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whereas statistics of less than attainable accuracy create economic friction. They act as sand thrown into the complicated gears of our system of distribution. They may even adversely affect employment of labor in the processing industries, as was the case with the estimates of the 1951 cotton crop.

Deviations (usually spoken of as errors) between preliminary estimates or forecasts of crop production and the final estimates may be divided into three major groups:

(1) Deviations due to the methods of sampling and estimating used by the Department.

(2) Deviations caused by actual changes in crop production, or acreage prospects, between the date to which the forecast relates and the time when the crop is harvested.

(3) Deviations resulting from policy decisions, such as the nonuse of weather and other information concerning current crop prospects between the time when the crop correspondents mail their questionnaires and the day when the crop report is issued. In the case of cotton reports, this policy decision is specified by Congressional action.

The purpose of our discussions is to consider, primarily, the first of these causes of deviations and to make suggestions as to methods of sampling and estimating that could be expected to result in an increase of the accuracy of national forecasts and estimates of the major

crops and kinds of livestock. The recommendations of the House Committee Report¹ were not limited to the cotton crop reports.

In view of my long, but somewhat intermittent, association with the Crop and Livestock Estimating Service since the early 1920's—first, as the Federal-State Statistician in Iowa and later as a member of the Crop Reporting Board—and because of my active participation in methodological research involving probability sampling and weather-crop relationship studies extending over several years, I was especially interested in the House Committee Report. I feel that this report, which Mr. Heimburger summarizes, is an excellent and nontechnical presentation of crop-reporting problems. Most of the Committee's recommendations appear to be basically sound and practical. Some need amplification and a few would probably contribute little or nothing to increasing accuracy; they might even be harmful. These are points that are touched upon in our discussion.

¹ UNITED STATES CONGRESS. HOUSE, COMMITTEE ON AGRICULTURE. CROP ESTIMATING AND REPORTING SERVICES OF THE DEPARTMENT OF AGRICULTURE. REPORT AND RECOMMENDATIONS OF A SPECIAL SUBCOMMITTEE. U. S. 82d Cong., 2d Sess. Committee Print. 75 pp. Washington, U. S. Govt. Print. Off. 1952.

Discussion of Subcommittee's Recommendations

Summary of Remarks by John J. Heimburger

THE HOUSE AGRICULTURE COMMITTEE approached the subject of the crop reporting service from a nontechnical viewpoint, in the hope that its findings would have the double effect of arousing general public interest in the improvement of the crop reporting procedures, and of focusing on those procedures the attention of technical experts who are competent to make affirmative suggestions for improvement. Mr. Heimburger said that the action of the American Statistical Association in taking up the report was therefore directly in line with the objective the committee had in mind. He expressed his own hope

that the association might appoint a permanent committee on the subject or take some similar continuing interest in the improvement of agricultural statistics.

The committee's study dealt in detail only with the crop estimating and reporting procedures in regard to cotton, and specifically with estimates and reports of the 1951 crop. But it was the understanding of the committee that the procedures relating to cotton are enough like those for other crops so that its comments and recommendations would apply generally to the crop reporting and estimating program.

One of the most disturbing things to the committee in the course of its study was the fact that, in spite of gradual improvement of cotton crop reports over a long period, an error as large as that which occurred in 1951 is still possible, and apparently can be neither anticipated nor prevented under the present estimating methods. The subcommittee specifically commended the officials of the Bureau of Agricultural Economics for their cooperation in the study, but it described as "most discouraging" the attitude that errors such as that of 1951 are inherent in any human undertaking and, although regrettable, are unavoidable and likely to occur in crop reports at any time in the future.

The committee considered at length the sources of information on which crop estimates are based and concluded that they could be both improved and extended. It recommended improvement of the voluntary crop-reporter lists and the utilization of other sources of basic information. It proposed that the field of objective measurements be carefully re-examined and their use reintroduced into the estimating procedure.

The committee was critical of the schedules on which crop reporters are asked to transmit their information. It pointed out that several of the questions called for an estimate or an exercise of judgment on the part of the reporter rather than the mere reporting of facts within his knowledge, and that some of the questions and definitions on the schedules appear to be unnecessarily complex and difficult to understand.

