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UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Economics

THE AGRICULTURAL STATISTICS PROGRAM

By Charles F. Sarle
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Perspective

The more commercialized the agriculture of a country, the greater the demand for current statistics concerning all aspects of agriculture. Where agricultural products are grown only for farm and local consumption, there is little demand for agricultural statistics other than perhaps for an occasional agricultural census. The evolution of the demand for agricultural statistics has been well exemplified historically in the United States.

The publication of statistics on crops, livestock, and prices of agricultural products is the oldest activity in the Department of Agriculture, having been started in 1862 when the Department was organized. These statistics were begun after several decades of agitation by leading farmers for unbiased agricultural statistics concerning condition during the growing season, and harvested production of crops that were being produced commercially, especially cotton, wheat, and other grains. These farmers wanted to be protected, as they said, from the effect of false and misleading reports emanating from those who wished to buy their products at low prices.

As a nation's economy becomes more diversified and complex, demand for agricultural statistics increases. Demand is not only for broader coverage of agriculture, but also for other facts relating to the ever-changing agricultural process, for statistics at more frequent intervals, and for greater accuracy. This demand is accelerated by the strain put upon a nation's economy by war. When national economies are subjected to world-wide depression and governments embark on production control and price-support programs, the demand for more and better agricultural statistics increases almost overnight.

Kinds of Agricultural Statistics

At present, the demand for agricultural statistics, which the Department's program endeavors to meet with the resources available, covers a broad field. In addition to statistics concerning production, prices, marketings, farm employment, and wage rates, the Bureau of Agricultural Economics maintains such regularly recurring statistical series or estimates as: Indexes of farm production; farmers' cash receipts and expenditures; parity prices and parity income; gross and net farm income; estimates of per capita food consumption for individual commodities; changes in land values and volume of sales of farm real estate; farm taxes and tax returns, interest paid and indebtedness; valuation of livestock and farm equipment; cost and returns for specific types of farming; estimates of farm population; migration to and from the farm; and similar series

which are prepared by bringing together and studying large masses of data collected by this Bureau and other agencies. (See Appendix A - "Who Uses Agricultural Statistics?")

To meet these needs, the Bureau of Agricultural Economics publishes numerous basic statistical series throughout the year. Included are series of current estimates of production, stocks, and prices of over 150 farm products, and also farm wages and employment. (See Appendix B - "Agricultural Statistical Series Published by the Bureau of Agricultural Economics")

Organization and Cooperation

The Bureau of Agricultural Economics is general overseer of the economic research and statistics program of the Department of Agriculture. Six divisions of the Bureau are engaged primarily in gathering crop and livestock statistics. These divisions are known collectively as Agricultural Estimates. There are six other divisions of the Bureau -- the economic investigations divisions which also construct and maintain regularly recurring statistical series, such as farm income and expenses, marketing margins, farm population, mortgage debt, land values, taxes, etc.

The Bureau maintains 41 State statistical offices which serve all States. The State agricultural statisticians in these offices are responsible for maintaining cooperative relations with State agencies and contact with farmers and other people; for collecting statistical data relating to agriculture for their respective States; and for analyzing, summarizing, and interpreting the information received from farmers and other sources which they forward to the Crop Reporting Board or to statistical divisions in Washington for review and assembly into State and national averages and totals.

In 40 States (35 State offices) formal cooperative agreements are maintained with State departments of agriculture, or State colleges of agriculture or both, for the collection and publication of agricultural statistics. In seven of these States the cooperation is limited to statistics on manufactured dairy products. In 21 States the agricultural statisticians cooperate with representatives of the Weather Bureau, and representatives from the State extension service or other State agency, in the issuance of joint weekly reports on weather and crop conditions.

In all other States, where formal agreements are not in effect, the Bureau's statisticians in the State offices maintain close working relations with State agencies and with other Federal workers in the agricultural field.

These cooperative relationships eliminate duplication in the collection and publication of agricultural statistics; and where enough State funds are allotted, make it possible to provide better local statistics such as county and district estimates; and in 12 States affords an unexcelled opportunity for effective use of annual State agricultural censuses taken by local assessors.

Appendix C is a chart that shows diagrammatically the Bureau's Nation-wide fact-finding organization, and how farm statistics are collected and distributed to the people who use them.

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Appendix C is a chart that shows diagrammatically the Bureau's Nation-wide fact-finding organization, and how farm statistics are collected and distributed to the people who use them.

The regular list of 80,000 volunteer farmer reporters receive a schedule the first of each month. Of this number about 24,000 schedules or 30 percent are returned and tabulated. The rural carriers distribute about 600,000 cards to farmers along their routes three times each year. About 160,000 cards or 27 percent are returned and tabulated. In June a mailed survey on crop acreages is sent to lists of about 344,000 volunteer reporters. Of this number about 75,000 schedules or 22 percent are returned and tabulated. In late October a mailed survey on crop acreages harvested, acres abandoned during the growing season and production are sent to about 320,000 volunteer reporters. About 88,000 schedules or 27 percent are returned and tabulated.

- (3) Field Observation and Contacts: Information concerning crops and livestock is obtained by general field observation and personal contact with well-informed growers and other "key" people who buy or handle farm products. This approach is practically indispensable, for example, in making estimates of fruit and vegetable crops, the production of which in most areas is highly localized because of special requirements of soil, climate, and markets; in evaluating the damage done to crops by such disasters as hurricanes, droughts, freezes, floods, or hailstorms, and in estimating cattle and sheep on feed.
- (4) Objective Plant Counts and Measurements: With certain important commercial and feed crops, objective plant counts and measurements are made in the fields in which these crops are growing. For example, just before harvest, yield per acre of small grains, corn, or soybeans can be estimated by taking small samples of specified areas from fields throughout the territory where the crop is grown. Objective methods are used in selecting the fields to be sampled and in selecting the small "sample areas" for harvest.

