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Corn Yield Validation Studies, 1953-83

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ABSTRACT

This document presents a summary of corn yield validation studies by the Statistical Reporting Service (SRS) from 1954 through 1983. A majority of the 11 studies conducted to examine relationships between objective survey estimates and actual yield of corn showed an unexplained difference of between 2.0 to 4.8 percent. However differences between the objective survey estimates and SRS's final estimated yields for a region of 10 major states generally have been between 6 and 12 percent. The principal recommendation is that SRS adopt the objective survey final average yield for the 10-state region, adjusted for non-sampling errors, as its final estimated yield of corn for grain for that region.

CONTENTS

CONTENTS

SUMMARY AND RECOMMENDATIONS

This document was prepared to bring together summaries of all the corn yield validation studies conducted by SRS from 1954 through 1983. These summaries include such items as the scope and extent of the study, the techniques used in determining the "true yields," problems encountered in the execution of the stuidies, and the findings of the studies.

The primary consideration of 11 of these studies was to evaluate the relationship between the objective yield estimate of net yield and the "true[1/]" harvested yield. An overview of these studies (table 1) shows that the non-sampling error in the objective yield survey estimates (defined as the mean difference between the objective survey estimate of net yield and the "true" yield) has varied from -3.2 percent (1968, Maryland) to 8.2 percent (1969, Missouri) of the true yield. The majority of the studies resulted in a nonsampling error of from +2.0 to +4.8 percent. However, the mean objective estimate of yield for the 10 States[2/] currently in the SRS corn objective yield program has varied between 6 and 12 percent above the corresponding SRS final estimates. (For individual States, of course, some relative differences are much greater.) There has also been a very strong tendency, with two notable exceptions, for the estimated acreage harvested to be above the survey acreage indication.

SRS may wish to consider the following recommendations:

1. The objective survey final estimate of production for the 10-State region, divided by the objective survey final estimate of acreage harvested and adjusted for probable non-sampling error, would be the principal SRS indication of corn yield for grain in the 10-State region. The "probable non-sampling error" should be determined by an annual "non-sampling error" survey which would measure the mean differences between the objective survey final net yield and the yield resulting from weighed production of all grain harvested and measured acreage of those fields.

2. The objective survey final estimate of acres harvested would be the principal SRS indication of acreage harvested for the 10-State region.

3. Until it is established that there is no loss of grain weight from biological maturity until harvest, the final objective survey estimate of net yield would be based upon observations taken within 7 days of the time the grower actually harvested the field.

4. That the other yield indications currently used by SRS be thoroughly evaluated and justified before additional resources are devoted to another round of "corn yield validation studies."

1/ The "true harvested yield" generally has been obtained by weighing the farmer harvested production from either all or portions of the fields and measuring the corresponding acreage in some manner. Until 1982, this acreage was measured with a surveyor's chain. In 1982 and 1983, acreage measurements were digitized from late summer low level photography in the county Agricultural Stabilization Conservation Service offices. Weighing usually has been at country elevators, although portable Load-o-meter scales were used to weigh production at or near the field in the 1965 and 1967 studies and portable platform scales were use to weigh the relatively small amounts of grain from the 1979 study.

2/ Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota and Wisconsin.

Table 1. SRS corn validation studies

Year	State(s)	Weighed No. of Fields	Yield Bu.	Objective Yield No. Units	Yield (Bu.)	S.E. (Bu.)	Measured Bias Percent	S.E. (%)	Harvest Loss (Bu.)
1956	IA	7	44.44	1/695	45.52	.73	2.4	1.6	NA
1957	IA	9	98.08	1/552	101.96	2.49	3.8	2.4	9.06
1960	IN, IL IA, MO	61	87.94	2196	90.37	.62	2.7	.7	8.66
1965	IN,IA,NE GA,KY	222	80.25	2296	84.30	.58	4.8	.7	9.10
1966	IA, NC	10	86.56	720	89.25	1.16	3.0	1.3	7.25
1967	IA	86	88.80	344	96.60	NA	8.1	1.7	5.70
1968	MD	2	63.79	160	61.84	1.95	-3.2	3.2	7.23
1969	IA	153	88.30	306	92.60	NA	4.6	2.3	8.50
	MO	148	89.00	296	2/96.90	NA	8.2	1.7	8.90
		148	89.00	296	3/94.60	NA	5.7	1.8	8.90
		148	89.00	148	4/90.80	NA	2.0	1.6	8.90
1971	IA	38	NA	880	NA	NA	2.2	1.1	NA
	IL	39	NA	920	NA	NA	.6	.9	NA
1982	IA, MO	48	114.90	768	119.70	4.60	4.2	1.4	NA
1983	IL,IA,MO	5/ 43	70.90	668	73.10	1.26	3.1	1.8	NA
		87	6/77.00	1392	77.50	1.27	.7	1.8	NA

NA Not available or not complete

1/ Units 2 rows x 25 feet

2/ Special units located adjacent weighed area.

3/ Special units - alternate procedure (All ears pulled and shelled at field).

4/ Hand harvested row - ears pulled and shelled at field.

5/ One-half subsample where production was weighed.

6/ Farmer reported yields.

CORN YIELD VALIDATION STUDIES, 1953-83.

By Fred B. Warren

INTRODUCTION

The Statistical Reporting Service (SRS) of the U. S. Department of Agriculture (USDA) has sponsored or conducted a number of corn yield validation projects since 1954. Several earlier reports have summarized some major elements of earlier studies. However, there has been no attempt to unify what had been previously attempted, how it was done, what problems were encountered, and what results were identified. This document is directed to that need.

BACKGROUND

The acreage, yield, and production estimates published by the SRS Crop Reporting Board (CRB), and by the Bureau of Census refer to the acreage of the crop actually harvested and the production actually taken from the field.

A major source of information used by SRS for its grain estimates, and the only source of information available to the Census of Agriculture, is farmer-reported acreages, yields, and production. There has always been concern as to how well the farmers know how much production they had, or even as to how much land was harvested. This is particularly true for a crop such as corn where most of the crop is stored on farms. Since the farm-stored crop is either fed to livestock on the farm where grown or sold at a later (often much later) time, farmers' best estimates of production often must be based on such factors as the number of loads hauled from the field or the amount of storage space occupied.

To insure a uniform standard for yield measurement, SRS developed objective yield surveys. In order to monitor differences between measured and reported yield, the Agency has sponsored or conducted the corn yield validation studies described in this document.

1953-55 IOWA CORN PRODUCTION STUDY

The earliest recorded attempt by SRS to evaluate possible sources of bias in farmer-reported yields was in cooperation with Iowa State University. Results from this study (1953-55 in Iowa) revealed that farmers tended to underestimate their production when these estimates were compared with volume measurements of ear corn in farm storage space. Average underestimates were relatively large, 25 percent in 1953, 15 percent in 1954, and 23 percent in 1955. (Objective yield procedures were then in a very early stage of development and there were no attempts to measure possible biases in the objective yield procedures.)