Special Research Unit Within BAE Recommended

The most important single recommendation made by the subcommittee, in its opinion, was for the establishment of a special unit within the Bureau of Agricultural Economics specifically to carry on research, analysis, and experimentation designed to discover the shortcomings of our present estimating procedure, to develop and try out new procedures, and to recommend improvements.

At this point, Mr. Heimburger suggested there had been some misinterpretation of the statement of the committee referring to "mod-

ern methods of statistical sampling" in its recommendation relating to regression charts. It was not the intention of the committee, he said, to discourage the use of improved sampling methods in the collection of data. On the contrary, it was assumed that one of the major fields to which the proposed research unit would turn its attention would be the determining of the extent that improved sampling methods could be used in agricultural estimating.

The committee devoted a great deal of study to the apparent failure of the 1951 cotton crop report to reflect the effect of adverse weather on the crop until several weeks after the damage had been done. From study of available records of weather the committee came to the conclusion that the dry hot weather, admittedly an influential factor in reducing the size of the 1951 crop, occurred chiefly during July and August and ended early in September. After the middle of September, the weather was generally more favorable than normal for the development and harvesting of the crop.

In spite of the fact that most of the bad weather occurred before issuance of the September cotton report, the production estimate made at that time was even higher than the estimate made on August 1. Although the period of unfavorable weather ended 3 weeks before the issuance of the October report, it was not until a full month later—when the November report was issued—that the effect of unfavorable weather conditions on the crop became apparent in the production estimates.

The committee was disturbed by this apparent lag in reflecting in crop estimates the effects of unfavorable weather. It recommended that the whole operation of crop estimating, from the selection of sources of information to the final making of national production estimates, be reviewed in an effort to discover the reason for this time lag, and to find methods by which weather influences can be reflected more quickly and accurately.

The committee was also disturbed by the fact that nowhere in the crop estimating and reporting procedure is any attempt made to adjust the estimates statistically by applying to the reported data a factor that will make allowances for the probable future effect of past or present weather conditions.

Estimating the United States Cotton Crop

By J. Roger Wallace

THE SPECIAL SUBCOMMITTEE of the House Committee on Agriculture is to be complimented upon its excellent report "Crop Estimating and Reporting Services of the Department of Agriculture" that has been so well summarized by John C. Heimbürger, Counsel for the House Agricultural Committee. This report, as stated in the foreword, was based on nontechnical evaluation of the methods and procedures of the Crop Reporting Board. In this paper, I will attempt to make a somewhat technical evaluation of the recommendations made in the report, and I would like to suggest a few in addition. From my experience and study, I would say that several of these recommendations are really basic, others are essential, and a few have little or no value.

As I see it, there is room for considerable improvement in making estimates of the cotton crop with the tools that the Board already has at its disposal. If, in addition, the more basic recommendations of the committee, along with several other suggestions that will be made, could be effectively implemented in terms both of funds and of administration, the accuracy of the United States estimates for cotton and other major crops could—there is reason to believe—be materially increased within a few years. The additional annual cost should be no more than a tiny fraction of the estimated \$125-million loss that the errors in the 1951 crop estimates are claimed to have cost cotton farmers.

No other major crop, with the possible exception of tobacco, has figures for checking purposes that are as accurate as the final ginnings of cotton. More time and effort is put into making estimates of cotton than in the estimates of any other single crop. The methods of sampling and estimating used in making the August and September estimates are essentially the same as those used for other major crops. Furthermore, the figures of ginnings reported currently during the fall have contributed materially to increasing the accuracy of the October-December estimates of cotton production.

The major consideration at present is the improvement of the August and September cot-

ton estimates. With this accomplished, the later estimates would tend to improve almost automatically, since they appear to be influenced by the earlier estimates. At this point, we should consider a highly significant fact concerning the September cotton crop estimates.

The Special Subcommittee report notes (page 8) that the over-all trend of average deviations, disregarding signs, between the August United States estimate and the final ginnings figures from 1915 to 1949, is improving. Comparing the average of these deviations for the first 10-year period (1915-24) and the 10-year period ending in 1950 (table II), it will be observed that they declined nearly 40 percent for the August estimates and about 50 percent for the October and December estimates, but less than 30 percent for the September estimates.