The yield of such crops as potatoes and peanuts can be determined by taking objectively selected hills in fields and weighing the potatoes or peanuts from the sample hills; the yield of cotton by counting and measuring the unopened bolls from plants growing in small row samples in the field. The percentage of infestation of boll weevil in cotton is measured by counting the sound and invested bolls. For citrus fruits "frame counts" are made in California and Florida in selected groves to determine the number of fruits on trees in comparison with previous years. Diameters of representative fruits also are measured to obtain an index of size. Estimates based on objective plant-count measurements are free from the bias of personal judgment of the observer or opinion of the reporter.

Another objective field measurement of crop acreages is obtained by a machine called the crop meter. This machine, which is attached to the speedometer cable of an automobile, is used to measure the frontage of each kind of crop along selected routes each year. These measurements provide an objective indication of

Sources of Data for Current Agricultural Statistics

The data used in making agricultural estimates fall into five general categories:

- (1) Enumeration Data: Data that are obtained by complete or nearly complete enumeration, such as the periodic agricultural censuses which have been taken every 5 years since 1920, and at 10-year intervals from 1840 to 1920; annual enumeration of crop acreages made by local tax assessors in about 12 States; and statistics covering the operations of various types of processors and handlers of commercial agricultural products, such as cotton ginnings, rice millings, peanut shellings, tobacco sales, sugar manufactured from sugarcane and sugar beets, vegetable processors, carlet shipments of fruits and vegetables, plant production of manufactured dairy products, shipments of livestock and grain, market receipts and quantities of certain agricultural products processed for sale. In some 31 States tax authorities report annually or biannually on the assessed numbers of livestock on farms.
- (2) Mailed Sample Data: Questionnaires are distributed in two ways. Either they are mailed directly to lists of volunteer reporters who serve without pay or are distributed by rural mail carriers to about 10 percent of the farms along their routes. The rural-carrier surveys, conducted in cooperation with the Post Office Department, are made once a year (October) to obtain information on crop acreages harvested, and twice a year (June and December) to collect information on livestock numbers and production of livestock.

In addition, the 41 field offices maintain a number of special lists of volunteer reporters to whom various types of mailed inquiries are sent, such as prices received by farmers, prices paid by farmers, special commercial crops, milk producers, feeders of cattle, sheep, and lambs, acreage planted, acreage harvested, and production of crops, etc. A mailed sample also is used to obtain information from flour mills and grain elevators, cotton ginners, local slaughterers of livestock, creameries, fluid milk plants, hatcheries, and other processors of agricultural products.

The inquiries sent to the list of volunteer reporters include questions concerning crops, livestock, farm wages, etc. in their respective localities and also questions concerning acreage and production of crops and livestock on their individual farms. The rural-carrier surveys always relate to the individual farms of the respondents.

During the entire year a total of about 9,500 separate schedules are mailed to lists of farmers and others including those distributed by the rural carriers. In all a total of approximately 9,800,000 schedules are distributed in this manner and about 2,600,000 or 26 percent are returned and tabulated.

survey, provided a reasonably dependable basis for estimates of harvested acreages of the more important grain and feed crops. Cotton ginnings provide an annual check on cotton production. The mailed returns from volunteer crop respondents who report on average yields per acre for different crops in their locality, usually provide a dependable basis for State estimates for yield per acre for major crops.

The monthly condition of growing crops reported in "percent of a normal or full crop," when interpreted on the basis of average relationship (regression) for that month and crop between reported condition and final yield per acre, usually provides a reliable indication, as of that date, of the prospective out-turn per acre for most major crops.

The closer the date of the reported condition to the time when the crop has reached maturity, the higher the relationship between condition and final yield, and hence the more reliable is the indication of prospective yield per acre. The earlier in the growing season that condition is reported, the greater the possibility that subsequent weather can materially modify these early indications of yield per acre.

The reported condition of a growing crop fails to be a dependable indication of prospective out-turn with some crops in certain areas even late in the season. With some crops, the report of the "probable yield per acre" used on a relative basis from year to year is a better indication of harvested yield than the condition, as the latter tends to reflect only the vegetative appearance of the growing crop.

Some difficulty is also experienced with such crops as potatoes and peanuts in certain producing areas where the vegetative appearance of the crop is not always a good indication of yield of these crops, which are produced beneath the surface of the ground. With such crops, there is a need for more intensive investigation of weather-yield relationships than it has been possible to make up to this time.

Limitations of Source Data

Census statistics available every 5 years are most reliable on acreage, yield, and production of major general crops. However, even the census statistics on these crops are subject to some error because the owner or tenant-operator on the farm when the census is taken is not always the same person who operated that farm the previous crop season. If the census could be taken in the late fall, this source of error would be held to a minimum.

The census statistics of the production of fruit crops in census years, along with some annual check data on the commercial movement of fruit crops and the reported condition of these crops in percentage of normal or "full crop," provide a reasonably satisfactory basis for estimates of the production of the major fruit crops in most States.

Vegetable and Special Commercial Crop Statistics:

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assessors' annual census records in the States where they are available. The respondents of an annual preselected interview sample also would furnish such a list.

The research should be directed toward the discovery of psychological, social, and economic factors that give rise to the differential response to mailed inquiries of different kinds. To the extent that these factors can be determined, "control items" could be included in the original interview schedule for use in stratifying and weighting the returns of subsequent mailed samples, thereby minimizing selectivity at the second level mentioned above.

The effect of repeated "follow-up" of the same schedule to the persons who fail to respond on the first request needs further investigation and may lead to the development of a basic theory of nonresponse that can be expressed mathematically and ultimately used in estimating for the farms of nonrespondents. The Bureau statisticians have other ideas along these lines that should be tested. Every effort should be put forth to combine the advantages of interview and mailed samples in order to maximize accuracy and speed in getting sample data at minimum cost.