1956-57 IOWA CORN VALIDATION

Iowa State University personnel interviewed farmers and made observations in objective yield plots in seven central Iowa cornfields in 1956 and in nine fields in 1957. The objective yield estimates from these fields were 2.4 percent higher than weighed yields (weighed production divided by measured acreage) in 1956 and 4 percent higher in 1957.

1960 CORN YIELD VALIDATION PROCEDURES

A corn-weighing project to determine the validity of field procedures used in the regular corn objective yield program was conducted by SRS in Indiana, Illinois, Iowa, and Missouri in the fall of 1960. Sixteen fields in each state were selected on the basis of location, size, potential yield, cooperation of the farmer, and availability of scales for weighing the farmer-harvested corn.

The fields ranged from 10 to 40 acres in size. Each field was divided into six equal parts with 6 sample plots located at random within each part. Final preharvest counts and measurements were made in these plots a few days before harvest. The number of ears in each 15-foot row was counted, the ears from one of the two rows was picked and weighed, and one ear was randomly selected for estimating moisture content and shelling percentage. Postharvest gleanings, as done on the regular objective yield survey, were made after the farmer harvested the field. Also, each field was measured with a surveyor's chain to determine its size.

The weighed production from fields harvested and weighed as ear corn was converted to equivalent shelled grain using a conversion factor of 0.8. However, the shelling fraction computed from the sample ears was 0.814. This tended to depress the weighed yields from those fields.

Analysis

The analysis was limited to statistical tests of the differences between the objective estimates of net yield and the derived yield computed from the weighed production and measured acreage. Although the average of the objective yield estimates in each of the four States was higher than the mean weighed yield, there was considerable variation in the State-to-State differences, ranging from an insignificant 0.42 bushels per acre in Iowa to a highly significant (at the .01 level) 5.68 bushels per acre in Indiana. For all States combined, the mean difference of 2.43 bushels per acre (2.7 percent) was significantly different from zero at the .05 level.

1964 VALIDATION STUDIES

The first of two different validation studies conducted in 1964 was a comparison of objective and reported yields from weighed and non-weighed fields. The second was a comparison of acreages and production from about 3,200 Iowa farms as reported to the 1964 Census of Agriculture and on the November 1964 USDA Acreage and Production (A&P) mailed survey.

Objective vs. Reported Yields

Objective and reported yields from weighed and nonweighed fields were compared to test the hypothesis that no differences existed between the two estimates when the production from the sample field had been weighed. The sample included 54 fields in 11 North Central States and 57 fields in 12 Southern States where farmers indicated that the production from the field had been weighed at an elevator.

In the North Central States, the average yield from the objective yield estimates was significantly higher, 8.1 bushels per acre or 11 percent, than the farmer-reported yield for the same fields. The Student's t for this difference was 3.86 so that the null hypothesis was rejected at the .01 level.

In the Southern States, the average yield from the objective yield estimates was 2 bushels per acre or 3.1 percent less than the farmer-reported yield. The Student's t of -0.65 for this difference was not significantly different from zero.

For 279 fields in the North Central States and 277 fields in the Southern States where production was not weighed, the farmer-reported yield averaged about 6 percent lower than did the corresponding objective yield estimates.

Mail Survey vs. Census

A special comparison study of about 3,200 farms in Iowa was made to compare reported acreages and production from 1964 Census of Agriculture and from the November 1964 USDA A&P survey. This study indicated that, in the aggregate, farmers reported almost the same information to the Census enumerators as they listed on the A&P mail questionnaires.

Another part of this study compared over 2,900 A&P mail survey reports with reports of the same items obtained by the Iowa State Farm Census. Again, the matched reports indicated that essentially the same information was obtained by both.

A similar comparison of 1964 yields reported to the Census Bureau with yields obtained by harvesting small plots in objective sample fields on about 150 Iowa farms showed that the Census yields were more than 20 percent below the corresponding objective yield levels.

1965 LEVEL OF CORN YIELD PROJECT

This study was carried out under the direction of SRS's Planning Committee to "resolve the problem of yield level for corn estimates." The necessity of this study was indicated by the wide differences existing between the objective yield estimates and the yields reported by farmers on the USDA mail surveys. These differences were on the order of 18 to 20 percent in the North Central States and from 10 to 12 percent in the Southern States. States included were Indiana, Iowa, Nebraska, Georgia and Kentucky.

Objectives

Objectives of the 1965 corn yield study were to:

(1) Determine the farmers' concepts of acreage and production as then reported on the November A&P mailed survey.

(2) Make a quality check on the field work of enumerators regularly assigned to perform the periodic objective measurements and counts.

(3) Obtain an aggregate validation of the objective yield procedures for several States.

(4) Establish a precise estimate of yield per acre for a group of States which would be independent of both the objective counts and the farmer-reported data.

(5) Isolate the causal factors associated with the differences in the objective and mailed surveys and make recommendations for appropriate corrective actions.

Procedures

The sample consisted of 500 area segments with corn for grain in the five-State area. The 500 segments consisted of 250 clusters of two segments each. The second segment in each cluster was located within 4 to 7 miles of the first.

Sample A, consisting of one segment from each cluster, was used primarily for the investigation of farmers' responses to questions on acreage and production. All resident farm operators in these segments were interviewed at about the same time as the regular mailed A&P survey. In addition to the standard questions on the mailed survey, the interview also included a series of probing questions to determine such items as the amount of grain removed before harvest, grain gleaned after harvest, grain used for landlords; payment on rented fields, and whether or not these quantities were included in the reported production. Other items included amounts moved from the farm, amounts already fed, and the quantities stored on the farm in each storage place. Still other questions were intended to help define the farmer's concepts of acreage and production.

Sample B, the second segment from each cluster, was used in the validation of the objective yield procedures and determination of actual yield levels. An initial screening located about 250 farms with corn for grain. These farms were then sampled for fields having corn for grain to be used for objective yield sampling and weighed production. A total of 250 fields were selected.

For most fields larger than 20 acres, a randomly selected portion of the field, usually between 12 and 25 acres, was selected for sampling and for weighing the harvested corn.

The (portions of) sample fields were measured with a surveyor's chain to determine the net acreage. In early October, four (eight in the two Southern States) objective yield samples were laid out in each field and preharvest observations, as in the regular survey, were taken by supervisory personnel (statisticians and supervisory enumerators). Where convenient, the farmer-harvest production was weighed at a commercial elevator. Otherwise, in about 65 percent of the fields, the production was weighed on portable Load-o-meter scales at or near the field.

At about the time the regular A&P survey was mailed, the sample B farmers were also interviewed via a questionnaire similar to that used for the sample A farms.

