EVALUATION OF GRAIN STOCKS ESTIMATES

by

Clarence Dunkerley

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GENERAL

The Statistical Reporting Service has been trying to improve the accuracy of grain stocks estimates. Introduction of the probability survey was viewed as a likely improvement but there is evidence that it has some operating problems that needed study. This research project was initiated to define problem areas and help develop procedures to correct them. The Indiana, Ohio, and Nebraska State Statistical Offices (SSO's) worked with the Research and Development Branch to complete this project.

Objectives

The primary objective of this research project was to identify and measure the effects of certain problem areas associated with the estimating procedure. Some specific objectives were:

(1) To develop techniques for improving the accuracy of reports from the probability grain stocks survey.

(2) Determine importance of on-farm and off-farm stocks of milled or mixed grains, grains in transit, and high moisture corn relative to our grain stocks estimates.

(3) Compare accuracy and efficiency of various estimation techniques.

(4) Determine the amount of incompleteness in the mill and elevator list.

(5) Test the use of a closed segment questionnaire with a mail survey.

Summary and Conclusions

A review of some of the results and conclusions are outlined in this section. Detailed results are in other sections of the report.

Off-Farm Stocks

The basic assumption of virtual list completeness for mills and elevators is justified. There appears to be a misunderstanding in some states about including seed dealers on the mill and elevator list or even if seed grain should be included in the estimate. The Crop Reporting Board includes seed grain in the Board estimates.

Mills and elevators do report government grain they have in storage. An insignificant amount of milled or mixed grain is included in their reports. Grains in transit are not generally included in a report.

On-Farm Stocks

The average difference between reported stocks and indicated stocks generally was not significant. The average absolute difference between reported stocks and indicated stocks was large. However, it is shown that there are many errors or mistakes in reporting stocks but they tend to be of offsetting magnitudes. Reasons for mistakes in reporting stocks and production are listed in the text. Overall the most frequent error was reporting as on-the-farm grain that was stored off-the-farm. Any attempt to reduce differences must be directed to all reasons, otherwise severe under or over estimates of stocks could occur.

In this study there generally were no significant differences detected between enumerators.

High moisture corn stored in silos is included in farmers' reports. Almost one-third of the unharvested corn is not included in the report.

The weighted direct expansion and the weighted ratio estimators had smaller sampling errors than the open direct expansion and the open ratio estimators, respectively.

The Sample

Ohio, Indiana, and Nebraska were selected for this project. In each state the counties were assigned to one of two strata depending upon how much grain (corn + soybeans + wheat + oats) were harvested. In Ohio, Stratum I included counties with 30 percent or more of the area having grain harvested. Stratum I in Indiana included counties with 45 percent or more of the area harvested and Stratum I in Nebraska included counties with 25 percent or more of the area being harvested for grain. Stratum II in each state included the remaining counties that had less than the amounts listed above.

Within each state 40 primary sampling units (townships) were allocated
to the strata proportional to the amount of grain harvested. The sample
allocation was:

State	:	Stratum I	:	Stratum II
Ohio............:		29		11
Indiana.........:		23		17
Nebraska........:		22		18

A secondary sampling unit (segment) for the on-farm grain storage was
selected from each primary s.u. The primary units were used for check-
ing incompleteness of mill and elevator lists which is discussed on
page 39 of this report. Each sample segment was approximately one square
mile in area and where possible coincided with a mapped land section.
All sampling units were selected with known probability.

ON-FARM GRAIN STOCKS

The Survey

Both Ohio and Indiana were geographically split into two enumerator areas
(EA) with four enumerators assigned to work within each area. Five seg-
ments within each EA were randomly assigned to each enumerator. Nebraska
was split into four EA's with two enumerators per EA. Five segments were
randomly assigned to each enumerator.

This design permits each enumerator's assignment to be treated as a simple
random sample of size five within that particular enumerator area. This
technique is referred to as "interpenetrating subsampling." Travel costs
are increased since each enumerator travels over the entire EA. However,
using this technique, analysis will provide an estimate of error that takes
account of enumerator biases, and differences between enumerators can be
assessed.

Eight enumerators were hired in each state and trained at a central loca-
tion. Enumerators were provided with a county highway map showing the
location and boundaries of each assigned segment. After the training
school they screened both the primary and secondary sampling units.
Screening consisted of identifying and listing each farm operator having
land (tract) in the segment (see Appendix 1). This was done prior to
January 1, 1970 so that the regular January 1 "Farm Grain Stocks Inquiry"
(Appendix 2) could be mailed to these tract operators.