Future Needs for Agricultural Statistics

The basic long-run objectives of the agricultural statistics program of BAE are threefold. They may be summarized as follows:

- (1) Statistical: To improve the accuracy of the official agricultural statistics of the Bureau and to develop additional essential statistics concerning agriculture that are needed in our complex industrialized national economy.
- (2) Research: To provide agricultural research economists and rural sociologists with representative observational data from a true cross-section sample of farms, farm operators, and farm people, or of specified sub-populations thereof, which would serve as a valid basis for testing provisional and alternative economic and social hypotheses concerning the behavior of agricultural phenomena, including farm people themselves.
- (3) Federal-State Cooperation: To develop in each State a sound, integrated cooperative sampling program for providing State interests with agricultural information needed at the State level, and to provide State economists and rural sociologists with representative observational data for research purposes.

The basic requirements of an agricultural statistics program to meet the above objectives include:

- (1) One large annual Nation-wide interview sample: This sample should be of sufficient size to provide reliable State estimates for about three-fourths of the States--the larger States in terms of number

acreage changes in various crops from one year to the next in certain areas of the country where this technique is practicable.

- (5) Preselected Interview Surveys: In recent years sample interview surveys have been successfully used to a limited extent in making estimates of certain kinds of agricultural phenomena, such as family and hired labor employed on farms and farm wage rates, farm income and expenses, inventories of livestock, crops, and farm machinery, etc.

Many kinds of important agricultural data are difficult or impossible to secure by mail and these must be obtained by enumeration or interview. The interview survey method makes it possible to reach all types of farms and farmers, including people who do not respond to mailed questionnaires. It is less expensive and time-consuming than a complete census.

In an interview survey, well-trained rural people are employed to interview all farmers (or others) in small areas of about five farms each selected beforehand on a representative basis. The chief thing is that a small but carefully selected cross-section sample of the population of farms or of farm operators is contacted and that the desired information is obtained by personal interview.

Statistics obtained in this way can be expanded into estimates for a small area within a State, for an entire State, for a group of States, or for the Nation as a whole, depending upon how many farmers are interviewed and how great an area is covered.

If national totals only are desired, the number of farms in the sample may be quite small for certain items. But to get accurate estimates for regions, States, or areas within States, proportionately larger samples are necessary. Thus, if State estimates are desired, almost as many interviews may be necessary within each State as would be required throughout the entire country for corresponding national estimates. The accuracy of an estimated average or total depends on the number of observations included in the sample as well as on the frequency of occurrence and degree of variability of these observations.

The number of interviews necessary depends also on the type of information or estimates desired. For instance, it takes a comparatively small sample to provide dependable data for items or conditions common to a large proportion of farms--say, the number of farms raising livestock or producing corn. But a comparatively large sample must be surveyed to get accurate statistics about something common to only a small proportion of farms, such as specialized equipment like combines or corn pickers, or the number of hired farm laborers.

Methods of Estimation

It is an oversimplification to say that the 5-year periodic census statistics are used as "bench marks" for current agricultural statistics and that the other data mentioned above are used only to provide a basis for estimates in intercensal years. Actually, the statistical series published by the Bureau of Agricultural Economics are in a large part estimates based on the relationships (regressions) that exist historically between mailed sample data and various presumably complete or nearly complete enumeration data, including the Federal census, State assessors' censuses in those States where they are available, and/or various commercial check data mentioned under class 1 source of data.

One example of agricultural statistics entirely independent of census enumerations is agricultural prices. In fact, the price data collected monthly by the Bureau of Agricultural Economics during a census year are used by the Census Bureau in arriving at the value of agricultural products. The price statistics of the Bureau of Agricultural Economics--prices received and prices paid by farmers--are based almost entirely on mailed samples from special volunteer price reporters who are usually local dealers and merchants in farm communities throughout the country.

The Bureau of Agricultural Economics of the Department of Agriculture is responsible for the current series of statistics relating to agriculture. The series relating to agricultural production for the United States and for each of the 48 States--intentions to produce, prospective production, and estimates of production as well as prices received and paid by farmers--must be timely to be of value. For example, the monthly crop reports relating to conditions as of the first of the month are issued between the 8th and the 10th of the current month, the twice-a-year reports of hog production (The Pig Crop Report) are issued within 18 to 20 days of the end of the 6-month period covered by the report. Somewhat more time (about 6 weeks) is allowed for the December report of harvested acreage and production of all crops. The public has been used to this kind of a "timetable" since about 1865, or for more than 80 years. Any attempt to extend the time by even a few days would be highly unpopular. Consequently the planning of future developments and improved sampling techniques will need to keep this speedy timetable in mind.

The Bureau of the Census is responsible for the agricultural census which is taken every 5 years. The census statistics provide information in great geographic detail, that is, by counties, but there is necessarily a considerable time lag in the release of census statistics.

Statistics on General or Major Crops:

The general crop statistics fall into two categories: (a) Estimates of acreage harvested, yield per acre and production; and (b) estimates of acreage planted, condition of the growing crop, and prospective production.

The Federal census and State assessors' censuses in many of the important North Central States, along with the annual (October) mailed rural carrier

survey, provided a reasonably dependable basis for estimates of harvested acreages of the more important grain and feed crops. Cotton ginnings provide an annual check on cotton production. The mailed returns from volunteer crop respondents who report on average yields per acre for different crops in their locality, usually provide a dependable basis for State estimates for yield per acre for major crops.

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Some difficulty is also experienced with such crops as potatoes and peanuts in certain producing areas where the vegetative appearance of the crop is not always a good indication of yield of these crops, which are produced beneath the surface of the ground. With such crops, there is a need for more intensive investigation of weather-yield relationships than it has been possible to make up to this time.

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only nine of the 29 vegetable crops for which the Bureau of Agricultural Economics makes official estimates. These crops were potatoes, sweetpotatoes, cabbage, snap beans, green peas, tomatoes, celery (Florida only), sweet corn (except in Florida, Arizona, and California) and lettuce (Arizona and California only), with a total value in 1945 of \$1,203,710,000. The remaining 20 vegetable crops, considered of minor importance, had an estimated aggregate value in 1945 of \$355,989,000. These other vegetable crops were not included in the census schedule primarily because of their sporadic geographic distribution. It has not been possible in the past to so select, train, and supervise census enumerators that they will consistently ask all the questions on the schedule relating to crops and other agricultural items that occur on only a small percentage of the farms in their respective enumeration districts.