Analysis

Analysis of the survey results was carried out by a sub-committee of the SRS Planning Committee.

In addition to the yield estimates based on objective counts and measurements, four other computations of yield per acre were made from acreages and production for the sample farms. These were: (1) the farmer's estimate for the entire farm, (2) the estimate for the derived farm total based on individual field data, (3) the yield determined by weighing the corn actually taken from measured sample fields, and (4) the yield determined by measurement of stored grain and acreage.

For the sample B farms, the farmers' reported yields were compared with sample A reported yields to determine if a conditioning effect existed that could be attributed to the farmers being more conscious of the actual production as a result of the weighing and objective counts.

The weight information and the objective yield sample data were compared to determine if there was any appreciable bias in the regular objective yield procedures for locating the sample plots.

The quality of the regular enumerators' work was checked by comparing the various counts, weights, and yields for the 250 fields done by supervisory personnel with corresponding information from the regular objective yield survey (unpaired comparisons).

The composite information for acreage and yield from the various phases was pooled where possible to determine how much of the difference between the objective estimates of yield and the weighed yield could be attributed to biases either in the farmer's estimate, objective technique, or differences in the definitional concepts of acreage, bushels, or production.

Results

The major findings from the study were that:

(1) The adjustment for additional dry matter (to be added to the kernel for samples testing over 30-percent moisture) which had been in use since 1961 was unjustified for 1965.

(2) With no adjustment for additional dry matter, the objective yield estimates were on the same level as the A&P yield indications but were about 4 bushels (5 percent) higher than the weighed-yield indication. A probable source of error in the objective yield estimate was the random number table used for locating sample units. Also, all parts of a field were not given equal chances of being selected. The effect of boundary problems, particularly the probability of nonrandom locations of the starting points of each 15-foot row section, augmented by the relatively short (15-foot) unit row length, was identified as another probable source of error.

(3) The quality of work done by enumerators appeared to be on a par with that done by supervisory personnel.

(4) Farmer-reported acreages at or near harvest averaged 1 percent higher than the measured acreages.

(5) There was no significant difference between yields derived from interview reports from farmers in the A and B samples. Also, (1) yields derived from entire farm reports were not significantly different from yields derived from summations of individual field reports, (2) production reported on a basis of disposition tended to be less than production reported either for the entire farm or for individual fields, (3) measurement of corn in storage averaged about 1 percent less than that reported by farmers, (4) the probability A&P interviews produced a yield within one standard error of the regular mailed A&P survey for the five States (and for the three Northern States but not for the Southern States), and (5) there is a movement of moisture from cob to grain and vice versa when corn ear samples are shipped in airtight containers.

Recommendations

A general recommendation was that research and development in objective yield methodology should be continued and that active participation in research by subject matter specialists and operations people is desirable. There were also the following specific recommendations for 1966:

(1) No adjustment should be made for dry matter laid down after the preharvest observations.

(2) All preharvest observations should be limited to those classified as mature except for those samples not maturing by November 1.

(3) Maturity categories should be more clearly defined and enumerators should be provided with visual aids to help differentiate between maturity categories.

(4) Research should be undertaken on the problem of determining dry matter addition in the late stages of corn ear development.

(5) The redesigned table of random locations for sample units (developed by the subcommittee) should be adopted in all states.

(6) The second unit of the sample plots should be located independently of the first.

(7) The SRS Planning Committee should consider enlarging the sample unit from two 15-foot rows to two 25-foot rows.

(8) A validation of recommendations 5 through 7 should be done in a limited number of fields in 1966.

It was further recommended that the SRS Planning Committee should consider:

(1) Adopting a uniform definition for a bushel of corn for grain.

(2) Adopting a definition of production of corn for grain as being bushels of either ear or shelled corn actually hauled from the field.

(3) Adopting a definition of harvested acres as being the net acres actually harvested, excluding nonproducing areas within the field boundaries.

(4) Research to determine if there exists a practical and economical means of locating corn objective yield sample plots in a completely random manner with all parts of the field having an equal probability of being sampled.

(5) An extensive search of the literature for information pertinent to a study of growth curves for corn be undertaken as well as a reconnaissance among experiment station workers to uncover information relative to growth curves for corn. (A bibliography with 14 entries was included in the report.)

CORN YIELD VALIDATION STUDY: IOWA AND NORTH CAROLINA, 1966

Objectives

Objectives of this study were to determine the validity of the field procedures used in the corn objective yield program and to study effects of changes made in 1966 as a result of the 1965 validation study.

Field Procedures

Five fields each in Iowa and in North Carolina were selected to reflect varying conditions of location, field size, yielding ability, variety, cropping practices, and soil conditions. In each of the 10 fields, 36 samples (72 plots) were observed immediately before harvest. Each plot was 45 feet long and two rows wide. Each row was divided into three 15-foot sections. All ears in the first 15 feet of each row of each plot were counted, picked, and weighed. Also, two ears for each row were used for estimating moisture content and shelling percentage. The only observations in the second and third 15-foot row sections were of stalks with ears and of ears with kernels.

After harvest, nine postharvest gleaning samples (18 plots) were laid out in each field to estimate harvesting loss. These plots were 15 feet long and two rows wide. Standard gleaning practices were followed with all ears and portions of ears being gleaned from both row middles and loose grain being gleaned only from the middle between the two rows.

Net yields for each field were estimated by subtracting the average harvest loss from the average gross yield. The variance of the average net yield for each field was computed as the sum of the variances of the average gross yield and the average harvest loss.

The 72 preharvest plots in each field were arranged in a 2 x 3 x 4 factorial experiment with three replications. The factors to be investigated were:

(1) Point of entry into the field. The most accessible corner was designated number 1. Corners 2, 3, and 4 were determined by proceeding counterclockwise around the field from corner 1. (Only square or rectangular fields were used in this study.)

(2) Methods of locating plots. Completely random locations based upon the dimensions of the field were compared with the unit location method used in 1966 and the unit location table used in 1961-65.

(3) Starting point of units. Stalk and ear counts obtained when the plot was started exactly at the ned of the nth pace into the field were compared with those obtained when the plot started a measured 5 feet further.

All fields were measured with a surveyor's chain to determine the net acres harvested for grain. All corn harvested by the farmer was weighed (method of weighing not specified) and tested for moisture and shelling tests were made on sample ears.

Results

(1) Overestimation. There was an overall significant difference of 3 percent (at the .05 level) between the objective estimates of net yield and the farmer-harvested yield. This difference is comparable with those observed on previous validation studies (1956, 1957, 1960, and 1965).

(2) The factorial experiment. Bartlett's test for homogeneity determined that the variances were not homogeneous over fields. Therefore, a 2 x 3 x 4 analysis of variance table was computed separately for each field. Four of the 10 fields had no significant main effects of interactions. Three additional fields showed the main effect for starting corners as the only significant effect while the analysis for the remaining three fields showed a significant effect for two-factor interaction and/or main effects.

