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# Evaluation of the 1983 Corn Objective Yield Validation Study

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ABSTRACT

Objective estimates of yield from 16 plots in each of 87 corn fields in Illinois, Iowa and Missouri were compared both with farmer reported yields and with weighed production yields to determine if the objective survey procedures resulted in detectable biases in the estimated net yields.

The major findings were that: (1) in only one state (Illinois) was there a significant difference between the objective yield estimates and the weighed production yields, (2) with respect to the objective survey estimated "at harvest" yields, farmer reported yields for fields that were not weighed were significantly larger than for fields that were weighed, and (3) for the validation study fields, objective estimates of yield based on observations obtained at maturity were significantly higher in two of the three states than estimates based on observations made within three days of harvest. However, when all operational objective yield sample fields in the three state area are considered, the regular objective yield estimates at maturity were slightly lower than estimates within three days of harvest. Evaluation of individual plot data from both the 1982 and 1983 corn validation studies showed that the average net yield from plots in the "first corner reached when approaching the field" was not significantly different from the average of all other plots.

KEY WORDS

Objective yield, corn, validation.

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SUMMARY

The mean difference between objective survey net yields based on observations taken at maturity and the actual yields in Illinois was significantly larger than zero. However, this was not the case in Iowa and Missouri. When the data for all three states were combined, the overall mean difference was significantly different from zero. Mean differences based on objective survey estimates taken within three days of harvest were less significant in Illinois and were not significantly large in the three state area. The results for Missouri were strikingly different from the 1982 study in that a highly significant difference was observed in 1982 but not in 1983. Also, the mean differences for Missouri and Iowa were significantly different in 1982 but not in 1983.

With respect to differences between the objective survey estimates and farmer reported yields for the validation fields, the only significant difference was between the weighed and unweighed fields. For the three states, the farmer reported yield for the unweighed fields averaged 3.23 bushels per acre more than the objective estimates, but 1.79 bushels per acre less for the weighed fields. The major contribution to this difference was in Illinois where the farmer reported yield for unweighed fields averaged 4.44 bushels per acre more than the objective yield versus 5.34 bushels per acre less for the weighed fields. For all objective yield fields in the three states, farmer reported yields averaged significantly less than the at harvest objective survey yields.

For the validation fields which were not harvested within three days of the "regular" final preharvest observations, there were significant decreases in the estimated yields before harvest in both Illinois and in Iowa, but not in Missouri. When the data from all the objective yield fields in the three states are combined, there was an average net increase of 0.7 bu/acre in the average yield. However, this apparent net increase was not significantly different from zero.

With the exception of one marginally significant difference in Missouri, there were no significant differences between the farmer reported acreages harvested and the ASCS digitized acreages. However, there were several fields where the difference, either relative and/or actual, was large enough that if the farmer reported yield had been derived from farmer reported production, it could have had a significant impact on the farmer reported yield.

The average net yield of samples in "the first corner of the field reached when approaching the field," the corner of the field in which the regular survey plots are located, was not significantly different from the average net yield in the other three corners. This was true not only for the 1983 corn validation study fields but also for the fields in the 1982 study.

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## INTRODUCTION

As part of an effort by the SRS (Statistical Reporting Service) to determine if there are consistent differences between the levels of yield indicated by its objective yield surveys and the yield actually obtained by farmers, a corn objective yield validation study was conducted in Iowa and Missouri in 1982. That study found a significant difference between the two states in the level of mean differences between derived yield based on weighed production and objective estimates of yield.(1) Therefore, the study was repeated in 1983, with a third state (Illinois) added to increase the scope of experience. The 1983 study was conducted in 30 of the regular SRS corn objective yield fields in each of the states of Illinois, Iowa, and Missouri. This report presents the results of the 1983 study.

The objectives of this study were to:

1. Determine if there were significant differences between the farmer reported yields, the objective estimates of yield, and, for a subsample of the study fields, the derived yield based on weighed production.

2. Determine if the objective survey estimates made when the crop first becomes biologically mature are significantly different from those made just before actual harvest.

3. Determine if locating the sample plots in the "first corner" of the sample fields results in choosing portions of the field which tend to be more or less productive than the remainder of the field.

## STUDY DESIGN

The 1983 Corn Objective Yield Validation Study had two parts. One was similar to the 1982 study in that it was conducted in a subset of thirty of the regular corn objective yield sample fields in each of

1/ "Evaluation of the 1982 Corn Objective Yield Validation Study," Fred B. Warren and Ronald J. Steele, SRS, USDA, August 1984.

the three states of Illinois, Iowa, and Missouri. The field selection for this study was as follows. First, the operators of all of the regular objective yield sample fields in these states were interviewed to determine whether or not the production from those fields would be weighed at a commercial elevator, and if they would cooperate in the study. Then a systematic sample of 15 fields in each group was selected from those who would cooperate. The changes from the 1982 study were that it included one more state (Illinois), each state had a total of 30 rather than 25 sample fields, and that the production from only 15 fields per state was weighed in 1983 whereas the production from all study fields was weighed in 1982.

Illinois was added because the 1982 study had indicated that the difference in level between the objective yield survey estimates and the derived yield based on weighed production was not constant between states. The change to a split sample (weighed vs. nonweighed production) was to determine if the level of yield difference was influenced by whether or not the farmer weighed his production.

As in 1982, the plan of operation was that when, in the course of the regular objective yield survey, a field was found to be biologically mature, final preharvest observations were taken in each of the 16 sample plots (four plots in each quadrant of the field). Then if the entire field was not harvested within three days (seven days in 1982), additional observations were taken in "mirror" plots adjacent to those original plots which still were not harvested.(2) These additional observations were taken just prior to the farm operator's intended harvest time. In several fields the farm operator was not able to harvest the field within three days of the second set of observations. Consequently, another set of "mirror" plot observations were taken just before actual harvest in those fields. As in 1982, postharvest gleanings were taken in plots adjacent to each of the original 16 plots.