The stocks inquiries were mailed by the SSO December 29, 1969 to the tract operators. Enumerative followup of the nonrespondents began January 19. If the tract operator had returned an "inquiry" by mail the enumerator completed only the "Supplement to Farm Grain Stocks Inquiry" (Appendix 3). If the respondent had not completed and returned the inquiry the enumerator was instructed to begin the interview with the mail inquiry and proceed to the supplement.

The supplement was designed to determine the accuracy of the data reported on the inquiry as well as how the tract operator estimated the production and stocks he reported. Questions on the supplement referred to grain stored on the total farm operation as well as grain stored inside the segment boundaries.

After the enumerator completed the supplement he was directed to measure all storage units containing grain located inside the segment. It was intended that these measurements be accurate enough to enable computation of the volume of grain within the storage unit.

Finally, the enumerator asked the respondent to provide weight information from sales slips when it became available. This was to measure the relationship between the measured grain volume and final weight of the grain.

In summary the survey procedure consisted of the following steps:

- Mailed inquiries to managers of potential grain storage bins in the segment.

- Enumerator followup of nonrespondents.

- Enumerator completed supplement for both respondent and nonrespondents to the mail inquiry.

- Enumerator accounted for all grain storage units in the segment.

- Enumerator measured the grain stored inside the segment.

- Enumerator returned later to evaluate weight bill, receipts, etc.

Summarization

Approximately 600 potential grain storage managers were interviewed. The questionnaires were edited for completeness in the SSO's and forwarded to the Research and Development Branch in Washington, D. C. Here the necessary coding and final editing were completed and the data transferred to ADP cards. Subsequent summarization and analysis were done using the WDPC's computer through the R&D RAX terminal.

Analysis

The characteristics were analyzed assuming univariate, independent, normal distributions for all characteristics recognizing multivariate methods would be more appropriate if the characteristics were not independent.

A. Estimation of differences in grain stocks reports using resident farm operator reports.

The estimator used for this "open expansion" of the difference is:

$$d = \sum_{h=1}^{2} \sum_{j=1}^{n_h} f_h \, d_{hj}$$

where

f_h = segment expansion factor in the hth stratum.

d_{hj} = difference between original report and "true value" for the entire farm with headquarters in the jth segment in the hth stratum.

The variance estimator is

$$V(d) = \sum_{h=1}^{2} A_h \, (A_h - n_h) \, \frac{S_h^2}{n_h}$$

where

A_h = number of sample segments in the population in the hth stratum.

n_h = number of sample segments selected for enumeration in h^{th} stratum.

$$S_h^2 = \sum_{j=1}^{n_h} (d_{hj} - d_{h.})^2 / n_h - 1$$

In the analysis, the deviations of the actual differences $(d_{hj} - d_{h.})$ are assumed to be normally and independently distributed with population mean zero.

The test statistic is

$$t = \frac{(d - \mu d)}{\sqrt{V(d)}}$$

which follows Student's t-distribution with $(n - 1)$ d.f. This distribution was used to test the null hypothesis that $d = 0$.

Tables 1-8 show, by commodity, the expansion for the following items on the inquiry and supplement:

1. Reported stocks from items 7, 9, 13, or 15

2. Reported production from items 24, 26, 30, or 32

3. The differences determined by reported stocks minus indicated stocks (item 36)

4. The differences determined by reported production minus indicated production (item 34)

Stratum I (Grain Stratum)

Tables 1-4 show the open expansions by commodity for the grain producing stratum in each state. The occurrence or nonoccurrence of differences in this stratum is meaningful since it contains most of the grain production.

The hypothesis that the true difference is equal to zero is not rejected for any of the differences for wheat stocks and/or wheat production in Table 1.

In Table 2 the difference in oats production reports for Ohio is significant at the 95 percent level. This difference would indicate that of those farmers reporting they tended to underreport their oats production by about four percent. The remaining differences in this table are not significant.

In Table 3 the only significant difference is with the soybean production report for Ohio. Of those farmers reporting they tended to underreport their soybean production by approximately four percent.

A production difference of less than one percent was significant at the 95 percent level in Indiana (Table 4). No other corn production or corn stocks differences were significant in the grain stratum in any of the three states.