The conclusions drawn from the analysis of the analysis of variance tables were limited. The starting point or point of entry into the field did not appear to have any effect on the gross yield estimates, the average gross yield for plots started at the dowel stick (end of the nth pace) was slightly higher (but not significantly higher) than that for plots started 5 feet further into the field, and differences in gross yields according to the method used to locate plots within the fields were borderline or nearly significant according to Friedman's test.

Comparisons of the total numbers of stalks and of ears with grain counted in the three 15-foot row sections in each row indicate that the numbers counted in the first 15-foot row

section were no different from those counted in the second and third row sections. However, there were still reservations about the accuracy of the Radson moisture testers.

1967 VALIDATION STUDIES

Validation studies in 1967 included both a planned corn-weighing project in Iowa and an extemporaneous evaluation of the effects of a very late harvest season in Ohio and Indiana.

Iowa Corn Weighing Project

The primary purpose of this survey was to establish as precisely as possible the actual yield per acre of corn harvested for grain. This was to be done by weighing actual production hauled from measured acreages for a sample of 86 fields (half of the regular objective yield sample in Iowa). Alternate fields (seven) were selected when the farmer refused to cooperate. (For this project, a bushel of corn was defined as the equivalent of 56 pounds of shelled grain at 15.5-percent moisture.) Fields over 30 acres were subdivided and a portion of the field randomly selected for weighing.

At harvest, objective counts and measurements were made in two additional sample units located in the sample portion of the field. Where the harvested corn was not hauled to a commercial elevator, loads of corn taken from the field were weighed on portable Load-o-meter scales. Samples of corn for moisture and shelling fraction determinations were taken from each load. After harvest, two additional gleaning units were laid out in each sampled portion and the field was chain-measured with angle measurements being taken at all corners.

Results

The weighed yield for the 86 fields averaged 88.8 bushels per acre. This was 6.7 bushel (7 percent) below the objective estimates from the special units and 8.6 bushels (8.8 percent) below the objective estimates from the regular units. The average yield for the nonvalidation fields in the regular objective yield survey was 90.8 bushels per acre, 6.6 bushels (6.8 percent) below the average yield from the regular samples in the validation fields.

Problems

Problems with the study included the following:

(1) Improper use of portable Load-o-meter scales. Proper use requires weighing in a level area and digging the scales down or blocking up the axle not being weighed so that the wagon is level at all times. This was known to have been a factor in some fields but it was not known how many. (NOTE: If this was a problem in 1965, when the same scales were used, it was not noted in that report.) For 13 fields where the production was weighed on commercial scales, the differences between the weighed and objective survey yields was only 4.2 bushels per acre.

(2) Difficulties with selecting a random sample of ears from a wagon load of picked grain and the lack of a convenient way to account for loose kernels in the wagons. Weighed yields for fields harvested as shelled grain were only 5.1 percent below the objective yield estimates.

Recommendations

Recommendations were that resources be devoted to (1) quality control visits to select sample fields and (2) research to develop ways of improving present procedures for estimating the weight of grain per ear. Such research should include evaluations of the scales and moisture testers being used, and an appraisal of the unbiasedness of the present procedure for selecting four ears for laboratory determinations of moisture content and shelling fraction.

Effects of Very Late Harvest

Harvest of the 1967 corn crop was delayed in some important corn-producing States because of unfavorable weather conditions. This prompted a special followup survey to the regular corn objective yield work in Ohio and Indiana.

All sample fields remaining for harvest as of early February 1968 in these two states (14 in Ohio and 17 in Indiana) were included in the followup survey.

Each of these fields was revisited and an additional preharvest count form completed. New units were laid out because the ears had been picked from the original units during the earlier preharvest visit. These new units were five rows further into the field than were the original units. In addition to the usual counts of ears and stalks, the position of each ear was classified in one of three positions. These were: (1) ear attached to standing stalk, (2) ear attached to lodged or broken stalk still rooted in ground, and (3) ear found loose in row middle, including ears attached to stalks broken off from the ground. Also, loose ears in the row 1 middles were tagged and mailed separately to the State laboratory.

Postharvest or gleaning work was completed for those fields that were harvested during February: 8 sample fields in Ohio and 12 in Indiana.

Results

The principal survey results are listed below.

(1) While the average numbers of stalks, ears, and gross yield per acre decreased from November 1 to the followup visits, the average weight per ear increased, and none of the observed changes were significantly different from zero. There was speculation that the increased ear weight resulted from a tendency for the weaker stalks (and smaller ears) to disappear first.

(2) The proportions of "ears on lodged stalks" and "ears detached and on ground" was much smaller in Ohio than in Indiana. For Ohio, 19.4 percent of the total ears were on lodged stalks vs. 31.1 percent in Indiana. For detached ears,the comparable percentages were 0.4 percent for Ohio and 7.7 percent in Indiana.

(3) The increased number of detached ears in Indiana was reflected in higher harvesting losses in that State. Gleanings in the Indiana followup fields averaged 19 percent of the gross yield, compared with 11.3 percent from the regular objective yield survey. Average harvest loss from the followup fields in Ohio was estimated at 11.9 percent, up only 1.6 percentage points from the regular objective yield survey.

1968 CORN OBJECTIVE YIELD QUALITY CHECK SURVEYS

This study included quality checks of enumerator field work in Indiana, Illinois, and Nebraska, and tests of the accuracy of the field and laboratory equipment in all corn objective yield States.

Quality Checks on Field Work

Forty objective yield fields were selected in each State for preharvest work and 20 fields for postharvest. The fields were selected for convenience except that the selected fields were assigned to at least five different enumerators. Each of the fields was visited by a professional statistician in mid-October, near the time when the enumerator would be making the final preharvest visit. Units previously laid out by the enumerators were checked for unit location, unit layout, and accuracy of counts within the unit. An additional pair of units was laid out and harvested by the statistician to obtain checks on the weight per ear.

Accuracy of unit location and unit layout were generally considered to be "satisfactory." Considering the matched observations for row width measurements and ear counts, the analysts found no Student's t values for the paired differences larger than $\pm$ 1.1. In comparing the expanded ear counts from the new units laid out by the statisticians and from the original units laid out by the enumerators, analysts found the Student's t values to be all less than $\pm$ 0.31. However, the average weight per ear from the units laid out by the enumerators was larger, although not significantly so, in each State.

Sample ears sent to the State laboratories by enumerators were 2.6 percent heavier than all ears harvested from the original units while, sample ears submitted by the statisticians were 1.4 percent lighter. However, none of the mean differences were statistically significant.