It is extremely difficult also to obtain reliable information concerning these sporadic phenomena by means of the mailed questionnaire to lists of volunteer correspondents. When the production of a vegetable or other special crop is highly localized geographically because of exacting soil, climate, or market requirements, the most economical method of obtaining information concerning acreage and production is by personal contact with well-informed growers and other "key" people who buy or handle such crops. The other and more expensive alternative is either a complete enumeration of all the producers in each local producing area or an interview sample of a large proportion of these growers.

Carlot shipments of such a crop from the area where it is produced are of much less value as check data now than 20 or 30 years ago. To an increasing extent, truck shipments are replacing carlot shipments. A program to obtain reliable statistics on truck shipments of commercial crops by point of origin would be expensive and difficult to supervise effectively.

Fortunately, reliable data on commercial production, processing, or market movement of certain crops such as cotton, tobacco, rice, peanuts, sugar, grain, and livestock and livestock products help to offset some of the difficulties in census statistics in estimating annual production on a regression basis from mailed samples.

Livestock Statistics

If the census could be taken at the same time of year each time and taken during a short period, the census livestock statistics of numbers of different kinds of livestock on farms would provide a much more satisfactory basis for annual inventory statistics. Census statistics of the production of livestock and livestock products during the preceding year are in considerable error (memory bias) because of the seasonal nature of such production. The same difficulty exists with any agricultural phenomena with high within-season variation, such as farm family and hired labor, farm expenses and income, etc.

Census data on milk production covering an entire calendar year are subject to considerable bias as they tend to be influenced by the level of production at the time of year when the census is taken. For example, if the census is taken in January --a period of low production in most areas--milk production

for the previous year will be greatly understated to the enumerator. A measure of the seasonal pattern of milk production per cow is obtained from the monthly reports of regular crop reporters and from the June and December returns from the rural mail carriers.

Statistics of manufactured dairy products include a complete enumeration of the plant output of the major products, together with current estimates of a monthly or weekly basis for the more important ones. Each year a complete enumeration of factory output of about 45 different kinds of dairy products is obtained. Dairy plants keep comparatively accurate records of production and in many States collection of data is assisted by State laws requiring the firms to report the amounts manufactured. In 28 of these States the Bureau has entered into cooperative agreements with certain State agencies to provide for the joint collection of these reports. These facts, plus a diligent followup program in obtaining reports for delinquent plants, have resulted in statistics that closely approach 100 percent completeness on all but a few minor items.

Poultry and egg production statistics also have high intraseasonal variability. Consequently, the census taken at only one time during the year does not provide reliable data on numbers of chickens produced or sold or eggs produced. However, the mailed sample taken monthly does provide a useful measure of the seasonal pattern of poultry and egg production.

Farm Employment and Wage Rates:

The Bureau of Agricultural Economics series on farm employment, family and hired labor (monthly) and farm wage rates (quarterly) are based on a mailed inquiry to the regular volunteer reporters of the Bureau. The sample returns on farm employment are adjusted during the season by factors derived from a comprehensive study of census data and farm labor requirements obtained from farm-management investigations made in different parts of the country. During the last few years, five Nation-wide interview and several special mailed surveys have been made on farm employment and wages. It was found that on the national level there was very little difference between the wage rates obtained by the interview sample and the mailed sample.

An analysis is now being made of data on farm employment and wages obtained by the two methods of sampling for the purpose of determining more satisfactory within-season adjustment factors for use with the mailed sample, pending the time when resources will permit a quarterly interview survey of farm employment. Farm employment varies greatly with the seasons of the year, and the farms of crop reporters who report monthly are not sufficiently representative to provide a sample that can be used without seasonal adjustments.

Mailed versus Preselected Interview Sampling

The mailed sample has several outstanding advantages and some serious shortcomings as compared with the preselected interview sample of a representative cross-section of farms. The mailed sample is inexpensive

both in time and money, and the returns can be obtained within a few days through the 41 field offices of the Bureau.

When the results of mailed samples are used on a regression basis with a reliable series of census, assessors, and/or commercial check data, useful State and national estimates can be made for major crops and classes of livestock in most States.

On the other hand, the mailed sample has serious limitations. As it is not a representative cross-section sample, only statistical averages and ratios can be used from it. These, in turn, must ordinarily be used on a regression or relative basis in making estimates. However, mailed samples on prices are an exception to this generalization. Other highly useful statistics, such as frequency distributions, frequencies of occurrence, and totals cannot be derived satisfactorily from the mailed sample.

Selectivity of Mailed Samples:

In using the mailed sample it is recognized that it is selective and not fully representative of the population for which it is drawn. It is selective at two levels: (1) The usual mailing list to whom mailed questionnaires are ordinarily sent is not a representative cross-section of the population of farm operators, unless it has been recently drawn from a complete census or is a list of operators obtained by a preselected interview sample survey.

(2) The response obtained by mail is never 100 percent complete, hence there may be selectivity in the responses that are obtained. The differential response of a mailed sample may vary greatly because of the effect of many unknown psychological, social, and economic factors over which the statistician has little or no control. The differential response is especially serious in sampling agricultural phenomena that occur on a relatively small proportion of farms. Experience has shown that a mailed questionnaire designed to obtain such information has better "drawing power" when a number of questions are added that relate to other phenomena that occur on practically all farms.

The differential response to a mailed inquiry is not necessarily constant from one season of the year to another, or from season to season, or from area to area as these little understood psychological, social and economic factors change in time. For example, a different response would be expected on a cotton acreage inquiry when the price of cotton has dropped sharply than when the price has remained fairly constant over a period of a year or two. Part of the changing selectivity of the returns from the mailed sample is caused by varying proportions of "in and out" producers of an agricultural product from season to season.

Considerable research and experimenting needs to be done with mailed sampling when a true cross-section sample of farm operators is used as a list to whom the mailed inquiries are sent. Using such a list eliminates the first cause or level of selectivity with mailed samples as they are now generally used by the Bureau. Such lists could be drawn from the tax

assessors' annual census records in the States where they are available. The respondents of an annual preselected interview sample also would furnish such a list.