State (All Strata)

Tables 5-8 show the open expansions for the entire state. These include absolute values of the differences which were calculated in addition to the actual differences. Differences from individual farms were summed to a segment total from which estimates and variances were calculated. Since differences were both positive or negative they were offsetting.

The distribution of the absolute differences are nonnormal requiring a different test statistic. A nonparametric method of calculating the $\sigma = 5$ percent rejection region for the population median (M) was used. This was used to test the null hypothesis that M = 0. The null hypothesis is rejected if the sample median $\hat{M}$ = 0 is outside the limits of:

$$\frac{n+1}{2} \pm \frac{Z \sqrt{n}}{2}$$

where

$\hat{M} = d \frac{n+1}{2}$ = the value corresponding to the $\frac{n+1}{2}$ item in the ordered array of the n differences

n = sample size

Z = the normal deviate corresponding to the desired confidence probability

Based on this test, none of the absolute differences calculated for resident farm operator reports were significant. The H_0: M = 0 could not be rejected.

Under the assumption that the indicated production determined by thorough probing is a "true" value, it appears that farmers tend to underreport their wheat production. However, the magnitude of this underreport is less than one percent of the total production.

The hypothesis that the true difference is equal to zero is not rejected for most of the differences in Table 5.

In Table 6 the actual differences reported by farmers tend to be compensating since the actual differences are not significant. When the magnitude of the absolute differences for stocks is considered, it can be noted that almost one-third of the oats stocks were reported incorrectly. The magnitude of the absolute production difference for the three states is considerably smaller.

The magnitude at the three state level of the absolute differences for soybean stocks amounts to slightly more than 10 percent of the total reported stocks (Table 7).

The absolute differences for corn at the three state level are large (Table 8). The magnitude of the absolute stock differences is almost 11 percent of the total reported stocks. However, the magnitude of the production differences is less than 1.4 percent of the total reported production.

Table 1.- Open expansion of reported stocks, production, differences,
and standard errors, Stratum I, wheat

Item	Ohio	Indiana	Nebraska
	Bushels	Bushels	Bushels
Reported stocks........:	559,824	1,240,085	1,225,835
Reported production....:	24,499,026	16,596,152	22,015,304
Difference, stocks.....:	48,448	17,716	1,193,260
Difference, production.:	-389,198	-134,507	-42,861
Standard errors			
Reported stocks........:	304,395	862,168	1,198,288
Reported production....:	4,560,127	3,895,491	5,557,266
Difference, stocks.....:	49,283	18,880	1,202,309
Difference, production..:	272,506	185,649	44,232

Table 2.- Open expansion of reported stocks, production, differences,
and standard errors, Stratum I, oats

Item	Ohio	Indiana	Nebraska
	Bushels	Bushels	Bushels
Reported stocks........:	7,148,757	3,835,080	5,014,778
Reported production....:	20,655,493	8,906,965	9,309,485
Difference, stocks.....:	2,275,975	65,613	1,217,262
Difference, production.:	-803,159**	0	274,313
Standard errors			
Reported stocks........:	2,504,736	2,010,550	2,225,837
Reported production....:	6,166,173	4,563,948	3,727,560
Difference, stocks.....:	1,817,673	84,443	812,262
Difference, production.:	371,072	0	273,435

** Significant at 95 percent level.

Table 3.- Open expansion of reported stocks, production, differences, and standard errors, Stratum I, soybeans

Item	Ohio	Indiana	Nebraska
	Bushels	Bushels	Bushels
Reported stocks........:	10,459,902	40,516,028	3,253,176
Reported production.....:	49,553,050	99,312,493	13,740,492
Difference, stocks.....:	-1,168,133	2,500,541	-621,490
Difference, production.:	-2,146,780**	-229,646	0
Standard errors			
Reported stocks........:	2,606,201	17,652,426	2,368,428
Reported production....:	24,531,338	26.626,529	5,416,422
Difference, stocks.....:	2,287,311	2,482,667	474,490
Difference, production.:	136,253	147,890	0

** Significant at 95 percent level.

Table 4.- Open expansion of reported stocks, production, differences, and standard errors, Stratum I, corn