For the fields where the production was weighed, the county ASCS offices provided measurements of the acreages harvested for grain by digitizing aerial photographs taken for ASCS programs.

The second part of the 1983 study included all of the operational corn objective yield survey fields in the three states. First, "mirror" plot observations (two plots in one corner of each field) were taken in all fields which were not harvested within at least three days after the regular final preharvest observations were taken. Also, all farm operators were asked, after the field was harvested, to provide their

(2) The "Final Preharvest" procedure requires removing ears from a portion of the sample plot. Therefore, it was necessary to move to a new location each time additional observations were taken. Due to the shape and location of the plots, the new locations were termed "mirror" units.

own estimates of the acreage harvested and actual production.(3) These data were used both to evaluate the differences between the objective yield estimates and the farmer reported yields, and to evaluate the effect of taking observations closer to actual harvest.

DEFINITIONS

To simplify terminology, the following definitions are used throughout the remainder of this report:

"Regular Yield" - Yield estimates based on validation study data obtained on the regular survey visit when the corn was first observed to be physiologically mature. In the operational objective yield program, ears are picked, weighed, and subsampled for laboratory analysis at this time to estimate final preharvest yield. The same procedures were used for the validation study, so "regular yield" is comparable to the final preharvest yield in the operational program.

"Mirror Yield" - Yield estimates based on additional preharvest observations taken after the "regular yield observations" and just before (within three days of) actual harvest. These additional observations were taken only if the field wasn't harvested within three days after the observations used to compute the "regular yield" were obtained.

"At Harvest Yield" - Yield estimates based on observations obtained within three days of actual harvest of the sample plots. The "mirror yield" is used for those portions of fields which had "mirror plot" observations. The "regular yield" is used for the remaining plots in the study.

"Actual Yield" - Yield derived from the total weighed production, adjusted to 15.5 percent moisture, and the ASCS digitized net acreage of corn for harvest of grain.

The regular yield, mirror yield, and at harvest yield are adjusted to 15.5 percent moisture content based upon laboratory determinations of moisture content of randomly sampled ears. Actual yield is adjusted to 15.5 percent based upon moisture determinations made at the commercial elevators.

"Farmer Reported Yield" - Farm operators were asked "How many bushels were or will be harvested from these acres?" If they were unwilling to estimate the total number of bushels harvested from the field, they had the option of providing an estimated average yield. If they did provide an estimate of total production, then the average yield was derived by dividing the reported production by the reported acres harvested. In either case, there was no adjustment for moisture content.

(3) The "final objective yield observations" are taken during the monthly survey when the field is found to be mature.

DATA PROBLEMS

Three of the ninety study fields were eliminated from this analysis. One of the three was harvested for seed corn and the grower had no basis for estimating production, one was not harvested at all, and one had not yet been harvested by the end of the designated data gathering period. Two additional fields could have been excluded. For one of these, the farmer reported acreage was 26 percent (7.7 acres) less than the digitized acreage. Since the objective estimates of yield agreed well with the derived weighed yield but the farmer reported yield was about 35 bushels higher, this field was excluded from the "farmer reported yield" comparisons. For the other field, the "actual" yield was about 30 bushels higher than either of the other two indications. In this case, a review of the weighing data revealed that the last four (out of 21) loads possibly were for another field so the weighed production was adjusted to exclude those last four loads.

ANALYSIS
Yields

The analysis of the differences in yields includes the following comparisons:

1. For the weighed validation sample fields only, the mean differences between the derived "actual yields" and the "regular" and "at harvest" objective survey estimated net yields;

2. For both the validation and regular objective yield sample fields, the mean differences between the farmer reported yields and the objective survey estimated net yields. These comparisons were made both for the "regular" and "at harvest yields;"

3. For those validation and regular objective yield sample fields which had "mirror units," the differences between the "regular" and "mirror" yields. This was to determine the effect of delayed harvest on the objective yield estimates.

The state average regular, at-harvest, farmer reported, and actual yields are summarized in Table 1. A field by field listing of these yields is in Appendix Tables A1, A2, and A3. A similar listing of acreages reported by the farmer, both before and after harvest, and of the ASCS digitized acreages is in Appendix Tables B1, B2, and B3.

Table 1.--Net Yields, by State and Type of Field

| State and Type of Field | Number of Fields | Net Yield (Bu/Acre) Regular Yields | At Harvest Yields 1/ | Farmer Reported Yields | Actual Yields |
|---|---|---|---|---|---|
| ILLINOIS | | | | | |
| All 2/ | 28 | 97.0 | 93.9 | 93.8 | --- |
| Mirror 3/ | 22 | 99.8 | 95.8 | 93.5 | --- |
| Weighed 4/ | 13 | 98.5 | 95.3 | 89.9 | 91.2 |
| Unweighed 5/ | 15 | 95.7 | 92.8 | 97.2 | --- |
| IOWA | | | | | |
| All 2/ | 30 | 89.1 | 88.2 | 90.1 | --- |
| Mirror 3/ | 12 | 99.0 | 96.9 | 99.4 | --- |
| Weighed 4/ | 15 | 84.1 | 83.8 | 82.9 | 84.9 |
| Unweighed 5/ | 15 | 94.0 | 92.7 | 97.2 | --- |
| MISSOURI | | | | | |
| All 2/ | 29 | 46.7 | 46.7 | 47.2 | --- |
| Mirror 3/ | 18 | 43.3 | 43.3 | 44.9 | --- |
| Weighed 4/ | 15 | 40.1 | 40.1 | 40.5 | 39.4 |
| Unweighed 5/ | 14 | 53.7 | 53.8 | 54.3 | --- |

1/ Regular yield is used instead of at harvest yield if no mirror unit observations were taken.
2/ All sample fields.
3/ Fields with mirror units.
4/ Fields where production was weighed.
5/ Fields where production was not weighed.

Differences From Actual Yields. Paired t-tests of the mean differences in Table 2 show that the objective yield estimates of "Regular" yields in Illinois averaged significantly higher than the "actual" yields ($\alpha = 0.01$). The mean difference for the "at harvest" yields was lower but was still significantly large ($\alpha = 0.05$). However, none of the mean differences for Iowa or Missouri were even close to being statistically different from zero.