This relatively poor showing of the September cotton crop estimates is surprising when we consider that the crop has been largely made by September 1, and that a small but important part of the crop usually has been ginned by that date. It is interesting that both the 1951 and 1952 September estimates deviated more than the August estimates from the final estimate, considering the December estimate as final for 1952. This leads to the question of the extent of improvement in the production estimates of other important crops. Perhaps Dr. Baker will give us some indication of this.

While on this subject of deviations, it is important to note that the deviations by States, in the August and September cotton estimates, are much greater—in fact, shockingly greater—than the deviations in the August and September United States cotton estimates. These are discussed in detail later.

New Research Unit a Basic Need

Unquestionably, the most basic recommendation of the Committee was that for the establishment within the Bureau of Agricultural Economics of "a unit devoted entirely to research, analysis, and experimentation directed at discovering the shortcomings in the Bureau's present methods and developing improvements

therein." Such a unit is essential in an organization that is primarily for service, such as the Agricultural Estimates Branch of the Bureau of Agricultural Economics. Research should not be confined, of course, to cotton-crop estimating alone. The Bureau has recognized the importance of this recommendation and is requesting additional funds for carrying it out.

Such a research unit could implement several of the recommendations of the Committee, especially those referring to an objective evaluation of the influence of weather on the growth and yield per acre of cotton and of other major crops, and the use of objective measurements of crop development and production such as those obtained from cottonboll counts and field measurements of corn, other grains, soybeans, and so on.

The value of the regression-chart system would be materially enhanced by using weather factors as additional independent variables. It is particularly important to ascertain, if possible, the degree of truth in the contention that weather developments prior to the report reference date are not fully reflected in the reporters' estimates of condition.

A research unit could demonstrate the practical application of scientific methods of sampling in obtaining basic information from farmers on the acreages and production of cotton and other crops, livestock numbers, and stocks of grain.

Vast research already has been conducted in these directions both in the United States and in several foreign countries. The results have been summarized in *Methods of Crop Estimating*, an unpublished work by Fred H. Sanderson, now in the State Department. Considerable research of this type was conducted under the direction of Charles F. Sarle and others who were with the Bureau of Agricultural Economics.

Earlier Research Used by Government Agencies

Following are a few examples of the results of this earlier research that are now being used by other agencies of the United States Government and of several foreign governments.

Area probability sampling was developed at Iowa State College by the Bureau of Agricul-

tural Economics and by the Bureau of the Census under the direction of Arnold J. King. This scientific method of sampling farms and households is now in general use by the Bureau of the Census, several State colleges and universities, and a few marketing research agencies. Although used by several foreign countries in crop estimating, it is not so used by the Bureau of Agricultural Economics, one of the agencies that developed the method.

Long-range weather forecasting research was conducted at the Massachusetts Institute of Technology under the direction of Professor Carl Rossby. The purpose was to develop valid methods of long-range weather forecasting to improve the accuracy of crop-production estimates. This project was transferred to the Weather Bureau in 1941 when that Bureau began to issue 5-day weather forecasts.

Research on the effect of weather on the yield per acre of cotton, corn, and winter and spring wheat, was conducted in cooperation with a number of State Agricultural Experiment Stations in 1938-40. This research involved specially designed field-crop experiments and crop and weather measurements.

Statistical studies of the relationship of weather to crop yields were conducted, some of which showed promise. Now that 5-day weather forecasts are issued twice a week by the Weather Bureau, it should be possible to use them to improve the findings based on condition and other factors between the report reference date and the issuance date.

The House Committee also made the important recommendation that the Bureau of Agricultural Economics collaborate with the Bureau of the Census in the taking of an annual census of agriculture. An annual sample census taken in the fall, using area probability sampling, should be more valuable to the economy of the United States than the quinquennial agricultural census, and, over a 10-year period, need not cost much more. This would furnish a valid basis for the harvested acreages of cotton and the harvested acreages and production of other major crops.