Item	Ohio	Indiana	Nebraska
	Bushels	Bushels	Bushels
Reported stocks........:	70,941,183	86,468,092	314,278,277
Reported production....:	160,984,297	196,218,957	317,834,912
Difference, stocks.....:	-4,675,222	2,141,608	-7,084,981
Difference, production.:	-4,451,823	763,735**	1,200,118
Standard errors			
Reported stocks........:	18,318,781	48,479,666	103,760,464
Reported production....:	42,563,118	63,309,592	79,468,999
Difference, stocks.....:	6,473,467	18,684,511	8,291,508
Difference, production.:	3,887,559	390,178	1,294,794

** Significant at 95 percent level.

Table 5.- Open expansion of reported stocks, production, differences, and standard errors, for wheat

Item	Ohio	Indiana	Nebraska	3-states
	Bushels	Bushels	Bushels	Bushels
Reported stocks...............:	963,780	1,798,456	5,076,035	7,837,803
Reported production..........:	26,746,928	22,466,486	25,865,504	75,078,918
Difference, stocks...........:	-50,690	17,715	1,193,260	1,160,285
Absolute difference, stocks.:	272,085	17,715	1,206,976	1,496,776
Difference, production......:	-389,198	-134,507	-42,861	-566,566*
Absolute difference, prod...:	507,626	223,740	42,861	774,277
Standard errors				
Reported stocks...............:	397,646	951,510	4,031,842	4,161,639
Reported production..........:	4,780,346	4,890,154	6,772,977	9,624,891
Difference, stocks...........:	165,039	17,787	1,199,762	1,211,191
Absolute difference, stocks.:	152,333	17,787	1,199,109	1,208,877
Difference production.......:	272,335	184,230	42,905	331,584
Absolute difference, prod...:	265,299	180,242	42,905	323,591

* Significant at 90 percent level.
** Significant at 95 percent level.

Table 6.- Open expansion of reported stocks, production, differences,
and standard errors, for oats

Item	Ohio	Indiana	Nebraska	3-states
	Bushels	Bushels	Bushels	Bushels
Reported stocks..............:	9,004,716	8,177,960	16,244,528	33,427,204
Reported production..........:	27,201,047	18,089,055	22,143,485	67,433,587
Difference, stocks...........:	1,941,671	211,786	-3,595,488	-1,442,031
Absolute difference, stocks.:	3,579,734	623,984	6,201,458	10,405,176
Difference, production.......:	-803,159**	0	274,313	-528,846
Absolute difference, prod...:	803,159	0	274,313	1,077,472
Standard errors				
Reported stocks..............:	2,684,030	3,261,458	11,452,162	12,206,274
Reported production..........:	6,983,351	7,379,558	13,361,282	16,785,379
Difference, stocks...........:	1,831,925	260,283	4,879,971	5,218,986
Absolute difference, stocks.:	1,859,256	500,451	4,877,793	5,263,093
Difference, production.......:	371,978	0	274,166	462,098
Absolute difference, prod...:	371,978	0	274,166	462,098

* Significant at 90 percent level.
** Significant at 95 percent level.

Table 7.- Open expansion of reported stocks, production, differences,
and standard errors, for soybeans

Item	Ohio	Indiana	Nebraska	3-states
	Bushels	Bushels	Bushels	Bushels
Reported stocks...............:	10,517,540	40,627,702	4,857,426	56,002,668
Reported production..........:	49,610,689	116,612,047	17,093,374	183,316,110
Difference, stocks...........:	-371,433	2,425,406	-589,405	1,464,568
Absolute difference, stocks..:	1,168,133	4,235,160	653,575	6,056,868
Difference, production.......:	-1,839,944	-280,519*	---	-2,120,463
Absolute difference, prod...:	2,146,780	332,634	---	2,479,414
Standard errors				
Reported stocks...............:	2,605,659	17,640,607	2,860,319	18,059,953
Reported production..........:	8,172,410	27,385,856	6,366,474	29,279,777
Difference, stocks...........:	714,569	2,484,298	476,818	2,628,631
Absolute difference, stocks..:	689,228	2,388,550	476,818	2,531,316
Difference, production.......:	1,319,868	164,103	---	1,330,031
Absolute difference, prod...:	1,303,243	162,582	---	1,313,345

* Significant at 90 percent level.
** Significant at 95 percent level.