The research should be directed toward the discovery of psychological, social, and economic factors that give rise to the differential response to mailed inquiries of different kinds. To the extent that these factors can be determined, "control items" could be included in the original interview schedule for use in stratifying and weighting the returns of subsequent mailed samples, thereby minimizing selectivity at the second level mentioned above.

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- (1) Statistical: To improve the accuracy of the official agricultural statistics of the Bureau and to develop additional essential statistics concerning agriculture that are needed in our complex industrialized national economy.
- (2) Research: To provide agricultural research economists and rural sociologists with representative observational data from a true cross-section sample of farms, farm operators, and farm people, or of specified sub-populations thereof, which would serve as a valid basis for testing provisional and alternative economic and social hypotheses concerning the behavior of agricultural phenomena, including farm people themselves.
- (3) Federal-State Cooperation: To develop in each State a sound, integrated cooperative sampling program for providing State interests with agricultural information needed at the State level, and to provide State economists and rural sociologists with representative observational data for research purposes.

The basic requirements of an agricultural statistics program to meet the above objectives include:

- (1) One large annual Nation-wide interview sample: This sample should be of sufficient size to provide reliable State estimates for about three-fourths of the States--the larger States in terms of number

of farms-- and for groups of smaller States. The State estimates from this sample would be limited primarily to agricultural items that occur on about 25 percent or more of the farms in a State or in a group of small States. However, National and regional estimates could be made for agricultural items that occur on a smaller proportion of farms. The minimum size of the annual Nation-wide sample to meet these objectives would be about 60,000 farms, with the sample distributed in about 2,400 counties. Eventually this sample should be increased to 100,000-120,000 farms distributed in all agricultural counties.

It would be necessary to establish a current list of the large commercial farms and use a higher sampling rate with these.

West of the hundredth meridian (in the far western and Pacific Coast States) it would be necessary to establish and maintain currently a list of the larger cattle and sheep growers who use public grazing lands for their herds and flocks, and to delineate the irrigated and dry-land farming areas on appropriate maps in order that the sample segments may be drawn predominately from these strictly agricultural areas. Delineation of nonfarming, cut-over, and forest lands would also make it possible to increase materially the efficiency of area sampling in many other States, such as Michigan, Wisconsin, and Minnesota, and some of the Appalachian, Atlantic Coast, and Gulf Coast States.

Schedule:

Experience of the Bureau indicates that if reliable information is to be obtained and good public relations maintained, the schedule should be no longer in terms of interview time than can be taken in 30 minutes to an hour on 90 percent of the farms. The primary emphasis of topics for inclusion on this annual interview sample schedule would be upon the more important characteristics of a farm and farm operator's family, such as acres in the farm, tenure, land use, acreage and production of crops, numbers and kinds of livestock, inventory of farm machinery, farm labor and wages, composition of the farm operator's family, modern farm and home facilities, and perhaps a few of the major farm expenses including rent, fertilizer, and interest payments, etc. In addition, there would be a few specific "key control items" for use in selecting subsequent subsamples for interview and mailed sampling or a combination of both.

In view of the high cost of an interview sample there is always pressure to include as many topics and items as possible. Hence the interview time becomes^s entirely too long for reliable results. Biases due to fatigue on the part of both interviewer and respondent are certain to occur with a long interview schedule. It is also more difficult and time-consuming to train and adequately supervise interviewers when the schedule and interview time exceeds the optimum.

Less complete coverage of the farms in the area sample segments is obtained when an excessively long schedule is used than with a short schedule. Although experience is not yet sufficient to determine the optimum length of interview it is apparent that from 30 minutes to an hour on 90 percent of the farms is the optimum for a successful interview. The large commercial farms and plantations in the South will, of course, take more time and will require high-quality, well-trained and experienced interviewers.

In view of the experience with census statistics, this annual interview sample should be taken at the same time each year. Probably the best time would be in the late fall, October to November, after most of the crops are harvested and before severe winter storms become frequent. April would probably be the next best time.

Such a sample not only would provide a sound statistical basis for State estimates of the fundamental aspects of agriculture, but also would serve the research economist and rural sociologist with a valid basis for subsampling in testing provisional economic and social hypotheses concerning agricultural processes and the behavior of farm people. The large sample would furnish answers to the questions of "how many" and "how much." By subsampling this large sample, specific segments of the population could be isolated for intensive investigation into the "why" of agricultural processes.

- (2) Three quarterly interview surveys a year: If more accurate statistics of agricultural phenomena that have a high within-season variability are to be obtained, interview surveys must be made oftener than once a year. These phenomena with high intraseasonal variation include family and hired labor, wages, production of milk, eggs, and livestock, the incidence of accidents and sickness to the farm population, and farm income and expenses. The frequency of occurrence of many of these items during a 3-month period is usually relatively low. A longer period than 3 months is too long for detailed and accurate memory by most farmers and would result in considerable "memory bias."

If the schedule to be used is simple and limited to one or both sides of a single sheet of paper, a combination of mailed and interview sampling would be most economical and could be so designed that reliable results would be obtained. If the items to be sampled were not changing rapidly and time permitted, the interview sample could be limited to a subsample of the nonrespondents of the mailed inquiry following two mailed requests for information. If the items of interest were changing rapidly (as would be the case with hired labor at or near harvest time), the interview sample would need to be taken simultaneously with the mailed sample. In either case, a subsample of the respondents of the October to November annual sample would be utilized.

On the other hand, if the schedule were longer and/or the subject matter more complex, the quarterly survey would be taken entirely by interview sampling. However, it would be made of a selected subsample

of the October to November annual interview sample, its size depending on the nature of the items and the level of accuracy required.

These quarterly surveys should probably be made in January, April, and July.