Of the 60 samples assigned for evaluation of the quality of the postharvest gleanings, only 22 were completed by both the enumerator and the statistician. Gleanings by enumerators averaged 11 bushels per acre while those by statisticians averaged only 8.6 bushels per acre. A portion of this difference may have resulted because the statisticians did their gleanings an average of 2 weeks later than did the enumerators.

Equipment Testing

The equipment tested included all laboratory scales and balances and moisture testers in all corn objective yield States, and all of the field scales in Indiana, Illinois, Wisconsin, Minnesota, and Nebraska.

The field scales were tested under field conditions using sets of three incremented weights carried by the supervisory enumerators. While the overall net error was quite small, two of the 92 field scales tested had at least one reading in error by at least 10 percent. These scales were replaced for 1969. Further, all other States were instructed to recall and test all field scales before the 1969 corn forecast season.

The laboratory scales and balances tested included 21 Ohaus balance-type scales and 3 Pennsylvania fan-type scales. Check readings were made at the beginning and end of each day using known weights of 147.5 and 295 grams. The data indicated that all scales were acceptable at those weights, although there was a slight underweighing (about 0.02 percent). However the Ohaus balance scales were more accurate than the more convenient fan-type scales.

To test the Radson moisture testers used in the State laboratories, each State prepared a number of split samples from predesignated sample fields. Half of each split sample was mailed to the regional laboratory (in Iowa) while the second half was kept in the originating laboratory. Then, on the same day, the regional laboratory tested its part of the sample on a Motomco moisture tester (accepted as the official moisture meter by the Grain Division of the Consumer and Marketing Service), and the originating State laboratory tested the other half on its Radson moisture tester. Six repeat readings were taken with each device. While there was little variation among readings on the same machine/sample combination, there were considerable variations among the readings on the Motomco and the Radsons. Readings obtained from the Motomco ranged from 8.9 percent lower to 2.9 percent higher than the comparable tests on the Radson. Repeated readings from the Radsons were also more variable than from the Motomco.

Conclusions and Recommendations

The first conclusion was that the field work by enumerators generally was satisfactory. However, more information was needed with respect to the amount of grain which vanishes between harvest and delayed gleanings. The second conclusion was that the field and laboratory scales were of adequate accuracy, if used properly and checked.

1968 STUDY OF PROCEDURES AND DEFINITIONS

A comprehensive study of corn objective yield procedures was carried out in two small corn fields in Maryland in the fall of 1968. The purpose of this study was to detect any field procedures which could have been responsible for biases observed in objective yield estimates of corn in previous validation surveys.

Procedures

(1) Each row was measured and divided into 45-foot count units. The first unit in each row started 6 feet into the field from the first stalk in the row and the last count unit ended 6 feet before the last stalk in the row. The length of the last count unit was recorded.

(2) The number of ears in each count unit was counted independently by two people. Any differences in counts were resolved by recounting. Ears in the 6-foot sections at either end of the field were also counted. Every 50th ear, after a random start was tagged for later ear weight and moisture determinations.

(3) Final preharvest observations using regular survey procedures were taken in 80 independently located sample units in each field. Each of the four principal corners of each field was used as the starting point for determining the location of 20 sample units. In addition, all of the ears in row 1 of one-fourth of the sample units were individually tagged and saved for ear weight and moisture determinations.

(4) Quality checks, particularly of ear counts and of row space measurements, were made by the project leader.

(5) After all preharvest observations had been taken, the fields were harvested by a two-row corn picker. All farmer-harvested grain was trucked to a commercial grain elevator where it was shelled, weighed, and tested for moisture.

(6) Postharvest gleanings of ears and of shelled grain were taken in 20 sample units per field within 2 days after harvest. Ten additional sample units were gleaned from each field on each of three later occasions.

(7) All sample ears taken from the field were individually shelled. The shelled grain from each ear was then weighed and tested for moisture.

Major Findings

(1) The estimated number of ears per acre in these two fields was significantly less (2.2 percent) than the average number of ears actually counted.

(2) While the average weight of grain per ear from the third and fourth ears in the first row of each unit was slightly less than the average weight of grain from the large systematic sample, the difference was not statistically significant.

(3) Delaying the postharvest gleaning operation by as much as 33 days after harvest could have resulted in a 3.8-bushel per acre underestimate of the farmer's harvesting loss.

1969 CORN YIELD PROJECT

This project was undertaken in Iowa and Missouri, both as part of a continuing effort to explain the difference between CRB yields and objective yield estimates, and because 1969 was a Census year and comparability between the 1969 and earlier Censuses was questionable.

Summary

Current CRB yields were 98 and 70 bushels per acre for Iowa and Missouri, respectively. Average weighed yields were 102.9 and 65.6 bushels per acre, each with a standard error of 3.3 bushels. The yield survey was designed to provide a probability sample of weighed fields. However, a few early fields were harvested before the initial contact was made. In addition, there were several fields where the farmer harvested without contacting the enumerator and there were some refusals. If a ratio estimate based on the objective yield average for the sample fields compared with all objective yield fields in the State were used, the weighed averages would adjust to 104.6 and 67.2 bushels per acre. These adjusted net yields were within one standard error of the current CRB yield in Missouri, but not in Iowa.

Objectives

(1) Estimate the "true" yield of corn with known precision (true yield is defined as the yield actually harvested and hauled from the field by the farmer).

(2) Estimate difference between the true yield and the objective estimate.

(3) If a difference is observed, estimate the components of this difference to the extent possible.

Methods and Procedures

The sample consisted of fields containing the even numbered regular objective yield samples in Iowa and Missouri. A total of 153 sample fields were actually completed, 93 in Iowa and 60 in Missouri. The true yield was obtained by harvesting and weighing (with platform scales) production from measured areas, usually two or four rows, in these fields.

Objective yield observations were taken in two special objective yield units randomly located and laid out in rows adjacent to the measured area. In addition, part (usually half) of a row near the weighed area was hand-harvested. The length of row was measured and the harvested ears were weighed and shelled and the shelled grain reweighed and tested for moisture. After the operator had harvested the selected rows, two postharvest units were randomly located in the harvested area and gleaned to estimate the harvest loss. The postharvest units included the same number of row spaces as used by the harvesting equipment and all row middles were gleaned for loose grain.

Results

(1) The average number of ears per acre was about 3 percent higher in the validation units than in the regular objective yield units. This differences was more pronounced in Iowa than in Missouri and was significantly different from zero for the two States combined, but not for either State taken by itself.

(2) The average weight of grain per ear from the regular objective yield units was slightly, but not significantly, smaller than from the third and fourth ears of the special units and larger than the average weight of grain per ear from all ears in the special units. However, the average weight of grain per ear from all ears in the special units was significantly less, particularly in Iowa, than from the third and fourth ears from the special units.

(3) Shelling fractions were computed for the third and fourth ears from both the regular and special objective yield samples, and for all ears picked in the special units and in the hand-harvested row. The mean shelling fractions for the third and fourth ears from the regular units were significantly less than for all other procedures. The third and fourth ears from the special units had significantly higher shelling fractions than for either of the other procedures.