Table 8.- Open expansion of reported stocks, production, differences,
and standard errors, for corn

Item	Ohio	Indiana	Nebraska	3-states
	Bushels	Bushels	Bushels	Bushels
Reported stocks...............:	80,947,227	261,940,829	346,363,277	689,251,333
Reported production..........:	177,563,435	466,443,820	354,732,662	998,739,917
Difference, stocks...........:	-5,774,965	4,295,928	-13,020,706	-14,499,743
Absolute difference, stocks.:	21,970,945	36,528,636	23,281,713	74,839,439
Difference, production......:	-6,231,701	887,818*	1,200,118	-4,143,765
Absolute difference, prod...:	10,269,026	1,970,580	1,371,563	13,611,138
Standard errors				
Reported stocks...............:	19,198,723	74,138,204	108,542,715	132,840,451
Reported production.........:	43,578,090	102,958,024	87,566,562	142,011,610
Difference, stocks...........:	6,611,248	19,058,952	9,239,576	22,188,331
Absolute difference, stocks.:	6,125,554	17,962,306	8,648,049	20,855,589
Difference, production......:	4,260,581	482,356	1,292,004	4,478,224
Absolute difference, prod...:	5,214,824	1,126,038	1,283,867	5,487,319

* Significant at 90 percent level.
** Significant at 95 percent level.

B. __Estimation of differences in grain stocks reports using a weighted
farm unit difference.__

The weighted farm unit differences that follow in Tables 9-16 were based
on reports from each farm that had land in the segment, regardless of
where the farm headquarters was located. The total farm report was pro-
rated to a tract value using the ratio of tract acreage (land inside the
segment) to total farm acreage.

$$\text{Weighted difference} = \frac{\text{Tract acreage}}{\text{Total farm acreage}} \times \text{Reported difference}$$

The weighted differences were expanded by the segment expansion factors to
stratum totals.

The estimator used for this weighted expansion of the difference is:

$$d_w = \sum_{h=1}^{2} \sum_{j=1}^{n_h} f_h \, d_{hj}{}^*$$

where

$$f_h = \text{segment expansion factor in the } h^{th} \text{ stratum}$$

$$d_{hj}{}^* = \sum_{k=1}^{M} d_{hji} \, \frac{a_{hjk}}{a_{hk}}$$

where

M = total number of k tracts in segment j

a_{hjk} = tract acreage of kth farm

a_{hk} = total acreage of kth farm

d_{hjk} = difference between original report and true value for
total farm report

The variance estimator used is

$$V\,(d_w) = \sum_{n=1}^{2} A_n \, (A_n - n_h) \, \frac{S_h^2}{n_h}$$

where

A_h = number of sample segments in population in h^{th} stratum

n_h = number of sample segments selected for enumeration in h^{th} stratum

$$S_h^2 = \sum_{j=1}^{n_h} (d_{hj}^* - d_{h.}^*)^2 / (n_h - 1)$$

In the analysis the deviations of the actual differences $(d_{hj}^* - d_{h.})$ are assumed to be normally and independently distributed with population mean zero.

The test statistic used is:

$$t = \frac{d_w - dw}{\sqrt{V(d_w)}}$$

which follows Student's t-distribution with $(n - 1)$ df. This distribution was used to test the null hypothesis that dw = 0.

Stratum I (Grain Stratum)

The weighted expansions of stocks, production, differences, and standard errors for Stratum I, the grain producing stratum, are shown in Tables 9-12.

In Table 9 it can be seen that a significant difference was detected in Ohio for reports of wheat production. The estimate of total production was underreported by about 3.5 percent. None of the other differences were significant.

Oat production was underreported in Ohio by approximately 4.5 percent. No other differences in Table 10 were significant.

Soybean production differences in Ohio and stocks differences in Indiana were significant (see Table 11). In Ohio the soybean production was under-reported by 5.3 percent. The stocks in Indiana were overreported by 17.9 percent.

There were no significant differences for the weighted expansions of corn production and stocks reports (see Table 12).

State (All Strata)

Tables 13-16 show the weighted expansions for the entire state. Absolute values for the differences are shown in addition to the actual differences.

The t-test statistic was not used with the absolute differences because of their nonnormal distribution. The test used was the population median as outlined in the previous section. Again none of the absolute differences could be considered significant using this test.

The results of the weighted expansion of differences for wheat shown in Table 13 are quite similar to the open expansions.

The absolute differences for oats stocks and production are about 14 percent of the total reported stocks for the combined 3-state total (see Table 14). Production differences are significant at the 90 percent level, and the magnitude would indicate that farmers tend to underreport the amount of oats produced by about 1.4 percent. Although reported stock differences are not significant, the large absolute stock differences indicate that as much as 25 percent of the total stocks were reported incorrectly.