- (3) Special mailed samples to the respondents of the annual interview sample: Special mailed samples to such a cross-section list of respondents would provide a much better basis of sampling than is now in use by the Bureau in making a number of its more important agricultural surveys each year. For example, if the annual interview sample were made in October or November, a mailed sample to these respondents could be made
- (a) In June each year, on hogs and milk cows, and on crop acreages planted, eventually to replace the June rural carrier livestock survey and the June acreage survey to voluntary correspondents. These two surveys are among the more important ones made during the entire season.
 - (b) In January on numbers and kinds of livestock on farms on January 1 as a basis for the annual estimates of livestock inventories. The October inventories would be brought up to January 1.
 - (c) In April to the respondents of the annual survey in the 12 North Central States to serve as a basis for a preliminary estimate of the size of the spring pig crop. There is an insistent demand on the part of the livestock industry for such statistics.
 - (d) In December on hogs and the fall pig crop, eventually to replace the December rural carrier livestock survey.
 - (e) In March on acreage planting intentions. The returns would be compared directly with the crop acres harvested the previous fall which are obtained on the annual interview survey.

If an annual interview survey of sufficiently extensive coverage could be taken in October or November, it would well replace the large acreage and production mailed survey now in use, the fall rural carrier acreage survey, and in combination with a mailed sample in December, it might also replace the December rural carrier livestock survey.

The "traffic load" of these five mailed samples plus the three quarterly surveys would be so heavy that it would be necessary to obtain a larger annual interview sample in October to November of 100,000 to 120,000 farms. Subsampling could then be used to spread the traffic load among the interviewed respondents. A sample of

120,000 farms would mean an average of 40 farms per county, which would provide a more valid basis for county estimates of major crops than we now have from the rural carrier acreage survey.

- (4) "Flash" surveys: There is keen interest in a sampling scheme that would get quick results from a small sample on what farmers are thinking and planning to do when they are subjected to the impact of forces (economic, weather, and economic-political) which are beyond their control. It is likely that surveys of this kind might be directed to specific segments of the farm population, such as cattle or lamb feeders, commercial hog or dairy producers, or producers of special commercial crops such as citrus or potatoes. For example, such surveys might be used to discover farmers' reactions to a proposed control-price support program with a specific agricultural commodity.

A large annual interview survey of 120,000 farm operators would provide an excellent basis for small but representative subsamples of operators falling into these special categories. Representatives of the Bureau's 41 field offices, with some help in the form of interviewers, could handle one of these small surveys of 1,000 to 3,000 farms rather quickly.

- (5) Vegetable and fruit crops statistics: The statistics that have the poorest foundation of census and other enumeration data and some of the most difficult problems of sampling and estimation are those relating to vegetable, fruit and specialty crops. If this problem is to be solved, it will be necessary to establish and maintain current lists of commercial producers of vegetables, fruit, and specialty crops, State by State, which could then be sampled by mail and interview methods either singly or in combination, to provide a sound statistical basis for the statistics of acreage, production, and marketings of such crops.

In the case of tree fruits, complete enumerations are needed every 6 or 8 years in all chief commercial producing areas to obtain information concerning the kind, age, variety, and production of tree fruits. Such a census is necessary as a starting point for subsequent sampling and subsampling.

- (6) Special small Nation-wide interview economic surveys: If fully reliable statistical series are to be developed and maintained on a national and regional basis for such economic items as gross and net farm income, farm expenditures, nonfarm family income, indebtedness, savings, etc., it will be necessary to make special small Nation-wide interview surveys, utilizing highly qualified interviewers who have had adequate training in the application of sound, practical social-psychological principles to the interview situation. These interviewers must be carefully supervised. In

fact, considerable research and experimentation is needed to determine the best methods for minimizing what might be called "income tax bias" that is so prevalent in the reports of farm income. It will be some time in the future before these methods are sufficiently developed to justify a Nation-wide sample of sufficient size to provide useful State estimates on farm income.

Conclusion: It is our conviction that a successful program of interview sampling must have three essential attributes. These attributes are like the three legs of a stool or table. Each must be strong and dependable or the stool is useless. These three attributes are:

- (a) Statistically sound and efficient sample design.
- (b) Psychologically sound and practicable schedule design and interviewing methods.
- (c) Practicable and efficient organization and operation in the Washington office and the 41 field offices of the Bureau, emphasizing particularly the most effective practices of selecting, training, and supervising interviewers.

APPENDIX A

Who Uses Agricultural Statistics

Although the need for measuring farm production and income is obvious in a general way as good "economic housekeeping," it is only natural to ask who, specifically uses agricultural statistics. The list which follows is far from complete, but it does indicate what kind of people ask for farm statistics regularly, and how they use the figures.

Farmers and Farmers' Organizations:

- (1) Individual farmers: in planning their planting, breeding, livestock feeding, and marketing programs.
- (2) Farmers' organizations, such as the Farm Bureau, Farmers' Union, and the Grange; in keeping abreast of current agricultural problems and in determining their policies.
- (3) Farmers' cooperatives: in planning their purchasing, sales, and marketing programs.

Transportation Companies:

- (4) Railroads and other transport services: in determining the number of cars and trucks needed to move the agricultural products of particular areas. The statistical data on production and time of harvest enable these carriers to distribute their equipment where it is most needed. This is especially important in wheat areas and with perishable products such as fruits and vegetables.

Middlemen and Processors of Agricultural Products:

- (5) Processors of agricultural products: such as packers, canners, millers, slaughterers, and manufacturing plants; in planning where to establish their plants, determining the source and volume of their raw products, the size of their operations, and in marketing their products.
- (6) Dealers and handlers of agricultural products: in their market operations. (Accurate data on the present and prospective supply of agricultural products help eliminate some of the middlemen's risks and thereby tend to reduce the margin he requires, and to stabilize prices.)
- (7) Operators of warehouses and other storage facilities: in planning storage for each year's crops and livestock products.

Manufacturers, Jobbers, and Merchants Serving Farmers:

- (8) Industrial organizations, manufacturers, jobbers, merchants, and mail-order houses, particularly those with farm customers or customers processing or packing farm products; in planning their production, sales, inventories, and advertising programs, in order to provide the farmer with goods he needs when he needs them.

