can be done about it until another survey is on the drawing board.

In a research project aimed specifically at developing procedures, the statistician has an opportunity to study the effectiveness of alternative techniques without regard to pressures imposed by an operating program. In particular, there is freedom from any feeling of compulsion to make estimates from the survey look as good as possible and to play down any deficiencies that might be detected.

At the time the first of the two surveys discussed in this report was in the planning stage, our statisticians were interested in several specific technical questions that had arisen in previous crop and livestock surveys. The type of sample under discussion was the familiar two-stage design in-

volving (1) a stratified random sample of counties, selected with probabilities proportional to numbers of farms, and (2) a sample of small area segments selected in these sample counties. Farms were the units of observation and the subject matter of the questionnaire covered items on crop acreages and production, livestock inventories, and related data. From the statistical viewpoint, topics of major interest about which there was some uncertainty were related to:

1. Definition of a farm and farm operator.
2. Rules for associating sample farms with sample area segments.
3. Control of sampling errors.
4. Response errors in reported data.
5. The suitability of the farm as the unit of observation.

General considerations entering into the planning of surveys of this type are so well known that it is unnecessary to elaborate upon them here. Suffice it to say that the 1954 sample consisted of a sample of 100 counties in the 10-State region, stratified by type-of-farming areas within States and selected with probabilities proportional to 1950 census numbers of farms. Within these sample counties, a sample of 703 small area segments was selected at random for interviewing, with the sampling rate within each county set to give an expectation of 35 census (1950) farms. The survey was planned in the same way as any other survey of that kind would be planned in an operating program. The ground rules were drawn up in accordance with the most up-to-date information available which, in the opinion of experts of the kind usually consulted in such matters, should have resulted in a successful survey.

As indicated later in this paper, experiences in the survey were no different from those encountered in similar previous surveys—some ideas worked well, other not so well. Steps that were taken the following year to overcome the difficulties will be discussed simultaneously with the 1954 results.

### Definition of a Farm and Farm Operator

Farm definitions have been troublesome ever since farm surveys of any kind were instituted; even now there is no unanimity of opinion as to a "best" definition. Perhaps there *is* no such animal; and the most the statistician can hope to do is to find the most appropriate definition for the particular subject-matter field in which he is working. For crop and livestock estimates, the most satisfactory definition appeared to be all land owned or managed by the operator, plus all land rented in, and minus all land rented out to tenants other than share-croppers. The decision to exclude croppers as separate farm operators was an effort to arrive at a farm definition that would correspond as closely as possible to farmers' own concepts of their farming operations.

That decision made it necessary to find a rigorous definition of "sharecropper." In this survey, sharecroppers were defined as persons who worked land in return for a share of the crop without furnishing their own tractor power or workstock. There was some argument against this definition because mere ownership of a mule would shift a person's classification out of the sharecropper category, even though his landlord regarded him as such. But the definition was retained for the very practical reason that it enabled interviewers to make clear-cut decisions as to how tenants should be classified. Attempts to define sharecroppers in terms of the degree of managerial responsibility exercised in the conduct of farming operations have proved troublesome in the past, because borderline instances in which decisions are difficult always arise.

Partnerships were treated by a rule that has proved satisfactory in the past. If both partners lived on the farm, or both lived away from the farm, the one that made the most decisions was considered to be the operator. If no such distinction could be made, the older partner was considered the operator. When only one of the part-

ners lived on the farm, he was automatically considered to be the operator.

Managers were regarded as operators when they actually made all decisions on the day-to-day operations of the farm. When a manager had a farming operation of his own and, in addition, managed a farm for someone else, the two operations were regarded as separate farms, and the same person was listed as the operator in both instances.

In defining a farm as all land owned or managed by the operator, plus all land rented in, and minus all land rented out to tenants other than share-croppers, it is also necessary to consider the scope of the agricultural operations.

Many rural "places" should not be regarded as "farms" if agricultural production is negligible or totally nonexistent. The rule adopted in 1954 was similar to one used in recent years by the Bureau of the Census—to classify a place as a farm if it scored 150 points on a rating system in which a specified number of points was assigned for each acre of a specified crop or group of crops and for each head of specified species of livestock. The number of points allowed for some items was greater on places of 3 acres or more than on places of less than 3 acres.