(4) Dry matter fractions were computed from the third and fourth ears sent to the State laboratories from both the regular and special objective yield units, and from samples of the shelled grain from all ears in the special units, from the hand-harvested row, and from the weighed area. Evaluation of this data showed that while the regular objective yield sample ears had a lower dry matter fraction, this could be explained by the higher moisture content associated with the earlier harvest dates.

(5) Gross yields computed from observations in the special units were significantly higher (at the 0.05 level) than gross yields from either the regular units or from the hand-harvested rows. This event resulted from higher ear counts in the special units and from higher average weights per ear for ears three and four from the special units. The higher average weights per ear from ears three and four were significantly higher than the average weight of all ears in the special units.

(6) The amount of grain remaining in the field after harvest was estimated from pairs of gleaning units associated with both the regular and the special preharvest units. No significant differences were found between the two estimates of harvest loss.

(7) Estimated net yields obtained by subtracting the estimated harvest losses from the gross yield were compared with the weighed yields from the selected portions of the field. These comparisons showed that the weighed yields, combined for both States, were significantly lower than any of the objective yield estimates except those from the hand-harvested rows. (The estimated yield from hand-harvested rows was quite low in Missouri.) The average differences ranged from 3.8 bushels below the regular unit estimated net yield to 7.9 bushels below the special unit yield based on the average ear weight from ears three and four.

1971 CORN VALIDATION PROJECT

The project was conducted in Illinois and Iowa. The method of harvest (ear or shelled) was determined for a subsample of operational sample fields. A further subsample of 20 fields for each method of harvest was selected in each State.

Procedures

An area of approximately 1 acre was defined in each sample field. Final preharvest observations were taken in 24 regular objective yield units in each field. Enumerator teams were present when the sample field was harvested by the farmers. The harvested corn (ear

or shelled) from the predefined sample areas was taken to commercial scales for weighing. If the field was harvested as shelled grain, a sample of grain was taken at the scales to determine the moisture content. If the field was harvested as ear corn, a sample of ears from the picker chute was obtained for determining the shelling fraction and moisture content. Following harvest, the sample area was measured and gleanings were taken in 12 regular postharvest units.

Analysis

Two different methods of computing estimated net yields were used in the analysis. The first used the actual (OY-T) and relative ((OY-T)/OY) differences between the average of the net yields obtained from the 24 objective yield plots (OY) in each field and the weighed yield (T). Disregarding one sample field where the enumerator appeared to have recorded gross (including container) rather than net weights for ears picked from row 1, this procedure resulted in a mean difference of 1.386 bushels per acre (1.4 percent) between the net yields from the objective yield plots and the yields from the weighed areas. Neither value was significantly different from zero.

The second procedure, labeled the "method of yield components," attempted to parallel the summarization procedure used by the operational survey. This involved computing field level averages for each of the components (number of ears, weight of grain per ear, average row width, and so forth) and computing field-level estimates for these average components. This procedure assumes that the various components are distributed multivariate normal and that they are mutually independent. For Iowa (Illinois apparently was not computed), using the method of yield components resulted in an estimated average net yield 1.68 bushels per acre higher than the estimate obtained by averaging the individual plot estimates. The report did not include any statistics as to the statistical significance of the differences between the two methods. However, the unpaired differences had a Student's t of 1.17, 39 degrees of freedom. Due to the presumed correlation between the average yields produced by the two methods, a Student's t test of the paired differences probably would have been much larger. (NOTE: While the report did not draw any conclusions from this analysis, it can be shown that in simple random sampling, averaging the individual plot net yield will provide an unbiased estimate of the net yield for the field.)

1982 CORN VALIDATION PROJECT

Study Design

This study was conducted in Iowa and Missouri. All fields in the regular objective yield survey in those States were screened to determine if the production from the field was to be weighed at harvest and if the grower would cooperate in the survey. Then sample fields for the validation study were selected systematically from this list.

Each selected field was assigned the equivalent of eight regular objective yield samples. Two of these samples (four plots) were randomly located with respect to each of the four principal corners of the field.

Procedures

One of the eight samples was laid out as part of the regular objective yield survey, using the corner of the field first approached by the enumerator as the starting point. If the enumerator found the field to be mature during a regularly scheduled survey visit, or if the enumerator was notified by the grower that harvest was about to start, then the enumerator laid out the other seven validation samples and made preharvest observations on all eight samples (16 plots). This involved counting, picking, and weighing the ears in each row of each sample plot, and sending the third and fourth ears for the first row of each plot to the SRS State laboratory for moisture and shelling fraction determinations.

If the area around a sample plot was not harvested by the grower within 7 days of the original preharvest observations, the preharvest observations were repeated in a so-called "mirror unit." This mirror unit was located in the following manner. Whereas the regular plot was located by walking a predetermined number of paces into the field and then measuring an additional 5 feet further into the field to the starting point of the plot, the starting point for the mirror unit was located by measuring backward 5 feet. The mirror unit was then located further back towards the entrance into the field.

As the field was harvested, the shelled grain was hauled to a commercial elevator, weighed, and tested for moisture. Care was taken not to mix grain from other fields with that from the validation fields.

After the area around each sample plot was harvested by the grower, postharvest gleaning plots were laid out five rows and five paces further into the field. All ears and pieces of ears were gleaned from both row middles of the postharvest plot and all shelled grain was gleaned from the row 1 middle. The grain from the ears and from the shelled grain were bagged separately and sent to the SRS State laboratory for weight and moisture content determinations.

After the field was harvested by the grower, the grower was asked to provide a best estimate of the acreage actually harvested and the actual production.

Sometime after the field had been selected for the validation study, a measurement of the acreage for harvest was provided by the local ASCS office. This measurement was obtained by digitizing low-level color photography taken of the field during late summer.

Results

The major conclusion from this study was that an apparent pattern of consistent nonsampling errors, either in the application of the objective yield procedures or in recording the elevator weights, had contributed to major difference in the results for the two States. For Iowa, the study showed essentially no difference between the objective yield estimates and the "actual yields" derived from the weighed production and the digitized acreages. However, the Missouri objective yield estimates averaged significantly higher than the "actual yields."

Another major finding was a significant difference in the objective estimate of yield whenever harvest was delayed at least 7 days past the time of the regular final preharvest observations. The 1983 survey was consequently modified to require additional mirror unit observations whenever harvest was delayed beyond 3 days from the regular final preharvest and to do this for all objective yield samples in the validation States.

1983 CORN YIELD VALIDATION STUDY

Study Design

The study design for the 1983 corn objective yield validation study differed from the 1982 design in the following respects.

(1) The study included three States instead of two. These were Illinois, Iowa, and Missouri. Iowa and Missouri were holdovers from the 1982 study.