Table 2.--Mean Differences for Weighed Validation Fields Only: "Regular" and "At Harvest" Objective Estimates of Net Yield Minus "Actual" Yields

| State | Number of Fields | Mean Difference (bu/acre) | Standard Error of Difference (bu/acre) | Student's t |
|---|---|---|---|---|
| Regular Yields | | | | |
| Illinois | 13 | 7.30 | 1.75 | 4.19** |
| Iowa | 15 | -0.78 | 2.51 | -0.31 |
| Missouri | 15 | 0.74 | 1.60 | 0.46 |
| Three States | 43 | 2.19 | 1.26 | 1.75* |
| At Harvest Yields | | | | |
| Illinois | 13 | 4.03 | 1.99 | 2.02* |
| Iowa | 15 | -1.11 | 2.49 | -0.45 |
| Missouri | 15 | 0.74 | 1.93 | 0.38 |
| Three States | 43 | 1.09 | 1.26 | 0.86 |

* The probability of obtaining a larger value of t when there is no difference is less than 10 percent.

** The probability of obtaining a larger value of t when there is no difference is less than 1 percent.

As in 1982, the state having the largest mean difference when only the regular yields were considered also showed the largest change when the at harvest yields were considered. However, the significant difference observed between Iowa and Missouri in 1982 was not found in 1983.

Any survey is subject to two general classes of nonsampling errors. The first class are those errors which are inherent to the survey procedures, as defined. Generally, their net effect will be to introduce a more or less consistent bias in the survey results. However they may also respond to certain conditions which may vary from region to region and from year to year. The second class of nonsampling errors result from the misapplication of the survey procedures. The consequences of these are unpredictable. One explanation of this lack of consistency in the results from Iowa and Missouri in these two years and between Illinois and the other two states in 1983 may be taken to indicate either that there was substantial misapplication of either the objective survey or validation procedures in at least one of the two states and in at least one of the two years. Another possibility is that the results

for Iowa in 1982 and Illinois in 1983 were influenced by some unusual conditions. In either case, the implication is that the results of these studies may not apply to any other state or year.

Farmer Reported Yields. The first step in the evaluation of the farmer reported yields was to compare them with the actual yields for the weighed fields. The results of these comparisons (Table 3) show that while the mean differences were not significantly different from zero, the standard errors of the differences, particularly in Iowa, were large. Among possible reasons for the large standard errors would be that the farmer did not refer to the elevator weight tickets in reporting and that the acreage he reported as having harvested was not even close to the ASCS digitized acreage.

These results for 1983 differ from those for 1982 in that there was a highly significant mean difference for Missouri in 1982. This inconsistency could be taken to imply that there were unrecognized problems with the "actual yields" in Missouri in 1982.

Table 3.--Differences for Weighed Validation Fields: Farmer Reported Yields Minus Actual Yields

| State | Number of Fields | Mean Difference Yield (bu/acre) | Standard Error of Difference (bu/acre) | Student's t |
|---|---|---|---|---|
| Illinois | 13 | -1.31 | 2.50 | -0.61 |
| Iowa | 15 | -2.02 | 3.18 | -0.53 |
| Missouri | 15 | 1.15 | 1.29 | 0.39 |
| Three States | 43 | -0.70 | 1.40 | -0.50 |

Given that the mean difference between the farmer reported and actual yields for the weighed fields was small, the next step was to examine the differences between the two objective survey estimates of net yield and the farmer reported yields in the weighed and unweighed validation fields.

Table 4.--Differences for Unweighed Validation Fields Only: "Regular" and "At Harvest" Objective Estimates of Net Yield Minus Farmer Reported Yields

| State | Number of Fields | Mean Difference (bu/acre) | Standard Error of Difference (bu/acre) | Student's t |
|---|---|---|---|---|
| Regular Yields | | | | |
| Illinois | 15 | -1.49 | 4.45 | -0.33 |
| Iowa | 15 | -3.20 | 3.28 | -0.97 |
| Missouri | 14 | -0.59 | 2.54 | -0.23 |
| Three States | 44 | -1.79 | 2.01 | -0.89 |
| At Harvest Yields | | | | |
| Illinois | 15 | -4.44 | 3.22 | -1.38 |
| Iowa | 15 | -4.53 | 3.10 | -1.46 |
| Missouri | 14 | -0.54 | 2.71 | -0.20 |
| Three States | 44 | -3.23 | 1.73 | -1.87* |

* The probability of obtaining a larger t-value when there is no difference is less than 10 percent.

These results are somewhat contradictory. The yields obtained from Illinois and Iowa farmers who did not have access to weight tickets averaged 4.44 and 4.53 bushels per acre higher than the at harvest yield estimates (Table 4) while yields obtained from farmers who did have access to weight tickets averaged 5.34 bushels less than the at harvest objective yield estimates in Illinois and 0.91 bushels less in Iowa (Table 5). Although the mean differences were consistently small in Missouri, the average difference at harvest for the three states combined varied from 3.23 bushels per acre higher for the unweighed fields to 1.79 bushels lower in the weighed fields. The differences between the means for the weighed and unweighed fields were significantly large at the 5 percent level of probability for both Illinois and for the three states combined.

Table 5.--Differences for Weighed Validation Fields Only: "Regular" and "At Harvest" Objective Estimates of Net Yield Minus Farmer Reported Yields

| State | Number of Fields | Mean Difference (bu/acre) | Standard Error of Difference (bu/acre) | Student's t |
|---|---|---|---|---|
| Regular Yields | | | | |
| Illinois | 13 | 8.61 | 2.16 | 3.98** |
| Iowa | 15 | 1.24 | 3.26 | 0.38 |
| Missouri | 15 | -0.41 | 1.22 | -0.33 |
| Three States | 43 | 2.89 | 1.47 | 1.97* |
| At Harvest Yields | | | | |
| Illinois | 13 | 5.34 | 2.79 | 1.91* |
| Iowa | 15 | 0.91 | 3.30 | 0.28 |
| Missouri | 15 | -0.41 | 1.57 | -0.26 |
| Three States | 43 | 1.79 | 1.54 | 1.16 |

* The probability of obtaining a larger t-value when there is no difference is less than 10 percent.