But the decision as to whether a place should be classified as a farm was not left to the interviewer. He was instructed to fill out a farm questionnaire whenever the "operator" of a place called the place a farm, and also whenever the operator did not consider the place a farm, if during the year, any poultry or livestock were kept or grazed, any fruit or vegetables were grown for sale, or any other crops were grown. The completed questionnaires were later reviewed by statisticians in Washington; questionnaires for all places not having enough points to qualify were discarded.

These definitions, with a few exceptions, worked well in 1954. Some interviewers complained that the concept of a sharecropper was too restrictive, but such comments were anticipated. For reasons already given, and in the light of experience with most of the instances encountered, the definition of a sharecropper was apparently as good as any that could be devised. Rules applying to partnerships also appeared to work well. Classification errors that occurred in 1954 were caused by failure of interviewers to follow instructions rather than by any deficiency in the rules.

The only serious difficulty in identifying farm operators occurred with managers. Whether a "manager" or his employer was classified as the operator of a given farm in the 1954 survey apparently depended largely upon which of the two happened to be interviewed. After the survey was completed, it was found in several instances that a manager had classified himself as an operator when his employer also considered himself in that category. Because of the difficulty of assessing the degree of responsibility actually exercised by self-styled managers, it was decided to modify the definition in the 1955 survey. Managers were not regarded as operators except when they had farming operations of their own on their own farms, in addition to "managing" farms for others. For farms with managers, the owners of the land were considered to be the operators in the 1955 survey. This approach appeared to work well. It will be retained in future surveys.

The definition of a farm did not always correspond to farmers' concepts of one. As in all such surveys, a few operators of small enterprises objected to being called farmers. This was no new experience and little can be done about it. Large operations with varied and complicated tenure arrangements were troublesome in the 1954 survey. But difficulties of this kind are related to problems of questionnaire construction rather than to farm definitions. They are discussed more fully in the section on response errors.

### Associating Sample Farms With Sample Area Segments

When use is made of an area sampling procedure in which farms are the units of observation, rigorous rules are needed to determine which particular farms should be regarded as "in" the sample area segments. The usual practice in the past has been to establish a reference point on each farm in question. When that reference point was inside the segment, the farm was in the segment—when it was outside the segment, the farm was out of the segment. When the farm operator lived on the farm, his residence served as the reference point. When the operator did not live on the farm, one of the following, in the order given, was used as required to establish a comparable reference point:<sup>1</sup>

1. The most valuable dwelling on the farm.
2. The most valuable building on the farm.
3. The main entrance to the farm.
4. The northwest "corner" of the farm.

Although this procedure has been used in many previous surveys, it has always been troublesome in situations in which the operator did not live on his farm. Even ascertaining whether an operator lives on his farm is not always a simple matter if a farm consists of several noncontiguous tracts and if there is doubt as to whether the particular tract on which the operator's residence is located should be considered part of the farm. For each tract of land that falls wholly or partially within the boundaries of an area segment, the interviewer must remember or ascertain the answers to the following questions:

1. What constitutes a farm?
2. Is this tract all or part of a farm?
3. Who is the operator?
4. Does he live on his farm?
5. If the operator does not live on his farm, what land is included in the farm?
6. What point on the farm should be used as a reference point for sampling purposes?
7. Is that reference point inside the segment?

It is difficult to provide step-by-step instructions to interviewers in reaching decisions on such questions. Attempts to explain the problem to interviewers in such detail that they can do the necessary sleuthing, as the canvass of a sample area segment unfolds, and come up with right decisions have also been discouraging. Usually, such attempts have confused interviewers more than they have helped them.

In planning the June 1954 survey, it was decided to return to a device that has been used before, although not extensively enough to have given it a fair trial. This is to consider a farm as being in a segment whenever the operator's residence is inside the segment, regardless of where the land is located.

This procedure has both advantages and disadvantages over the other approach. The main advantages are that: (1) The interviewer can be given relatively simple instructions on how to proceed; and (2) the order of questioning respondents is the same in all instances—the whole process becomes more systematized and the likelihood of error is diminished.

The chief disadvantage is the increased diligence that must be exerted in ferreting out farm operators in the sample area segments in which such

<sup>1</sup> See BROOKS, EMERSON M. A REPORT ON THE GENERAL ENUMERATIVE SURVEYS. Agricultural Economics Research. 5:37-48. 1949.

operators live if they do not live on their farms. In predominantly rural areas this is no serious problem because there a house-to-house canvass can be made without difficulty. Errors or shortages that occur in the open-country segments are therefore negligible in comparison with the errors and uncertainties experienced with the other approach.