Credit Agencies and Insurance Companies Serving Farmers:

- (9) Banks, insurance and credit organizations: in calculating the risks in financing farm production, storage, and marketing, in managing farm properties under their control; or in insuring farmers against crop failures, livestock losses, etc.

Farm Magazines and Newspapers:

- (10) Editors and writers for farm and trade papers, newspapers, and radio services; in developing background for articles and programs of timely interest and value to farmers.

Agricultural Education and Research Institutions:

- (11) State Agricultural colleges and extension services: State and county extension workers and others who advise farmers about planting, breeding, and marketing operations. Statistical data are the basis for their educational programs, and also measure the effectiveness of their crop and livestock work.
- (12) Agricultural research workers in industry, State Experiment Stations, private research organizations, and Government: basic agricultural data are necessary for many types of economic research on such subjects as production, marketing, and other phases of the business side of farming.
- (13) Economists who prepare Outlook and Situation Reports: various periodic reports published by the Bureau of Agricultural Economics, and by Land-Grant Colleges present an analysis of current facts about farm products, food supplies, and agricultural markets. Such reports give farmers a picture of the current economic situation and prospects which may affect their business operations or future plans. The Bureau's basic statistics, used in making these analyses, are supplemented with information collected by research workers directly and by data from the Production and Marketing Administration and from fact-finding agencies outside the Department of Agriculture, such as the Federal Reserve Board, the Department of Commerce, and the Department of Labor.

Federal and State Governments:

- (14) Legislators and administrators in local, State, and national governments: as a basis for constructive public programs for farmers; as a source of current facts on farm production and of long-time records; for determining quickly the extent of damage done by drought, floods, and hurricanes; for dealing with such international groups as the International Emergency Food Council and the Food and Agriculture Organization of the United Nations; for establishing foreign trade policies; for carrying on the "action programs" of the Department of Agriculture--conservation, crop insurance, crop loans, commodity buying programs, and distribution of surpluses.

Lack of, or incomplete statistical data might easily cost the taxpayers many times the expense of maintaining an efficient agricultural estimating and statistical service.

APPENDIX B

Agricultural Statistical Series Published by the Bureau of Agricultural Economics

As the farmers' principal economic fact-finding and research agency, the Bureau of Agricultural Economics publishes many statistical series about farm products, farm people, and many phases of farm business.

Primary Statistics:

The types of agricultural statistical series that are obtained by sampling are summarized below. All of these series are for the United States (excluding possessions) and most of them also are by States.

- (1) Crop acreages (108 crops)
- (2) Conditions of crops and pasture; prospective and harvested yields per acre and production (136 crops)
- (3) Stocks of products on and off farms.
- (4) Numbers of livestock and poultry on farms; livestock feeding operations; livestock raised; volume of dairy, poultry, and livestock products.
- (5) Crop planting and livestock-breeding intentions.
- (6) Farm disposition of crops and livestock
- (7) Processors' operations
- (8) Prices received and paid by farmers
- (9) Farm wage rates
- (10) Farm employment
- (11) Interest and tax payments
- (12) Farm machinery information
- (13) Land values
- (14) Farm population and movement to and from farms.

Statistics Computed From Primary Series

To make these primary data easier to interpret and use, various kinds of series have been developed which might be described as statistical measuring-sticks.

These include the widely used index numbers of prices paid and received by farmers, of farm real estate values, volume of production and farm output. They also include parity prices and livestock-feed price ratios. These measuring-sticks, computed on the same basis for a period of time, show in brief form the gist of the meaning in many different groups of statistical series.

For instance, the index of prices paid by farmers shows in one figure the present level of prices compared with a base period for 186 different commodities bought by farmers, plus interest and taxes. The index of prices received by farmers shows in one figure the present level of prices received for 165 commodities produced and sold by farmers also compared

with a base period. When the index of prices received is divided by the index of prices paid, the resulting single figure, known as the parity ratio, shows how much farmers' products are worth in terms of purchasing power.

The types of statistics which are computed from the different primary groups described above are summarized in the following list. For some of these groups listed below, the primary statistics are combined with data from fact-finding agencies outside the Bureau to compute the series required.

- (1) Supply and disposition of agricultural products.
- (2) Cash receipts and gross farm income, farm production expenses, and net farm income.
- (3) Financial condition of agriculture.
- (4) Retail value, farm value, and marketing margins of food products produced by farmers.
- (5) Total and per capita consumption of food products produced by farmers.
- (6) Feed supplies per animal unit.
- (7) Consumption of feedstuffs by various classes of livestock.

Statistics About Farm Business and Farm People.

Although the above-listed statistical series covers a wide range of agricultural information there is demand from many sources for more statistics about farm business and farm people and for greater accuracy in the existing statistical series in this field. Steps are already being taken, insofar as resources permit, to collect more factual information by interview sampling and otherwise to serve as a basis for establishing new statistical series and for strengthening the Bureau's present series for wider use. The list which follows shows the subjects on which information, now inadequate or completely lacking, is most needed.

- (1) Farm labor and farm wages
- (2) Farm population and migration to and from farms.
- (3) Accidents on farms
- (4) Sickness of farm people and medical and hospital facilities.
- (5) Farm home facilities
- (6) Farm family living expenditures.
- (7) Farm production expenses
- (8) Income from the sale of farm products.
- (9) Family income from sources other than farming.
- (10) Inventories of farm equipment, livestock, and crop stocks.
- (11) Net farm income
- (12) Farm indebtedness, credit, and interest rates.
- (13) Land utilization.
- (14) Land ownership and tenure
- (15) Land values and rents.
- (16) Values of farm buildings, new construction, and repairs.
- (17) Changes in farm management practices
- (18) Methods and costs of marketing
- (19) Farmers' marketing intentions
- (20) Consumer preferences