** The probability of obtaining a larger t-value when there is no difference is less than 1 percent.

The mean differences between the two objective estimates of net yield and the farmer reported yields for all validation fields show much the same pattern as when they are compared with actual yields, albeit this time there are no statistically signficiant differences (Table 6). The Illinois regular yield has the largest (positive) difference but substituting the mirror yields brings the at harvest differences down to almost zero. At the same time, there was a slight decrease in the at harvest yield for Iowa while Missouri remained almost constant.

Still another set of comparisons between objective yield estimates and the farmer reported yields was based upon data from the operational objective yield survey in these states (Table 7). Except for Iowa, the mean differences do not agree with those from the validation samples. For Illinois, the mean difference increased from a not quite significant average 3.13 bu/acre to a significant ($\alpha$ = 0.05) average of 4.63 bu/acre while the validation sample mean difference decreased from 3.20 to 0.10 bu/acre. A different situation occurred in Missouri. There, while there was little change from "regular" to the "at harvest yields," the mean differences from the operational survey samples were more than five bu/acre higher than for the validation samples.

Table 6.--Differences for All Validation Fields: "Regular" and "At Harvest" Objective Estimates of Net Yield Minus Farmer Reported Yields

| State | Number of Fields | Mean Difference (bu/acre) | Standard Error of Difference (bu/acre) | Student's t |
|---|---|---|---|---|
| Regular Yields | | | | |
| Illinois | 28 | 3.20 | 2.72 | 1.18 |
| Iowa | 30 | -0.98 | 2.31 | -0.42 |
| Missouri | 29 | -0.49 | 1.35 | -0.37 |
| Three States | 87 | 0.53 | 1.27 | 0.42 |
| At Harvest Yields | | | | |
| Illinois | 28 | 0.10 | 2.31 | 0.04 |
| Iowa | 30 | -1.81 | 2.28 | -0.79 |
| Missouri | 29 | -0.47 | 1.51 | -0.31 |
| Three States | 87 | -0.75 | 1.18 | -0.63 |

Table 7.--Differences for All Operational Objective Yield Sample Fields: "Regular" and "At Harvest" Objective Estimates of Net Yield minus Farmer Reported Yields

| State | Number of Fields | Mean Difference (bu/acre) | Standard Error (bu/acre) | Student's t |
|---|---|---|---|---|
| Regular Yields | | | | |
| Illinois | 196 | 3.13 | 1.99 | 1.58 |
| Iowa | 182 | -0.89 | 1.83 | -0.49 |
| Missouri | 88 | 5.07 | 2.27 | 2.23* |
| Three States | 466 | 1.92 | 1.18 | 1.62 |
| At Harvest Yields | | | | |
| Illinois | 196 | 4.63 | 2.05 | 2.26** |
| Iowa | 182 | -2.13 | 1.92 | -1.11 |
| Missouri | 88 | 5.34 | 2.21 | 2.41** |
| Three States | 466 | 2.13 | 1.22 | 1.73* |

* The probability of obtaining a larger value of t when there is no difference is less than 10 percent.

** The probability of obtaining a larger value of t when there is no difference is less than 5 percent.

Delayed Harvest. One major finding from the 1982 corn validation study was that there could be a significant reduction in the objective survey estimated yield if harvest was delayed as much as seven days after the corn was found to be biologically mature. This finding was important since the current operational survey procedure is to take the final preharvest observations when the field is first found to be biologically mature. Depending upon the season, many fields may not be harvested for several weeks or months after they reach maturity.

As a result of the 1982 study, the procedures in the three validation states for 1983 were changed to require additional preharvest observations not more than three days before harvest in all of the operational and validation samples.

The first step was to compute the average change in the estimated yield for each field (from those plots where the farmer harvest had been delayed at least three days). Student's "t" test was then applied to the resulting differences. The results (Table 8) show that significant reductions in the estimated yields did take place in the validation fields in Illinois and Iowa but not in Missouri. However, a similar analysis (Table 8) for all of the operational objective yield samples showed apparent but nonsignificant net increases in estimated yields in Illinois and Missouri, and for the three states combined. A correlation analysis of yield changes versus the number of days between the regular and mirror unit observations showed essentially zero correlation ($r = -0.02$, $n = 252$). Further, a plot of the changes in yield versus the number of days showed no apparent nonlinear relationships.

This problem requires further study.

One possible concern with this data is that the proportions of validation fields having mirror units in Illinois and Iowa are significantly different from the proportions of all objective yield fields having mirror units. For Illinois, 79 percent of all validation fields had mirror units versus 54 percent of all objective yield fields. In Iowa, only 40 percent of the validation fields had mirror units versus 52 percent for all fields. There is no immediate explanation for this phenomenum. Also, there is no assessment of possible impact on the evaluation of these statistics in Table 8.

Table 8.--Differences Between Objective Estimates of Yield: "Regular" Minus "Mirror Unit"

| State | Number of Fields | Mean Difference (Bu/Acre) | Standard Error (Bu/Acre) | Student's t |
|---|---|---|---|---|
| Validation Fields Only | | | | |
| Illinois | 22 | 3.95 | 1.47 | 2.69* |
| Iowa | 12 | 2.07 | 0.86 | 2.40* |
| Missouri | 18 | -0.03 | 1.06 | -0.03 |
| Three States | 52 | 2.14 | 0.77 | 2.76** |
| Operational Fields | | | | |
| Illinois | 106 | -2.77 | 1.96 | -1.41 |
| Iowa | 94 | 2.40 | 2.01 | 1.19 |
| Missouri | 53 | -1.93 | 2.22 | -0.87 |
| Three States | 253 | -0.67 | 1.21 | -0.56 |

* Reject hypothesis of no difference at 0.05 level of probability.
** Reject hypothesis of no difference at 0.01 level of probability.