But as many farm operators live in urban areas, the sample of segments must cover those areas as well as those in open country. Sampling urban areas at the same rate as those in open country in 1954 led to 25 sample segments falling in such areas. As these were heavily populated, a canvass of every household to search for farm operators was impracticable. Some shortcuts were introduced to solve the difficulty. These consisted mainly of a skip-house technique in which the interviewer asked members of a household if they knew anyone in the immediate neighborhood who might be a farm operator.

Such questioning made it possible to reduce the workload of canvassing households. It was necessary to contact households only when there was reason to believe that a farm operator lived there, or when neighbors were unable to give positive information about such a possibility. This was coupled with an "informed-person" approach in which county agents, local offices of other agricultural agencies, representatives of farmers' organizations, bankers, and feed and implement dealers were asked to supply names of people living in the segment who might be farm operators.

On the surface, this procedure appeared to work well enough, even though some subsampling of operators in urban areas had to be done in order to finish the job within the time allotted for the survey. In analyzing the 1954 data, it was assumed that coverage of operators was complete and that no "double" reporting had been done. Our 1955 results cast some doubt on the validity on the latter assumption that we avoided double reporting in 1954.

Because of the density of population in most urban segments, it seems desirable to reduce their size in future surveys and to include a proportionately larger number in the sample. This would serve to reduce the workload of each enumerator who had such a segment in his territory, and it would also reduce sampling errors. More farm operators than we expected live away from

their farms. Also, they often tend to congregate in urban areas. Although the 25 urban sample segments in 1954 represented only 3.6 percent of the total, they accounted for about 15 percent of the total number of farm operators picked up in the survey. Several of the urban sample segments picked up very large numbers of operators, often of large farms.

In a refinement made in 1955, instead of 25 sample segments in urban areas, we selected 79; and their size was made proportionately smaller so that the overall sampling rate was the same as before. This revision in the number and size of urban segments produced some rather marked changes in the urban portion of the sample from 1954 to 1955. First, only about half as much cotton and corn was picked up in these segments in 1955 as in 1954. The number of operators in urban segments also declined sharply in comparison with those in rural segments. Table 1 shows the comparison.

TABLE 1.—Number of farm operators in urban and rural segments

Item	1954	1955	1955/1954
Urban segments.....	<i>Number</i> 437	<i>Number</i> 336	<i>Percent</i> 76.9
Rural segments.....	2,438	2,347	96.4

In retrospect, it looks very much as though operators were overcounted in 1954. Furthermore, in subsampling the highly congested areas, more than the right proportion of large operators appear to have been picked up, thus causing an overexpansion in the reported data. Double reporting, in the form of nonresident operators and managers or tenants claiming the same land, no doubt added to the suspected bias in this part of the sample.

#### Control of Sampling Errors

Considerable information as to the magnitude of the sampling errors likely to be encountered is available from past surveys. One purpose of a research study on sample survey techniques is to devise ways and means of reducing the effects of such errors. One control that was exercised in the 1954 survey was the device of stratifying counties by farm type in the selection of sample

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counties within States. There was nothing new about that particular technique. In the survey, it became apparent that a fairly large portion of the within-county variability was contributed by a few urban sample segments which contained large numbers of farm operators. The occasional large farms that were picked up also contributed their usual disproportionately large share toward the overall sampling errors.

It was anticipated that reducing the size of urban sample segments and increasing their number would cause some reduction in within-county variability in 1955. It was also thought that the introduction of a supplemental list of large farms, which would be interviewed independently of the area sample, would effect a further reduction in error. For this reason, a supplemental list of 1,000 large farms was selected for interview in the 100 sample counties.

The list of 1,000 was selected from a total list of about 3,000, obtained chiefly from county Agricultural Stabilization and Conservation (ASC) offices. The list presumably included all farms of 1,000 or more acres of farmland, except for several counties in Texas where the size limit was 2,000 acres. Farms on the list not chosen for enumeration as "large" farms reverted to the "other" farm category and were enumerated only if the operator lived within the area sample.