(2) While the study included 30 validation fields per State rather than the 28 in 1982, only 15 fields per State were selected because the production was to be weighed on commercial scales. For the other 15 fields in each State, the farmer-reported yield (derived from farmer reported production and acreage harvested) was to be taken as the "true yield" for comparison purposes.

(3) Mirror unit observations were to be taken if harvest was delayed more than 3 days after the regular final preharvest observations. These were to be taken just before the grower expected to harvest the field or the still unharvested portion of it. In many instances, the mirror unit observations were taken but actual harvest was delayed more than an additional 3 days so that a second set of mirror unit observations was taken in at least a portion of many fields.

(4) Postharvest interviews and gleanings and mirror unit observations where needed were obtained for all of the regular objective yield samples in the three States. The postharvest interviews were to determine the farmer-reported yields and the gleanings were used to estimate harvest loss.

Procedures

With the exception of the change from 7 to 3 days as a criteria for taking the mirror unit observations, the same field procedures were used in 1983 as in the 1982 study.

Results

The major findings were:

(1) There were no significant differences between the objective yield estimates and the derived farmer-reported yields.

(2) Only in Illinois was there a significant difference between the objective yield estimates and the derived weighed yields.

(3) While the regular objective yield estimates for the validation fields were significantly higher than the corresponding mirror unit yields in two of the three States, when all objective yield sample fields in the three States were considered, the average yield from the mirror units was slightly higher.

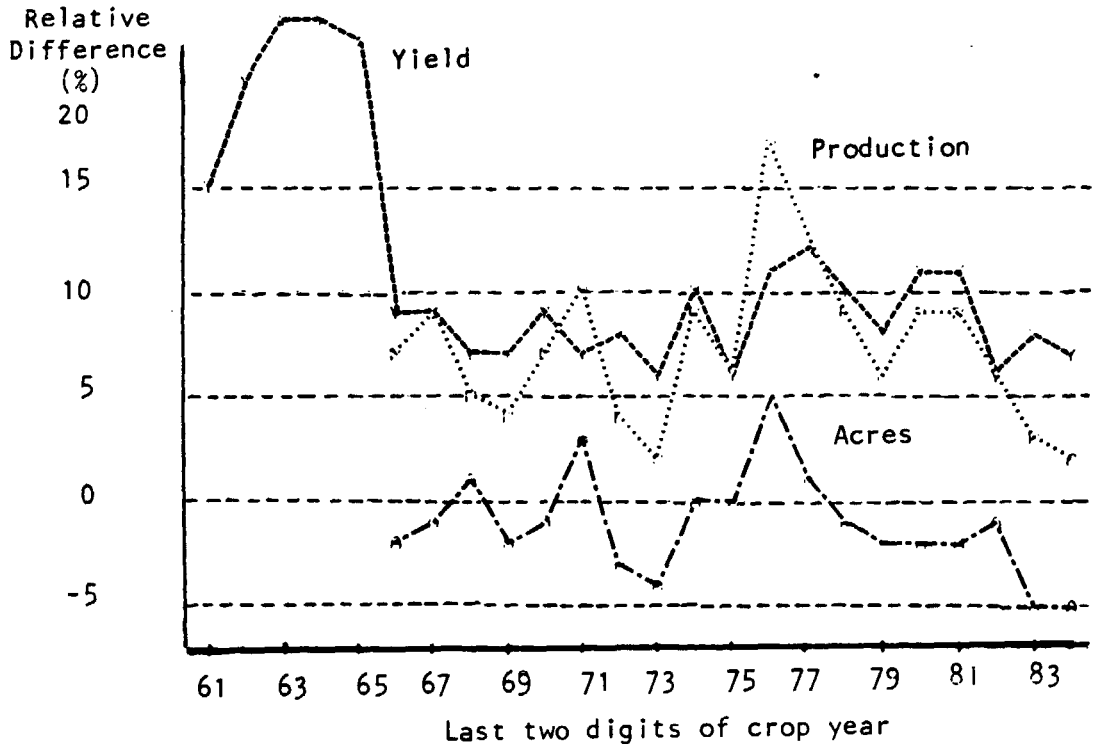
Whereas there was a significant difference in the results for Iowa and Missouri in 1982, there were no such differences in 1983. In fact, the results for Iowa and Missouri were much closer to each other than those for Illinois. This lack of consistency was taken to indicate that whatever nonsampling errors were involved were related more to the application of the survey methodology than to the biases inherent in the procedures as defined. This implies a need for additional training, emphasis on the need for quality work, and quality control and feedback during the operational surveys.

The average net yield from sample plots located with respect to "the first corner reached when approaching the field" was found not to be statistically different from the average net yield from plots located with respect to all other corners of the field. However, the average net yields from the second corner and third corner, counting clockwise from the first corner, were significantly different. These findings were obtained from analysis of both 1982 and 1983 validation study data.

COMMENTARY

SRS has conducted several major corn objective yield validation studies during the past 20 years. As shown in figure 1, only the 1965 study resulted in enough changes in survey procedures to have an appreciable effect on the level (with respect to the SRS final estimates of yield) of the objective yield estimates. (Relative differences 1/, by years for the 10-State area now included in the SRS corn objective yield program 2/ are plotted in figure 1 and listed in table 2.)

Figure 1. Relative Differences Between Objective Crop Cutting estimates and CRB Estimates of Final Yield, Acreage, and Production 10 Corn Objective Yield States, 1961-84



1/ Relative difference is computed as (objective survey - CRB) / CRB.
2/ The 10-States now included in the SRS corn objective yield program are Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin.

Since 1965, the majority of the corn objective yield validation studies have resulted in unexplained differences of from 2 to nearly 5 percent between the objective yield estimates and the weighed production yield final estimates from the validation fields. At the 10-State level, the objective estimates of yield from 1966 through 1973 were consistently between 6 and 9 percent above CRB's official estimates. Since 1973, the relative difference between the objective survey and the final SRS estimates of yield at the regional level has varied more widely, from 6 to 12 percent. In 4 of the last 10 years, the objective survey estimated yield for the region has been at least 10 percent higher than the final SRS estimate. These variations were much greater than might be explained through sampling error. More serious, however, is the fact that the CRB does not appear to have been consistent from year to year with the use of the final objective yield estimates.