Acreages

One point of concern in every survey which obtains average yields by dividing some estimate of production by acreage is the question of "How good is the acreage value?" For the derived weighed yields, this study used acreage values digitized by the county ASCS offices from relatively low-level aerial photographs. These photographs are subject to some distortion, particularly near the edges. The data in Table 7 has been compiled to provide a brief summary of how the digitized acreages compare with the farmer reported acreages harvested (which may come from the same source). A field by field listing of acreages reported by the farmer on the initial preharvest and postharvest interviews as well as the ASCS digitized acreages is included in Appendix Tables B1, B2, and B3.

As shown in Table 9, there was almost no difference in the average acreage obtained from the two sources. However, there was at least a four acre difference in two fields in each state. In terms of relative differences, which are more critical insofar as the derived yields go, seven fields had relative differences ranging from 11 to 23 percent. It is not known if these differences resulted from faulty digitization, faulty memory on the part of the farmer, or inadequate probing by the enumerator.

Table 9.--Mean Differences Between Acreages Harvested: Reported by Farmers Minus ASCS Digitized

| | State | n | Mean Difference | Standard Error of Difference | Student's t |
|---|---|---|---|---|---|
| Absolute 1/ | | | | | |
| | Illinois | 28 | 0.064 | 0.254 | 0.25 |
| | Iowa | 30 | 0.160 | 0.320 | 0.50 |
| | Missouri | 29 | -0.534 | 0.306 | -1.75 |
| Relative 2/ | | | | | |
| | Illinois | 28 | 0.0046 | 0.0054 | 0.86 |
| | Iowa | 30 | -0.0111 | 0.0086 | -1.29 |
| | Missouri | 29 | -0.0072 | 0.0139 | -0.52 |

1/ ASCS digitized acreages minus farmer reported harvested acreage (acres).
2/ (ASCS digitized acreages minus farmer reported harvested acreage) / (Farmer reported harvested acreage).

Corners

In the operational survey, sample plots are located with respect to the "first corner of the field reached in approaching the field." If this corner is more or less productive than the other corners, or if the enumerator has a tendency to "select" starting corners on some other basis, such as productivity, this procedure has a potential for biasing the results of the objective yield survey.

To determine if the productivity of the "first corner" of the study fields was significantly different from that of the other corners, each of the four principal corners of each study field was used as the starting point in locating the plots for two samples. The "first corner" was labeled corner 1 and the other corners were numbered consecutively in a clockwise manner from the first corner. Regular and at harvest net yield data were obtained from four randomly located plots in each corner.

The objectives of this analysis were (1) to determine if the average net yield estimated from plots in corner 1 was significantly different from the average of all other plots in the field, and (2) to determine if the average net yield for any corner of the field was significantly different from any other corner.

The first objective was met by computing a linear contrast between yields from corner 1 and the average from all other corners. This

was done both for both the 1982 and 1983 validation studies. These statistics (Table 10) do not indicate that yield from the corner first reached when approaching the field are significantly different from the remainder of the field. Therefore, there seems to be no reason to alter the present procedure of locating sample plots in the first corner approached in reaching the field.

Table 10.--Contrasts Between the First and All Other Corners

| State | df | At Harvest Minus (num,den) | At Harvest Corner 1 F Others | At Harvest Pr>F | Regular Minus | Regular Corner 1 F Others | Regular Pr>F |
|---|---|---|---|---|---|---|---|
| | | | Bu/Acre | | | Bu/Acre | |
| 1982 | | | | | | | |
| Iowa | (1,180) | -3.14 | 0.91 | 0.34 | 2.38 | 0.48 | 0.49 |
| Missouri | (1,196) | 5.19 | 1.45 | 0.23 | 4.28 | 1.15 | 0.28 |
| Combined | (1,380) | 1.20 | 0.19 | 0.66 | 3.37 | 1.63 | 0.20 |
| 1983 | | | | | | | |
| Illinois | (1,220) | -2.24 | 0.50 | 0.48 | -2.41 | 0.50 | 0.48 |
| Iowa | (1,236) | -2.83 | 1.21 | 0.27 | -1.88 | 0.59 | 0.44 |
| Missouri | (1,228) | 1.98 | 0.71 | 0.40 | -1.19 | 0.25 | 0.62 |
| Combined | (1,692) | -1.04 | 0.44 | 0.51 | -1.82 | 1.30 | 0.25 |
| 1982-83 | | | | | | | |
| Illinois | (1,220) | -2.24 | 0.50 | 0.48 | -2.41 | 0.50 | 0.48 |
| Iowa | (1,420) | -2.96 | 2.12 | 0.15 | -0.03 | 0.01 | 0.99 |
| Missouri | (1,428) | 3.47 | 2.17 | 0.14 | 1.34 | 0.67 | 0.57 |
| Combined | (1,1076) | -0.24 | 0.03 | 0.86 | 0.03 | 0.01 | 0.98 |

The second objective was met through the use of an analysis of variance to determine if there were significant differences between the net yields in different corners of the fields, and the Ryan Einot-Gabriel-Welsch multiple range test[4/] was used to determine which, given significant F values from the analysis of variance, of the corners yielded appreciably more or less than the others.

Statistics from this analysis (Table 11) tell a perplexing story. When all the data are combined, the regular yields from corner 2, for some unknown reason, are significantly higher than those from corner 3. This phenomenum is even more pronounced when the at harvest yields are considered.

4/ SAS Users Guide: Statistics, 1982 Edition, SAS Institute, Inc., Cary, N.C.