Allocation of the thousand large farms to the sample counties was made in such a way that counties that carried a heavy weight in the estimate for the entire region were more heavily represented. The proportion of cropland included in the large farms present in the counties also was taken into account. Considerable judgment was exercised in selecting farms for interview from the list of all large farms present in the county. An attempt was made to choose farms that appeared to be intensively cultivated so that most of the improvement in the resulting estimates would relate to crop acreages and production.

Preliminary analyses of 1955 data indicate that in most instances these attempts to reduce sampling errors were rather effective. The list of large farms reduced sampling errors for practically all items. But, strangely enough, improvement in sampling error of cotton acreage was rather small. Apparently, livestock numbers and acreage and production data for crops other than cot-

ton are more highly correlated with size of farm than cotton acreage and production. The use of smaller-sized urban sample segments further reduced sampling errors considerably on most items. It appears that for some items the breaking up of urban segments into smaller units, which permitted more careful and complete canvass, was more effective as a device for reducing sampling errors than the introduction of the large-farm list. Sampling errors for some major items in the two enumerative surveys are given in table 2.

TABLE 2.—*Sampling errors for selected items*

Item	Unit	June 1954 error	June 1955 error
		<i>Percent</i>	<i>Percent</i>
Cotton planted.....	Acres.....	14.3	13.7
Corn planted.....	Acres.....	8.9	7.3
Cattle, all.....	Number.....	11.3	8.9
Hogs, all.....	Number.....	13.5	9.4

### Response Errors in Reported Data

Response errors usually encountered in interview surveys are of several kinds. One type relates to such things as omission of eligible farms or inclusion of ineligible farms and failure of interviewers to pay proper attention to the particular farm unit to which answers to individual questions on crops and livestock should apply.

Another type of error arises from misunderstanding of questions by individual farmers or from inability of respondents to supply exact information. In the 1954 survey, a few instances of ineligible farms were included. Some eligible farms may have been excluded. But the largest source of error appeared to be a failure of replies to questions on crops to apply to the particular farm unit specified by the definition. This was particularly noticeable for crops frequently grown on shares when a farmer had a number of tenants who paid a share of the crop for rent. Apparently, operations of such tenants were properly excluded from the farming unit by the interviewer when recording total farmland, but when farmers reported on their individual crops they frequently tended to include crops grown by share tenants along with their own operations.

This stemmed from the well-known fact that farmers often consider crops grown by some types

of tenants as under their own control, even though the interviewer classified the tenants themselves as independent operators. Every effort had been made in designing the questionnaire to restrict each farmer's report to the land that was defined early in the questionnaire as his own operation, but it was evident from an examination of the resulting data that these efforts were not completely successful in 1954.

To overcome the difficulty, an entirely different approach was employed in 1955. Early in the questionnaire, the farmer was asked whether he rented any land out. If he answered "yes," he was asked if he could supply information on those tenants' operations. Land for which the farmer could not report was deducted from total land owned plus land rented in. This was established as the operating unit. In most instances, the farmer stated that he could supply all the information requested. He was then asked to report information on the established operating unit as a whole. After this was done, the farmer was asked to report for each tenant, other than croppers, individually. Information on sharecroppers was obtained for the group as a whole, as they were not classed as operators. After he had reported information for the individual tenants and for sharecroppers, he was asked whether or not all the items reported for these tenants had also been included in data he had reported for his own operation, and if not, what items were omitted.

By having all of this information on the questionnaire, it was possible later to list the data in the office in such a way that data on crops and livestock could be properly allomated to the farmer's own operations and the operations of his tenants. This was not too difficult, and it provided a workable solution to a long-standing difficulty. Some farmers may not have supplied information for their tenants as accurately as they believed they had, but possible errors in reporting appeared to be small in relation to duplications that occurred when this device was not used in 1954.

In several instances, tenants farmed land owned by more than one landlord, or had other farming operations of their own in addition to being tenants of the particular landlord interviewed. When that happened, it was necessary to visit the tenant, if he lived in the segment, to get the information for his entire operation. In this situa-

tion, the information supplied by the landlord who was interviewed was used mainly to make sure that appropriate deductions were made so that the landlord's own operation was covered properly.

In the 1954 survey, an attempt was made to gain some information about the way in which farmers interpret some questions that appear on other questionnaires used by the Agricultural Estimates Division. One of these related to the farmer's interpretation of the question on "pigs saved." It was suspected that farmers who sold or gave away pigs from litters might not regard them as "saved." Probing questions in the 1954 survey reveal that the total number of "pigs saved" was reported about 3 percent too low, because some farmers omit pigs that are sold or given away.