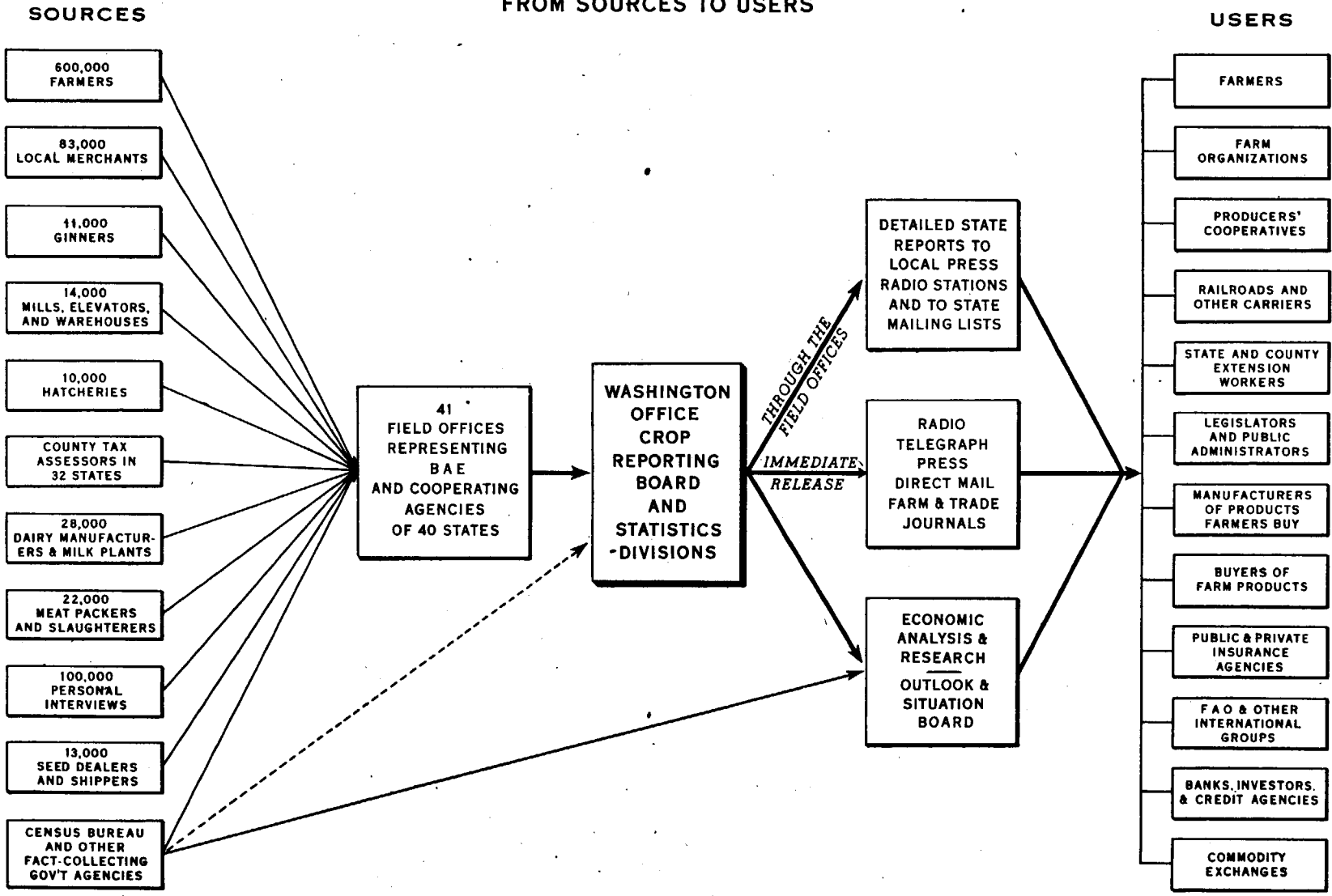
The Bureau's statistical series showing changes in the farm business are not as complete as its statistics about farm products. As much of the basic information is obtained only once in 5 or 10 years by the Bureau of the Census, many of these series are more valuable as historical data than for current use. Furthermore, the Bureau of Agricultural Economics has had to depend very heavily upon data from other Federal, State, or private agencies. Much of this information, although adequate for special purposes for which it is collected, is difficult to use in the Bureau's official statistical series, especially those computed from primary series, which must be dependable and up-to-date, and must be maintained in a form which can be used for many purposes.

The Bureau's limited staff of professional economists working in the field on cooperative research projects with Land-Grant Colleges has collected a great deal of farm business data, but the information has been collected from farms representing a specific area and for the purpose of analyzing the special farming problems of that area. It is therefore difficult to combine this information into estimates for larger areas. The Bureau's research staff is now undertaking to develop farm management data that will show annual changes in systems of farming, in income, expenses, and net income by types and sizes of farms for the more important farming areas. For this kind of statistical series, sample surveys are needed to provide data from representative farms on a comparable basis by areas, types of farms, and periods of time.

Thus, much of this information which is already collected and published does not fully meet present needs, especially those of people doing economic research on agriculture. A great deal of work needs to be done to collect and compile this type of information in time to be of the greatest use in recognizing and dealing with the far-reaching changes now taking place in American farming. In addition to timeliness, the information must meet other standards. It must be organized into statistical series so that figures from one year to another are comparable, and can be accurately interpreted. Furthermore, it must represent American agriculture as a whole, and its important subdivisions by areas or types of farming.

Most of this information which cannot be collected by mail must be collected by personal interviews. Because of the time, cost, and other difficulties involved in complete enumerations of all farms, the technique of interview sample surveys, promises the best answer to the exacting requirements of collecting this information and preparing statistical series for publication.

AGRICULTURAL ESTIMATES OF THE BUREAU OF AGRICULTURAL ECONOMICS FROM SOURCES TO USERS



APPENDIX C

This chart shows how information flows through the Bureau's statistical organization from the sources to the people who use it. The government's official agricultural estimates are based on reports from a cross-section of farmers and people who do business with farmers. They are checked against the complete enumerations made every five years by the Bureau of the Census, and against the reports of buyers, processors and

carriers of farm products, whose operations are a measure of farm production. Besides their immediate usefulness to farmers and the general public, these estimates provide basic data required for analysis of farm income, prices, costs, parity price determinations, and prospective demand and prices for farm products.