Table 11.--Analysis of Variance between Corners and Multiple Range Tests

| | | At Harvest | | | | | | Regular | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | df (num,den) | F | Pr>F | Corner 1/ 1 | 2 | 3 | 4 | F | Pr>F | Corner 1/ 1 | 2 | 3 | 4 |
| 1982 | | | | | | | | | | | | | |
| Iowa | 3,180 | 3.44 | 0.0179 | AB | A | B | AB | 1.56 | 0.1996 | A | A | A | A |
| Missouri | 3,196 | 0.67 | 0.5767 | A | A | A | A | 0.76 | 0.5238 | A | A | A | A |
| Combined | 3.380 | 1.22 | 0.3001 | A | A | A | A | 1.86 | 0.1346 | A | A | A | A |
| 1983 | | | | | | | | | | | | | |
| Illinois | 3,220 | 3.05 | 0.0292 | AB | A | B | AB | 1.73 | 0.1609 | A | A | A | A |
| Iowa | 3,236 | 0.80 | 0.4963 | A | A | A | A | 0.64 | 0.5927 | A | A | A | A |
| Missouri | 3.228 | 1.19 | 0.3134 | A | A | A | A | 0.71 | 0.5514 | A | A | A | A |
| Combined | 3,692 | 3.96 | 0.0083 | B | A | B | B | 1.99 | 0.1128 | A | A | A | A |
| 1982-83 | | | | | | | | | | | | | |
| Illinois | 3,220 | 3.05 | 0.0292 | AB | A | B | AB | 1.73 | 0.1609 | A | A | A | A |
| Iowa | 3,420 | 3.55 | 0.0146 | B | A | B | AB | 1.164 | 0.1769 | A | A | A | A |
| Missouri | 3,428 | 1.17 | 0.3202 | A | A | A | A | 0.67 | 0.5741 | A | A | A | A |
| Combined | 3,1076 | 4.53 | 0.0038 | AB | A | B | AB | 2.86 | 0.0354 | AB | A | B | AB |

1/ Corners were numbered consecutively, clockwise from the 'first corner' reached when approaching the field. Different letters indicated significantly different (a=0.05) average estimated net yield.

RECOMMENDATIONS Additional training, emphasis on the need for quality data, and quality control/feedback are needed to improve the likelihood that procedures are applied as intended in all states. This is particularly true of farmer/grower questioning such as the post-harvest interview where farmer reported yields often deviate widely from the objective yield estimates. This may require the development of a series of probing questions designed to determine how the farmer arrived at an estimate.

A point of continued concern is the apparent inconsistency between states, between years within states, and between the operational validation surveys within states with respect to the differences between the objective survey estimates of yield from observations

taken at maturity and at harvest. A recent article in the Prairie Farmer5/ indicates that this may be related to the moisture content of corn when the "at maturity" and "at harvest" observations are taken in that there is a net loss of dry matter associated with a transfer of nutrients within the kernel at certain levels of moisture. This suggests that a further evaluation of the combined 1982 and 1983 corn validation study datasets be undertaken to determine if this phenomenum was responsible for the observed inconsistencies.

5/ "Letting Corn Field Dry May Cost 5 to 20 Bu.", by John Vogel, Prairie Farmer, Sept. 1, 1984.

APPENDIX

Table A1.--Net Yields by Sample Field: Illinois

| | Sample Field Number | Net Yield (Bu/Acre) | | | |
|---|---|---|---|---|---|
| | | Objective Estimate | | | |
| | | Regular Units | Mirror Units | Farmer Reported | Actual |
| | 18 | 51.9 | 46.7 | 53.0 | 55.1 |
| | 24 | 117.5 | 111.2 | 102.0 | -- |
| | 35 | 117.7 | 99.3 | 82.3 | -- |
| | 48 | 102.3 | 103.1 | 107.7 | -- |
| | 55 | 68.4 | 81.3 | 95.0 | -- |
| | 58 | 141.6 | 144.6 | 125.0 | 137.6 |
| | 70 | 115.9 | 111.3 | 123.5 | 106.8 |
| | 78 | 160.3 | 160.5 | 145.0 | -- |
| | 84 | 133.3 | -- | 150.0 | -- |
| | 90 | 70.5 | 60.5 | 50.9 | 48.3 |
| | 92 | 114.4 | 106.4 | 99.3 | 116.9 |
| | 94 | 117.3 | -- | 115.0 | -- |
| | 102 | 105.2 | 101.1 | 101.0 | 99.3 |
| | 104 | 68.8 | -- | 80.0 | -- |
| | 116 | 158.5 | 147.6 | 133.9 | -- |
| | 132 | 131.9 | 122.7 | 123.0 | 121.9 |
| | 137 | 78.7 | -- | 95.7 | -- |
| | 151 | 118.0 | 119.7 | 110.0 | 109.1 |
| | 155 | 96.8 | 85.4 | 96.8 | -- |
| | 163 | 63.3 | 56.1 | 70.0 | -- |
| | 183 | 33.0 | 33.8 | 45.1 | -- |
| | 197 | 26.0 | -- | 40.0 | -- |
| | 212 | 94.2 | 89.4 | 100.0 | -- |
| | 221 | 72.6 | 61.6 | 66.3 | 62.6 |
| | 233 | 67.7 | 65.8 | 62.3 | 57.7 |
| | 261 | 99.7 | 103.6 | 80.6 | 94.6 |
| | 262 | 98.2 | -- | 90.0 | 90.3 |
| | 263 | 93.4 | 96.2 | 84.0 | 85.8 |
| n = 28 1/ | AVE | 97.0 | 93.9 | 93.8 | -- |
| n = 22 2/ | AVE | 99.8 | 95.8 | 93.5 | -- |
| n = 13 3/ | AVE | 98.5 | 95.3 | 89.9 | 91.2 |
| n = 15 4/ | AVE | 95.7 | 92.8 | 97.2 | -- |

1/ All sample fields. Regular yield is used for mirror yield if no mirror units were observed.

2/ Fields with mirror units.

3/ Fields where production was weighed. Regular yield is used for mirror yield if no mirror units were observed.

4/ Fields where production was not weighed. Regular yield is used for mirror yield if no mirror units were observed.