A number of questions was asked in an attempt to discover whether or not farmers report yield and production of corn in standard units as called for in the questionnaires. It was found that, although the units in which yield and production were reported varied from one part of the region to another, farmers apparently were aware of the number of standard bushels represented by such units. In most instances, production was reported in units that can easily be converted to standard bushels. In a few instances, farmers apparently had no concept of what constitutes a standard bushel.

Another series of questions was devoted to learning whether oats cut and fed unthreshed should logically be classified as "grain" or "hay." It was found that oats cut and fed unthreshed were largely in the mature category. These questions were pursued no further in 1955.

It is believed that there may be important differences in the way farmers report acreages of individual crops. Apparently this is due to differences in concepts of what to include in reporting acreage of a crop. Allotment crops are believed to be reported more nearly on a cultivated area basis and—excluding such areas as fence-rows and bare spots—nonallotment crops on a total field basis. There is some evidence to support this belief. Careful studies on 200 fields distributed equally among cotton, corn, sorghum, and soybeans showed that reported cotton acreages agreed closely with cultivated areas. Reported acreages of the other three crops had a tendency to exceed even the total measured field size.



## Suitability of the Farm as a Unit of Observation

One suggestion offered in connection with discussions on the control of response errors was that a "closed-segment" approach might be invoked as a quality check on the enumeration of farms. This involves taking an inventory of crop acreages and livestock numbers and related data for all tracts of land within the boundaries of selected sample segments, without regard to the particular farms with which these tracts are associated.

Some experience with such an approach, as it applies to estimating crop acreages, is available in the United States. It is the accepted practice in most foreign countries that use objective methods in sampling for crops. Although the success with which it could be applied in estimating other items was questioned, our tests indicated that it might yield more accurate results than the farm approach.

The advantages of the "closed-segment" approach are self-evident. Difficulties with farm definitions are avoided and sampling errors are reduced because effects of variation in size of farms are eliminated. It also makes it possible to verify reported land use data by direct measurement with less difficulty than would be experienced if such verification were to be applied to data covering entire farms. With large-scale aerial photographs of selected sample segments available, all land involved in the canvass of the segments can be delineated on such photographs. This is not always the case when farms are the units of observation. The selection of sample fields for objective yield data is also simplified.

For the June 1955 survey, about 100 segments were selected in 85 additional counties to do experimental work on this subject. The results have fully met expectations—so much so that in future surveys for the collection of crop and livestock data, this approach will be recommended by our research staff. Interviewers were enthusiastic because of the simplicity of the instructions and the ease with which field operations can be conducted.

From the statistical viewpoint, the reduction in sampling errors is gratifying. One closed segment appears to be the equivalent of at least two segments using the farm approach, and for some items the superiority is even more marked. The verification of reported data on crop acreages is greatly simplified. It appears that data such as livestock numbers, stocks of agricultural commodities, and other agricultural items in addition to crop acreages, can be collected by this method just as conveniently as with the farm approach.

In the initial test, there were indications of an upward bias in the livestock data. Some livestock were discovered to have been reported inside the segment when they were actually outside. But with additional experience and care in the field-work such biases should be eliminated. There is some evidence that data on livestock numbers obtained with the closed-segment approach may eventually prove to be more accurate than that obtained with the farm approach; farmers who respond for closed segments report only numbers within the boundaries of the sample segments; they do not need to disclose all their holdings.

One interesting observation relates to the corn acreage picked up by this approach. Apparently more corn acreage is reported when the inventory is on a segment basis than when the farm is the unit of observation. This apparently is caused by attention being directed to many small patches not intended for grain that may be overlooked or disregarded by the farmer when he reports for his farm as a whole. The fact that most of this corn is not intended for grain makes this hypothesis all the more reasonable. Total acreages on corn for *grain*, as recorded in the "closed segment" approach corresponded rather closely with total acreages of corn for *grain* obtained from data reported for entire farms.

Currently the Agriculture Estimates Division is considering plans for farm surveys to be conducted during the 1956 crop season. It is likely that the "closed-segment" approach will be used in all segments in the June 1956 survey, with livestock items obtained for the whole farm as well.