The Committee thought that a crop-estimating and reporting system based entirely on modern methods of statistical sampling would be much more costly than the methods now

used, and doubted that the improvement in accuracy would justify the cost. There is no doubt about this; nevertheless consideration should be given to using scientific sampling methods where they are most needed and when cost would not be greatly increased, in order to place a sound foundation under the crop-reporting system.

From the standpoint of the cotton farmer and the entire cotton trade, the primary objective should be to provide more accurate crop estimates at the national level. They are what determine prices. At present, the primary objective seems to be to provide serviceably reliable estimates at the State level in the hope that the national estimate will be reliable. Analysis of reliability of State estimates, to be discussed later, indicates that good luck rather than good management has prevented most of the early-season cotton-crop estimates from being as far out of line as the 1951 estimates.

Size and Cost of Needed Sample

With the primary objective firmly established to provide more accurate crop estimates at the national level, no large area probability sampling of farms would be required. From data already collected, the size of the sample needed and the probable cost can be fairly well determined.

1. An annual census of agriculture, taken in the fall, to replace the quinquennial censuses, would not be excessive in cost. It would provide a high level of accuracy at the national level and probably would improve the State estimates. With the national crop estimates on a sound scientific basis, smaller mailed samples than those now employed could be used to pro-rate the national estimate among the States, bringing considerable monetary saving. Cotton does not fit directly into this picture since we have a reliable measure of final ginnings, but the problem of estimating the cotton crop cannot be considered without taking other agricultural enterprises into account.

2. Obtaining more accurate early-season estimates of acreages remaining for harvest is the next problem. This problem played a large part in wrecking the 1951 cotton-crop estimates. A national area probability farm survey taken about July 1 would help. Improvements in the present system of mailed sampling may be possible, to improve the July acreage estimates. Then, the acreage for harvest could be estimated on September 1 to provide a sound basis for truing up the estimates of the earlier crops.

It has been estimated that a national area probability sample of somewhere around 10,000 farms would be

sufficient to provide national estimates of acreage and that the cost would be less than \$150,000. If, owing to peak-load activities, the Bureau of Agricultural Economics is unable to conduct a July sample farm survey, it could be contracted out to one of the private agencies that are competent to handle this problem.

In the years that lie ahead, it appears virtually certain that contraction of export markets for cotton and others of our farm products will necessitate cut-backs in acreage in several of the major crops. Experience shows that the mailed-survey method of estimating acreage falls down whenever the Production and Marketing Administration is endeavoring to effectuate national acreage "goals." Under present-day conditions, the only alternative to a national area probability sample survey of acreage is actual measurement of a small sample. This would be very expensive and probably would yield no better results.

3. The basic problem of increasing the accuracy of estimates of yield per acre can be met by methods developed through research, making more effective use of reported crop condition, and utilizing weather data and objective measurements obtained from area probability sampling.

There is little doubt that the accuracy of the cotton-crop estimates can be improved considerably as a result of research and the application of more scientific methods, coupled to some extent with improvement of the present system.

More detailed observations on the accuracy of the cotton crop reports in recent years will now be considered, together with suggestions for improvement within the present system.

There is a tendency, on the part of both the Board and the public generally, to evaluate cotton crop estimates solely from the standpoint of their accuracy with respect to actual productions on a total basis. The August crop estimate, of say 15,000,000 bales, is compared with the actual outturn of 15,200,000 bales, and is adjudged to have been a very good estimate.

This we may call an over-all evaluation. There is nothing like it to induce complacency on the part of those who make estimates and those who use them.

Evaluating Crop Estimates by States

The real test of crop estimates under the present system is by States. Admittedly, there is a certain amount of give and take in the making of any estimate. All of us have a tendency to lean a little backward here if we think we may have leaned a little too far forward there. Try as we may, the human equation cannot be eliminated entirely.

In evaluating the accuracy of cotton-crop estimates by States, it can be contended that unfavorable weather developments in some States, after the making of the estimate, were largely offset by favorable developments in other States. Undoubtedly, that happens sometimes but it cannot happen most of the time.