APPENDIX

Table A2.--Net Yields by Sample Field: Iowa

| | Sample Field Number | Net Yield (Bu/Acre) Objective Estimate Regular Units | Mirror Units | Farmer Reported | Actual |
|---|---|---|---|---|---|
| | 7 | 91.7 | 94.1 | 87.5 | 105.2 |
| | 12 | 80.7 | 83.5 | 95.0 | -- |
| | 16 | 84.9 | 79.1 | 85.0 | -- |
| | 17 | 85.4 | 86.6 | 85.0 | -- |
| | 28 | 109.7 | 105.8 | 110.1 | -- |
| | 47 | 108.4 | 107.1 | 99.5 | 116.6 |
| | 55 | 93.0 | 91.6 | 99.3 | 93.4 |
| | 64 | 127.8 | -- | 130.4 | -- |
| | 74 | 120.8 | -- | 109.0 | 92.2 |
| | 83 | 64.1 | -- | 85.9 | -- |
| | 94 | 47.2 | -- | 50.0 | -- |
| | 101 | 96.4 | -- | 61.6 | 93.1 |
| | 105 | 90.4 | 84.8 | 75.0 | -- |
| | 121 | 62.6 | -- | 50.0 | 56.0 |
| | 125 | 102.7 | 99.3 | 96.6 | 100.6 |
| | 131 | 149.3 | 144.9 | 135.6 | -- |
| | 134 | 144.8 | -- | 159.0 | 153.6 |
| | 152 | 71.8 | -- | 80.0 | 77.7 |
| | 154 | 101.2 | -- | 92.0 | -- |
| | 156 | 90.5 | 89.2 | 106.3 | 96.7 |
| | 174 | 97.9 | -- | 116.0 | -- |
| | 183 | 100.8 | 96.6 | 117.9 | -- |
| | 194 | 51.4 | -- | 53.6 | 58.4 |
| | 195 | 79.1 | -- | 65.0 | -- |
| | 201 | 98.2 | -- | 100.0 | 101.0 |
| | 204 | 140.7 | -- | 145.1 | -- |
| | 211 | 18.2 | -- | 20.0 | 16.8 |
| | 216 | 25.3 | -- | 28.1 | 27.2 |
| | 221 | 50.7 | -- | 70.0 | -- |
| | 226 | 86.4 | -- | 93.1 | 85.5 |
| n = 30 1/ | AVE | 89.1 | 88.2 | 90.1 | -- |
| n = 12 2/ | AVE | 99.0 | 96.9 | 99.4 | -- |
| n = 15 3/ | AVE | 84.1 | 83.8 | 82.9 | 84.9 |
| n = 15 4/ | AVE | 94.0 | 92.8 | 97.2 | -- |

1/ All sample fields. Regular yield is used for mirror yield if no mirror units were observed.

2/ Fields with mirror units.

3/ Fields where production was weighed. Regular yield is used for mirror yield if no mirror units were observed.

4/ Fields where production was not weighed. Regular yield is used for mirror yield if no mirror units were observed.

APPENDIX

Table A3.--Net Yields by Sample Field: Missouri

| | Sample Field Number | Net Yield (Bu/Acre) | | | |
|---|---|---|---|---|---|
| | | Objective Estimate | | | |
| | | Regular Units | Mirror Units | Farmer Reported | Actual |
| | 2 | 46.0 | 43.7 | 53.1 | -- |
| | 3 | 37.5 | 31.6 | 40.0 | 52.0 |
| | 4 | 31.5 | 32.5 | 25.0 | 30.2 |
| | 8 | 64.0 | 71.1 | 69.9 | 68.5 |
| | 11 | 19.5 | 27.2 | 20.0 | 20.8 |
| | 24 | 54.4 | 53.3 | 51.3 | 51.6 |
| | 26 | 94.1 | -- | 100.1 | 94.4 |
| | 31 | 32.3 | 27.8 | 34.4 | -- |
| | 36 | 19.4 | 15.1 | 25.0 | 16.3 |
| | 37 | 16.4 | -- | 18.3 | 18.7 |
| | 44 | 93.7 | 99.2 | 110.0 | -- |
| | 47 | 86.7 | 88.0 | 75.0 | -- |
| | 56 | 32.6 | -- | 31.1 | 28.2 |
| | 82 | 12.7 | -- | 13.8 | -- |
| | 85 | 33.7 | 32.1 | 50.0 | -- |
| | 87 | 85.9 | -- | 79.0 | 72.3 |
| | 88 | 72.0 | -- | 69.0 | -- |
| | 90 | 28.9 | -- | 22.2 | 20.4 |
| | 91 | 2.9 | 2.4 | 3.7 | 3.6 |
| | 94 | 27.3 | 22.6 | 20.0 | -- |
| | 95 | 10.5 | -- | 12.5 | 10.1 |
| | 96 | 19.0 | 18.2 | 20.0 | -- |
| | 102 | 45.2 | 44.2 | 44.1 | 42.5 |
| | 106 | 43.5 | 43.6 | 40.0 | -- |
| | 109 | 51.2 | 49.7 | 50.0 | -- |
| | 117 | 113.6 | -- | 125.0 | -- |
| | 129 | 55.6 | 64.7 | 50.0 | -- |
| | 139 | 64.8 | -- | 50.0 | -- |
| | 150 | 58.9 | 56.0 | 65.8 | 61.1 |
| n = 29 1/ | AVE | 46.7 | 46.7 | 47.2 | -- |
| n = 18 2/ | AVE | 43.3 | 43.3 | 44.9 | -- |
| n = 15 3/ | AVE | 40.1 | 40.1 | 40.5 | 39.4 |
| n = 14 4/ | AVE | 53.7 | 53.8 | 54.3 | -- |

1/ All sample fields. Regular yield is used for mirror yield if no mirror units were observed.

2/ Fields with mirror units.

3/ Fields where production was weighed. Regular yield is used for mirror yield if no mirror units were observed.

4/ Fields where production was not weighed. Regular yield is used for mirror yield if no mirror units were observed.