The production differences for soybean stocks are significant at the 95 percent level (see Table 15). The magnitude of the absolute stock difference indicates that more than 21 percent of the total stocks are reported incorrectly. The production differences show that farmers underestimate soybean production by about 2.6 percent.

The absolute differences for corn stocks and production are not significant at the 95 percent level (see Table 16). The magnitude of the absolute differences in reporting stocks amounts to almost 18 percent of the total stocks reported. The magnitude of the absolute differences in reporting production is about four percent of the total reported.

Table 9.--Weighted expansion of reported stocks, production, differences, and standard errors, stratum I, wheat

Item	Ohio	Indiana	Nebraska
	Bushels	Bushels	Bushels
Reported stocks	668,581	499,315	2,287,082
Reported production	21,016,160	14,167,815	20,478,296
Difference, stocks	2,692	-5,249	1,619,301
Difference production	-745,021*	-29,526	-1,001,241
Standard errors			
Reported stocks	260,910	371,299	2,219,647
Reported production	2,307,604	2,123,955	5,319,915
Difference, stocks	84,071	9,440	1,620,503
Difference production	417,456	91,251	936,916

** Significant at 95 percent level.
* Significant at 90 percent level.

Table 10.--Weighted expansion of reported stocks, production, differences, and standard errors, stratum I, oats

Item	Ohio	Indiana	Nebraska
	Bushels	Bushels	Bushels
Reported stocks	6,953,889	2,872,537	5,833,430
Reported production	17,493,460	9,183,852	10,098,991
Difference, stocks	1,268,258	74,799	941,235
Difference production	-805,850**	-5,905	213,450
Standard errors			
Reported stocks	1,710,410	1,821,558	1,821,558
Reported production	3,841,175	3,554,652	3,554,652
Difference, stocks	1,188,590	56,295	703,692
Difference, production	318,890	8,042	213,118

** Significant at 95 percent level.

Table 11.--Weighted expansion of reported stocks, production, differences, and standard errors, stratum I, soybeans

Item	Ohio	Indiana	Nebraska
Reported stocks	10,462,055	20,181,247	2,557,965
Reported production	48,887,161	68,411,394	17,920,330
Difference, stocks	-1,789,342	3,059,534**	-158,587
Difference, production	-2,732,462**	-175,187	-179,160
Standard errors			
Reported stocks	2,687,373	5,264,262	1,234,478
Reported production	6,169,072	9,927,523	5,923,080
Difference, stocks	1,124,812	1,331,012	233,224
Difference, production	1,034,943	670,226	193,013

** Significant at 95 percent level.

Table 12.--Weighted expansion of reported stocks, production, differences, and standard errors, stratum I, corn

Item	Ohio	Indiana	Nebraska
Reported stocks	61,520,220	109,346,033	206,247,102
Reported production	126,717,636	210,227,989	248,618,118
Difference, stocks	-978,109	1,742,681	-15,910,990
Difference, production	-4,569,175	341,844	-3,922,671
Standard errors			
Reported stocks	11,914,890	16,507,064	38,534,201
Reported production	20,895,992	21,849,990	33,986,337
Difference, stocks	3,928,145	5,443,618	14,508,129
Difference, production	3,887,559	1,859,640	3,092,226

Table 13.- Weighted expansion of reported stocks, production,
differences, and standard errors, for wheat

Item	Ohio	Indiana	Nebraska	3-states
	Bushels	Bushels	Bushels	Bushels
Reported stocks..............:	1,143,522	994,403	19,385,178	21,523,103
Reported production.........:	25,219,160	23,687,409	43,399,820	92,306,389
Difference, stocks..........:	-103,363	-496,615	1,847,105	1,247,127
Absolute difference, stocks.:	373,227	505,145	2,197,909	3,076,281
Difference, production......:	-756,548*	-241,707	-1,001,241	-1,999,496*
Absolute difference, prod...:	1,178,045	459,335	1,001,241	2,638,621
Standard errors				
Reported stocks..............:	339,927	484,381	1,093,084	1,094,685
Reported production.........:	2,939,000	3,460,000	12,476,000	13,276,000
Difference, stocks..........:	171,112	491,319	1,636,890	1,717,580
Absolute difference, stocks.:	159,321	491,309	1,718,137	1,794,091
Difference, production......:	416,000	213,600	936,200	1,046,400
Absolute difference, prod...:	406,000	208,200	936,200	1,041,000

* Significant at 90 percent level.
** Significant at 95 percent level.