Evaluation of the cotton-crop estimates by States for August and September for 1950, 1951, and 1952, reveals some rather shocking deviations from the final outturn. For 1952, the December estimate was used for the final outturn, which will not be available until May 1953.

The August 1950 estimate of 10,308,000 bales deviated only 3.0 percent from the actual outturn but the average deviation for the State estimates was 11.4 percent. In calculating the deviations, signs have been omitted. Virginia, Florida, and "Other States" were omitted from the calculation of the average deviations since they are relatively unimportant from the standpoint of cotton production. Also, the Virginia deviation was 150 percent and would have exerted undue influence on the averages. The deviation for the total September 1950 estimate was 1.3 percent; the average of the State deviations was 10.5 percent. The August range was from 0.9 percent to 27.1 percent; the September range was 0.9 to 18.1 percent.

The same test applied to the August 1951 estimate showed a total deviation of 15.9 percent and an average deviation by States of 12.8 percent. The range was 0.8 to 47.2 percent. For September 1951, the total deviation was 14.2 percent, the average of State deviations 13.0 percent, and the range 0.4 to 35.3 percent. Evaluated from a State standpoint, the August and September 1951 estimates were not much worse than the 1950 estimates. The trouble was that practically all of the deviations carried plus signs.

The August 1952 estimate of 14,735,000 bales, showing a deviation of only 2.0 percent from the December estimate which we are considering here as the final outturn, actually was the worst of the lot. The average of the State deviation was 15.2 percent and the range from 3.0 to 61.5 percent. The September estimate, with a total deviation of 7.6 percent, showed an average deviation by States of 10.3 percent with a range from 4.1 to 17.6 percent.

It is rather surprising to discover that the August 1952 estimate, evaluated from a State standpoint, was worse than the August 1951 estimate. There is no room for complacency in this evaluation. Criticism may be in order for using a straight average for the State deviations without regard to the relative importance of each State from the standpoint of cotton production. Nevertheless, this evaluation points up the essential weaknesses of present cotton-crop reporting methods.

So far as known, no attempts have been made to ascertain to what extent the deviations in the respective August and September State estimates were due to unforeseeable weather factors. As weather conditions during August are influential in determining yields, it could be argued that most of the deviations in the August estimates were due to unforeseeable weather factors. By September 1, however, most of the crop is made and it takes unusual weather after that date to change the crop prospect very much. As the deviations by States tend to be in the same direction for August and September, that weakens the weather argument for the August deviations.

As long as these wide deviations in the State estimates are tolerated, there will be the possibility, indeed the probability, that occasionally the majority of the deviations will be in the same direction, with a resultant substantial overestimate or underestimate of the United States crop. To assume that the errors in one direction will about offset the errors in the opposite direction is tantamount to trusting in blind luck. Yet that seems to be the basis on which the Crop Reporting Board is working.

Since the October estimates are based partly and the November and December estimates almost entirely on ginnings to date and the estimated percentage of the crop ginned as determined from reports of ginners, we have been inclined to think of the necessity of effecting a relatively smooth transition from the August and September estimates—based largely on reported condition and reported boll-weevil infestation—to the later estimates. However, analysis of ginners' estimates of the percentage of the crop ginned indicates that ginners, in making their October and November indications of percentage ginned, are influenced to some extent by the official estimates of the

United States Department of Agriculture that have gone before. (If the Board has underestimated the crop in their States, ginners tend to overestimate the percentage ginned, and vice versa.) Improvement in the early-season crop estimates should result in improving the later-season estimates, by reducing the errors in ginners' estimates of percentage ginned.

In making the August, September, and, to a lesser extent, the October crop estimates, the Board relies upon mailed questionnaires. These are tabulated in the State offices, and the State averages for condition, boll-weevil infestation, bolls safe, date of first open boll, and so on, are forwarded to the Bureau of Agricultural Economics to be used in estimating cotton production by States for all the cotton-growing States. The State statisticians also make their own estimates of State production, which are forwarded to the Bureau of Agricultural Economics where they are given consideration. In a few States, the statisticians go so far as to estimate the production by crop-reporting districts.