Table 2. Final CRB and objective survey estimates of total acreage harvested and average mean per harvested acre, with coefficients of variation and relative differences, 10 objective yield States

	Acres				Yield			
		Objective Survey				Objective Survey		
Year	CRB	Estimate	C.V.	Rel. Diff.	CRB	Estimate	C.V.	Rel. Diff.
	(000)	(000)	%	%	(bu/a)	(bu/a)	%	%
1966	45714	44718	1.83	-2.18	79.3	86.6	1.07	9.23
1967	48452	48190	1.90	- .54	83.5	91.2	1.02	9.19
1968	44606	44993	1.90	.87	84.9	90.9	.91	7.01
1969	43304	42472	1.95	-1.92	92.0	98.1	1.01	6.66
1970	45897	45289	1.92	-1.32	76.8	83.5	1.00	8.81
1971	51451	52797	1.67	2.62	94.0	100.5	.87	6.95
1972	46612	45116	1.78	-3.21	101.2	108.9	.73	7.55
1973	49765	47560	1.74	-4.43	95.1	101.1	.84	6.26
1974	51735	51581	1.85	- .30	72.4	79.3	1.21	9.52
1975	53480	53388	1.48	- .17	90.2	95.9	1.05	6.36
1976	54920	57665	1.61	5.00	89.2	98.7	1.07	10.67
1977	56700	57019	1.43	.56	94.9	105.8	.91	11.58
1978	57120	56830	1.64	- .51	104.7	115.1	.75	9.88
1979	57780	56500	1.45	-2.22	114.1	123.4	.72	8.11
1980	58590	57415	1.43	-2.01	95.7	106.4	.89	11.13
1981	59390	58035	1.51	-2.28	113.4	126.2	.74	11.23
1982	58910	58421	1.40	- .83	116.3	123.3	.79	6.02
1983	40640	38592	1.68	-5.04	82.1	89.0	1.14	8.42
1984	57740	55079	1.46	-4.61	108.3	116.3	.82	7.38
Mean				-1.19				8.52
Standard Error				.56				.41

Objective survey estimates of acreage and production were not computed before 1966. Since that time, there has been a strong tendency, with notable exceptions in 1971 and 1976, for the objective estimates of acreage to be about 1 to 3 percent below the CRB final estimate of acreage harvested. (A test of the hypothesis that the true mean difference was zero resulted in a highly significant ($Pr < 0.005$) Chi-square.) Consequently, the relative difference between the objective and CRB estimates of production generally has been slightly less than for yield.

Any attempts to explain the directional relative difference spread between the objective yield survey yield estimates and the official CRB estimates of yield must operate from either or both of two premises. The first is that there are as yet undetected major errors in the objective survey procedures. The second is that the CRB estimates, particularly for some States, are on the wrong level. In turn, this implies that there are as yet undiscovered, and unsearched for, problems with the nonprobability mail A&P survey which has been the major indication of final yield in most States.

Table 3. Relative differences between objective and CRB estimates of corn yield

Year	IL	IN	IA	MI	MN	MO	NE	OH	SD	WI
					(percent)					
1966	4.4	12.5	7.1	- .6	8.6	19.1	19.0	6.5	26.3	6.9
1967	10.7	7.3	5.3	11.5	12.5	10.9	24.1	-5.7	21.8	2.9
1968	4.8	6.5	6.9	3.7	5.7	8.3	18.0	5.1	15.4	.6
1969	6.5	7.8	7.3	-6.9	8.2	8.8	11.3	6.1	1.5	-4.7
1970	10.8	13.0	10.0	- .4	9.9	7.5	11.1	3.5	-6.9	1.5
1971	8.7	10.8	8.6	6.1	6.5	10.0	9.3	6.2	-27.3	.2
1972	7.2	8.4	7.9	6.4	10.4	- .4	3.5	5.0	41.4	3.1
1973	10.0	3.3	8.4	-1.6	5.1	- .5	0.9	11.8	10.4	4.2
1974	13.0	11.1	10.6	5.8	9.8	16.7	12.4	5.2	-20.6	- .7
1975	2.1	2.4	12.2	5.8	12.0	13.0	8.5	2.3	-7.6	5.1
1976	14.2	8.0	9.3	2.2	18.2	22.8	5.2	12.1	-29.8	15.3
1977	11.2	8.9	11.7	14.0	10.1	14.6	8.2	17.0	37.8	8.2
1978	9.5	7.7	8.1	3.7	10.7	9.5	10.2	10.4	71.8	1.4
1979	9.4	6.9	7.9	6.9	4.4	17.6	8.3	5.2	13.1	7.1
1980	13.0	16.5	10.0	2.7	7.9	14.7	9.6	11.9	32.5	5.4
1981	14.8	12.9	12.6	2.1	8.3	24.1	7.6	10.0	8.9	3.5
1982	8.8	13.0	2.0	5.2	0.6	10.3	2.0	11.9	18.1	.5
1983	13.9	17.8	3.8	- .7	3.3	15.9	7.2	10.0	30.8	-2.8
1984	7.5	12.9	6.7	- .1	2.8	13.2	7.0	10.8	19.9	- .7
Mean	9.13	9.88	7.92	3.46	8.16	12.43	9.65	7.65	13.55	3.00
S.E.	.93	.93	.73	1.10	.93	1.49	1.32	1.14	5.79	1.04

It is not impossible, but it is unlikely considering the amount of research on searching for them that there are major errors in the objective survey procedures, as defined. For example, it is very hard to imagine that the objective survey procedures, as defined, would result in a 14-percent difference in Illinois when the validation study showed an average bias, on weighed fields, of about 6 percent. There is, of course, the possibility that the objective survey procedures are not being applied as carefully in the regular survey as they were applied on the validation studies.

If there are errors in the CRB estimates, one source would be in the harvested acreages and production reported by growers on the CRB A&P inquiry, and on the 5-year Censuses of Agriculture. While much of the crop does get weighed eventually, most corn stored on the farms where grown is not weighed until after these surveys have taken place, so the grower is required to "guess" the probable production/yield. (On the 1983 validation study, growers whose production was weighed reported an average yield which was 1.8 bushels per acre more than the objective survey average, while those who did not weigh their production reported an average yield which was 3.2 bushels less. NOTE: A draft study of the differences between farmer-reported yields and the objective estimates for the same field, over all 10-States now in the corn objective yield program and from 1979 through 1984, shows that the mean differences between farmer-reported yields on the form D and objective estimates of yield varied significantly by State, from a high of 11.9 to a low of -1.4 bushels per acre.)

One of the practical problems is that of the apparent inconsistencies, between States and years, in the differences found between the "actual" and the objective estimates of yeild in the various validation studies. The main point of concern is that SRS should be consistent with its use of objective yield data. If balance sheet considerations prevent SRS from reaching the objective yield level, it should be consistent in its departures from that level.

It is time for the burden of proof to shift from the objective yield surveys to the other surveys used by SRS. For example, the A&P survey is based on a non-probability sample with no evidence that it is properly distributed by size or region. Further, farmers who do not know their production cannot report it accurately. That farmers report consistently both to SRS and to the Census does not make up for their lack of knowledge nor for the inadequacies in the design of either.

The final recommendation is that the other survey indications used by SRS be thoroughly evaluated and justified before additional resources are devoted to another round of "corn yield validation studies."