Table 14.- Weighted expansion of reported stocks, production, differences, and standard errors, for oats

Item	Ohio	Indiana	Nebraska	3-states
	Bushels	Bushels	Bushels	Bushels
Reported stocks............:	9,978,757	7,147,172	14,862,149	31,988,078
Reported production........:	24,274,053	16,438,944	23,122,293	63,835,290
Difference, stocks.........:	721,845	523,977	-1,465,140	-219,318
Absolute difference, stocks:	3,526,292	616,213	3,966,528	8,109,033
Difference, production.....:	-1,052,543**	-53,056	213,450	-892,149*
Absolute difference, prod..:	1,108,527	133,710	213,450	1,455,687
Standard errors				
Reported stocks............:	2,760,000	2,310,000	5,600,000	6,660,000
Reported production........:	5,500,000	4,000,000	8,200,000	10,660,000
Difference, stocks.........:	1,230,000	350,000	2,506,000	2,989,000
Absolute difference, stocks:	1,400,000	419,000	2,513,000	2,910,000
Difference, production.....:	403,000	99,000	213,200	466,500
Absolute difference, prod..:	398,000	94,500	213,200	461,300

* Significant at 90 percent level.
** Significant at 95 percent level.

Table 15.- Weighted expansion of reported stocks, production,
differences, and standard errors, for soybeans

Item	Ohio	Indiana	Nebraska	3-states
	Bushels	Bushels	Bushels	Bushels
Reported stocks.............:	10,519,693	22,218,678	3,642,438	36,380,809
Reported production.........:	50,224,374	92,224,029	19,855,056	162,303,459
Difference, stocks..........:	-1,789,342	4,070,804**	-142,545	2,138,917
Absolute difference, stocks.:	3,135,656	4,300,244	450,910	7,886,810
Difference, production......:	-2,732,462**	-1,380,026	-179,160	-4,291,648**
Absolute difference, prod...:	3,767,632	2,629,484	206,592	6,603,708
Standard errors				
Reported stocks.............:	2,687,709	5,457,867	1,487,946	6,263,073
Reported production.........:	6,277,000	11,688,000	6,107,000	14,605,000
Difference, stocks..........:	1,122,850	1,684,884	234,672	2,038,307
Absolute difference, stocks.:	1,169,651	1,681,975	217,457	2,060,197
Difference, production......:	1,062,000	1,184,000	193,900	1,612,000
Absolute difference, prod...:	1,075,800	1,279,000	192,600	1,682,000

* Significant at 90 percent level.
** Significant at 95 percent level.

Table 16.- Weighted expansion of reported stocks, production, differences, and standard errors, for corn

Item	Ohio	Indiana	Nebraska	3-states
	Bushels	Bushels	Bushels	Bushels
Reported stocks............:	78,924,742	228,117,610	271,341,150	578,383,502
Reported production.........:	156,055,632	427,793,894	333,325,726	917,175,252
Difference, stocks..........:	1,036,933	12,041,512	-29,537,490	-16,459,045
Absolute difference, stocks.:	19,327,676	40,984,658	43,004,852	103,317,186
Difference, production......:	2,660,188	-4,359,629	-3,152,631	-4,852,072
Absolute difference, prod...:	12,584,520	15,600,312	9,111,658	37,296,490
Standard errors				
Reported stocks............:	13,850,000	32,652,000	46,390,000	58,395,000
Reported production.........:	23,858,000	57,886,000	45,000,000	77,103,000
Difference, stocks..........:	4,243,683	10,120,697	18,764,000	21,737,000
Absolute difference, stocks.:	4,368,400	15,314,881	18,081,783	24,095,222
Difference, production......:	3,204,000	9,116,000	3,703,000	10,348,000
Absolute difference, prod...:	4,928,000	8,595,000	3,490,000	10,505,000

* Significant at 90 percent level.
** Significant at 95 percent level.