Recommendations for Improvement of Estimates

The House Committee made a number of recommendations which it believed would help to improve the cotton crop estimates. The Committee seemed more concerned with the definition of normal condition and the expression of condition in mathematical terms than are the crop reporters, who do not seem to have difficulty in regard to the concept of condition. It must be remembered that even slight changes in time-honored questions would tend to weaken the significance of the replies until experience had been accumulated over a period of years. There appears to be room for improvement in the lists of crop reporters, although it is a moot question whether cotton farmers are the best cotton-crop reporters available.

It is unfortunate that the House Committee did not call upon the American Statistical Association for more expert assistance in evaluating the methods employed by the Crop Reporting Board in estimating the cotton crop. While on this subject, it might be noted that the Board is one of the few government organi-

zations issuing statistical data to the public that has no committee of the American Statistical Association to review its methods and to make suggestions for improvement.

The methods used by the Board to estimate the cotton crops by States as of August 1 and September 1 are, I feel, open to considerable criticism. Some years ago, the Board abandoned the method in use for several years of estimating the yield per acre—through condition, weevil infestation, and other factors—and multiplying it by the indicated area left for harvest, to determine the probable production.

So-called production indices now are computed and plotted against historical production as determined by the census returns on ginnings. One of the reasons given is that it was believed that yield per acre is related to a certain extent to the size of the acreage planted. "Par yields" are computed by dividing historical yields by the November condition. Par yields for the last 10 years are assigned given weights to arrive at a weighted current par yield. The current par yield multiplied by the current condition, multiplied by the indicated area for harvest, divided by 480 (which is the net bale weight) gives the production index. A second independent variable used in this analysis is an index of weevil infestation, computed by multiplying reported weevil infestation by the indicated area left for harvest.

The Board feels that this method has given good results, for some States at least, but, in view of the record, I am not too sure of this.

The November condition figures which are influential in determining par yields, have never been published. The August, September, and October condition figures, however, are published. Personally I do not know what value there is to a November 1 condition figure. By November 1, most of the crop has been harvested and ginned in many States. The quantity left to be harvested varies from year to year, depending upon the earliness or lateness of the crop. This is the cotton most correspondents refer to when they report on November 1 condition. If the crop is entirely harvested by that time, as is often true in the lower part of the Cotton Belt, most correspondents do not report condition. Or they put down a figure just to be agreeable.

Even the October 1 condition does not mean much, if anything, in the earlier areas, as many of our correspondents have taken the pains to tell us.

So, the Board starts off with a par yield derived from an all but meaningless November condition and historical yield. The par yield then is multiplied by the current condition. Here the Board is assuming that there is a straight-line relationship between current condition and current yield. But that is not necessarily true. Many reporters are reluctant to report condition over 100; often they are equally reluctant to report very low condition. Hence, there is a tendency for the relationship between current condition and current yield to be curvilinear, at least for the extremes of condition. The relationship between acreage and yield is nebulous. There may be some relationship between acreage changes and yield, since farmers often are said to take out their poorer lands when they decrease acreage.

Confusion Over Acreage and Yield Indicated

There is evidence, however, that the Board is confused over this matter of acreage and yield. In the old Cotton Belt, acreages now are smaller than they were 20 years ago. In some States, there has been a secular trend in yields for a number of years, largely associated with better methods of farming, and the trend has continued upward even in years when acreage has been increased. The two factors of acreage decrease and yield increase do not appear to be directly related.

Undoubtedly, a seemingly close correlation can be derived between production and the so-called production indices, after adjustment for weevil infestation, in some of the eastern States. For Georgia, for example, almost any kind of a study you want to throw together on factors affecting yields gives good results. But similar studies for other States, particularly the Western States, are worthless.

The evidence, it would seem, is against continuing the use of the production-indices method and for reverting to direct estimating of yield per acre. The deviations in yield that are not explainable by condition, weevil infestation, and other known factors, need to be studied. Some of them undoubtedly are due to

weather after August 1 or September 1, as the case may be. The use of even a short-term weather forecast as a supplement to the findings from reports of correspondents should tend to cut down the errors in the August and September cotton-crop forecasts.