APPENDIX

Table B1.--Acreages by Sample Fields: Illinois

| Sample Field Number | Acreages in Field | | |
|---|---|---|---|
| | Initial Interview | Postharvest Interview | Digitized |
| 18 | 11.0 | 22.5 | 22.5 |
| 24 | 7.0 | 7.0 | 7.1 |
| 35 | 24.7 | 23.7 | 23.7 |
| 48 | 34.0 | 32.5 | 32.3 |
| 55 | 155.0 | 155.0 | 151.0 |
| 58 | 90.4 | 90.4 | 89.8 |
| 70 | 40.0 | 40.0 | 42.9 |
| 78 | 40.0 | 36.5 | 36.7 |
| 84 | 99.0 | 98.7 | 100.0 |
| 90 | 33.0 | 33.0 | 33.0 |
| 92 | 15.1 | 15.1 | 14.7 |
| 94 | 75.7 | 75.7 | 75.3 |
| 102 | 16.0 | 16.0 | 16.1 |
| 104 | 37.0 | 37.0 | 41.2 |
| 116 | 44.0 | 42.0 | 42.3 |
| 132 | 38.0 | 38.0 | 37.9 |
| 137 | 20.0 | 20.0 | 20.0 |
| 151 | 32.0 | 32.0 | 32.1 |
| 155 | 59.5 | 59.5 | 57.7 |
| 163 | 102.5 | 102.5 | 101.9 |
| 183 | 40.0 | 40.0 | 40.2 |
| 197 | 40.0 | 45.2 | 45.2 |
| 212 | 25.0 | 21.8 | 21.8 |
| 221 | 34.0 | 34.0 | 34.8 |
| 233 | 21.0 | 21.0 | 20.8 |
| 261 | 3.0 | 3.1 | 3.1 |
| 262 | 8.0 | 7.8 | 7.8 |
| 263 | 6.0 | 6.0 | 5.9 |
| AVE | 41.100 | 41.286 | 41.350 |

APPENDIX

Table B2.--Acreages by Sample Fields: Iowa

| Sample Field Number | Acreages in Field | | |
|---|---|---|---|
| | Initial Interview | Postharvest Interview | Digitized |
| 7 | 72.0 | 72.0 | 69.0 |
| 12 | 76.0 | 76.0 | 75.5 |
| 16 | 30.4 | 30.4 | 30.5 |
| 17 | 40.0 | 40.0 | 43.3 |
| 28 | 22.5 | 24.3 | 24.3 |
| 47 | 63.2 | 60.2 | 63.6 |
| 55 | 38.6 | 39.7 | 39.6 |
| 64 | 18.0 | 16.1 | 17.1 |
| 74 | 17.0 | 16.7 | 16.7 |
| 83 | 16.7 | 16.3 | 16.3 |
| 94 | 70.0 | 70.0 | 70.0 |
| 101 | 22.0 | 25.0 | 29.3 |
| 105 | 42.0 | 42.0 | 41.2 |
| 121 | 46.0 | 46.0 | 45.5 |
| 125 | 48.7 | 48.7 | 44.7 |
| 131 | 80.0 | 59.0 | 59.0 |
| 134 | 70.0 | 70.0 | 70.0 |
| 152 | 58.0 | 58.0 | 59.2 |
| 154 | 46.0 | 46.0 | 43.9 |
| 156 | 20.8 | 20.8 | 21.6 |
| 174 | 58.0 | 53.4 | 53.4 |
| 183 | 39.0 | 39.0 | 39.1 |
| 194 | 14.0 | 14.0 | 14.5 |
| 195 | 27.5 | 24.4 | 24.4 |
| 201 | 229.0 | 229.0 | 228.0 |
| 204 | 26.5 | 25.5 | 25.5 |
| 211 | 55.0 | 40.0 | 38.1 |
| 216 | 24.7 | 24.7 | 25.3 |
| 221 | 33.0 | 33.0 | 36.2 |
| 226 | 52.0 | 52.0 | 52.2 |
| AVE | 48.553 | 47.073 | 47.233 |

APPENDIX

Table B3.--Acreages by Sample Fields: Missouri

| Sample Field Number | Acreages in Field | | |
|---|---|---|---|
| | Initial Interview | Postharvest Interview | Digitized |
| 2 | 8.0 | 8.0 | 8.6 |
| 3 | 42.0 | 42.0 | 42.1 |
| 4 | 25.0 | 22.6 | 22.6 |
| 8 | 68.0 | 68.0 | 63.4 |
| 11 | 6.0 | 6.0 | 6.0 |
| 24 | 29.5 | 26.0 | 26.0 |
| 26 | 42.0 | 42.0 | 41.0 |
| 31 | 34.0 | 27.0 | 25.3 |
| 36 | 35.0 | 35.0 | 33.0 |
| 37 | 27.0 | 27.0 | 23.4 |
| 44 | 85.0 | 85.0 | 83.6 |
| 47 | 30.0 | 30.0 | 30.4 |
| 56 | 10.0 | 9.0 | 9.7 |
| 82 | 8.0 | 8.0 | 7.4 |
| 85 | 16.0 | 16.0 | 16.6 |
| 87 | 43.0 | 43.0 | 44.3 |
| 88 | 4.0 | 4.0 | 4.0 |
| 90 | 17.0 | 17.0 | 15.5 |
| 91 | 9.0 | 9.0 | 8.4 |
| 94 | 37.5 | 37.5 | 37.5 |
| 95 | 21.0 | 20.0 | 17.8 |
| 96 | 15.0 | 15.0 | 15.0 |
| 102 | 13.0 | 13.0 | 13.0 |
| 106 | 40.0 | 35.0 | 30.8 |
| 109 | 65.0 | 62.0 | 60.6 |
| 117 | 6.0 | 6.0 | 7.4 |
| 129 | 15.0 | 15.0 | 15.4 |
| 139 | 35.0 | 35.0 | 37.3 |
| 150 | 20.0 | 20.0 | 21.5 |
| AVE | 27.793 | 27.003 | 26.469 |