Even with a good acreage figure, however, the Board will continue to have trouble in making early-season crop forecasts unless it changes its approach to the problem. For instance, the condition figure—as reported by crop correspondents—bears much less relationship to the yield per acre in some States than it does in others. As a general rule, the significance of the condition figure declines the farther west you go. It is not at all clear why this should be true. But there are some indications that the condition is both a qualitative and a quantitative measure, with the degree varying between the several States. The very fact that we have to modify the findings based on condition with a measure of weevil infestation or probable weevil damage indicates that the reported condition refers, to a considerable extent at least, to the appearance of the plant, with only limited reference to the yield potentialities.

In recognition of this problem, *The Journal of Commerce* several years ago introduced in its crop schedules a quantitative question on probable production, using the ratio approach. Applied to historical production on a crop-district basis, the ratio furnishes on a State-wide basis a measure of what crop reporters expect production to be. Although they may not have a good idea of what their county is likely to produce, most merchants, warehousemen, and ginners do have a good idea of what the area they service is likely to produce, especially on a ratio to historical production basis. We now have several years of such records. The data show promise of becoming increasingly valuable, particularly in the western cotton-growing States. In each of the last 3 years, for example, the September estimates for Texas and Oklahoma, as thus computed, have been considerably closer to the actual crops than have the September estimates of the Crop Reporting Board.

The great advantage of a direct quantitative approach to the problem of estimating cotton production is that it cuts directly across acreage and yield per acre, eliminating the ever-present

possibility that errors in the same direction in both estimates of acreage and yield will be multiplied into a wide over- or under-estimate of the crop. As yet, this method does not give equally good results in all States, but we will know more about it when we have data for a few more years.

As the Cotton Belt is not a homogeneous area, there is no reason why we should not use different approaches to the problem in different States. In the western part of the Belt, where the normal moisture is less than the optimum, an increase in weevil infestation—resulting from more than normal precipitation—can mean something quite different, from the standpoint of yield or production, than would a similar increase in weevil infestation in the eastern part of the Belt, where the normal precipitation is more than optimum. To no inconsiderable degree, we are dealing with separate universes that must be treated separately while endeavoring to find the best method of estimating the crop for each State.

It is gratifying that the Crop Reporting Board this season conducted a split test in two States, one in the East and the other in the West, using a quantitative question at the individual farm or plantation level which could be applied on a ratio basis to a State-wide estimate of the crop. There is reason to believe that the

studies originated at *The Journal of Commerce* several years ago prompted this test. It is to be hoped that they will be continued, and conducted on a broader scale than formerly.

There is some question, of course, as to whether a direct quantitative question necessitating responses on a baleage basis with reference to actual individual production last year and estimated individual production in the current year will yield as good results as those where the reference is on a ratio basis. It has been our experience that reporters sometimes furnish two answers to our quantitative ratio question, one giving the estimated ratio for the reporter's own farm and the other for his vicinity or county. Invariably, the individual farm ratio is higher than the vicinity or county ratio. That could mean (1) that crop reporters are better than average farmers or (2) that farms of the crop reporters are not representative of their vicinities even after allowing for this differential.

Within the framework of the present mailed-survey system of cotton-crop estimating, considerable improvement obviously is possible through the application of continuing research. If this could be coupled with the use of more modern methods of sampling and estimating, the possibility of major errors in cotton-crop estimates would be substantially reduced.

Improving the Crop Reports

By Lauren Soth

THE JOB assigned to me is to tell how the crop reports could be improved from the viewpoint of the consumer or user of agricultural statistics. I can certainly qualify as a consumer, or at least as a retailer of crop reports. Our newspapers gobble up all the information the United States Department of Agriculture issues on crop conditions, storage stocks, and so on. We value it highly as news. The figures released not only have an important bearing on markets and consequently are the raw material

going into decisions of farmers and other businessmen, they also are the basis for various "automatic" formulas in farm legislation—determining the level of price support, whether crop acreage controls go into effect, and so on.

Now, just as a general comment, before going any farther, I should say that our fact-gathering in agriculture in the last several years has not kept up with our requirements. We have gone farther in the use of the figures than the figures themselves justify. Take the