C. Basis for Reporter Data.

Methods used by farm operators to estimate production are summarized in Tables 17 and 18. Both tables are from data reported in item 34 of the supplement (see Appendix 3). Table 17 shows the open expansion of production using only resident farm operators. Table 18 shows the weighted expansion of production using total farm production data from all farms and prorating it to a tract value. It is prorated using the ratio of tract acreage to total farm acreage.

$$\text{Weighted production} = \frac{\text{Tract acreage}}{\text{Total farm acreage}} \times \text{total farm production}$$

The weighted production is expanded by the segment expansion factor.

Proportions of grain by method estimated for both the open and weighted expansions of production are approximately the same. These production estimates were made at the time of the January 1 grain stocks report. At this time of year, virtually all of the grains have been harvested and some have been marketed. As a result, farmer reports of production will be influenced more by bin capacity and scale weights of grain sold than by field observations or wagonloads.

A comparison of the findings of this study with a similar question in the "1965 Level of Corn Yield Project," [1] is shown for corn data in Table 19. The most apparent change from 1965 is the increase of production estimates based on scale weights and the corresponding decrease based on wagonloads. It should be noted that comparisons between 1965 and 1970 may have limited validity because (1) the 1965 data are percentages of respondents interviewed in each category, and (2) the 1965 interviews were made nearer to harvest-time. Whereas the 1970 data are percentages of production in each category.

From Tables 17 and 18, approximately three-fourths of the wheat, soybeans, corn, and over one-half of the oats production is estimated for the January 1 grain stocks survey based on the reporters knowledge of crib or bin capacity, or scale weights. The two cash grain crops, wheat and soybeans, have a greater amount of production based on scale weights.

Methods used by farm operators to estimate stocks on hand are summarized in Table 20. The data for this table are from responses to Item 39 of the supplemental questionnaire (see Appendix 3). The stocks reported are for those located only inside the sample segment boundaries.

Wheat was not included in Table 20 because of insufficient data in the sample. The most common method of estimating stocks is by observing crib or bin capacity. Scale weights are not as important in estimating stocks still on hand compared to estimating production. One reason would be that production estimates can be made from grain sold but stocks have not been sold and weighed.

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[1] Report of subcommittee to the Planning Committee, 1965 Level of Corn Yield Project, SRS, USDA, 1966.

Table 17.- Open expansion of production, percentage by kind of grain
and by method estimated

State	Kind of grain	Method				
		By field observation	By number of loads hauled	Estimated from bin capacity	By scale weight	Other
		Percent	Percent	Percent	Percent	Percent
Ohio......:	Wheat	-	7.8	2.4	88.8	0.9
:	Oats	4.7	10.0	48.9	35.4	1.0
:	Soybeans	2.0	4.7	11.4	79.9	2.0
:	Corn	7.1	9.0	60.6	23.2	-
Indiana...:	Wheat	7.9	0.9	3.7	87.4	-
:	Oats	8.5	36.7	34.8	19.9	-
:	Soybeans	7.5	1.2	40.1	51.2	-
:	Corn	15.1	7.8	50.3	26.9	-
Nebraska..:	Wheat	12.4	-	-	67.0	20.5
:	Oats	20.7	54.0	16.3	9.0	-
:	Soybeans	40.0	7.2	13.1	37.8	1.9
:	Corn	5.3	34.5	42.8	17.4	-
3-states..:	Wheat	8.4	2.1	1.4	76.8	11.1
:	Oats	10.7	30.7	35.0	23.1	0.4
:	Soybeans	10.0	3.2	26.7	59.2	0.9
:	Corn	9.6	18.5	49.5	22.4	-

Table 18.- Weighted expansion of production, percentage by kind of
grain and by method estimated

State	Kind of grain	Method				
		By field observation	By number of loads hauled	Estimated from bin capacity	By scale weight	Other
		Percent	Percent	Percent	Percent	Percent
Ohio......:	Wheat	2.3	5.4	3.5	87.5	1.2
:	Oats	7.1	9.3	47.3	34.0	2.6
:	Soybeans	6.7	2.9	13.8	75.8	0.9
:	Corn	8.4	7.7	51.6	31.1	1.3
Indiana...:	Wheat	7.9	1.5	2.4	87.3	-
:	Oats	7.7	26.2	31.4	34.8	-
:	Soybeans	7.7	0.3	18.7	71.2	2.1
:	Corn	11.0	8.5	43.1	36.9	1.4
Nebraska..:	Wheat	17.8	0.2	7.0	67.8	7.3
:	Oats	14.0	45.0	30.6	6.8	3.6
:	Soybeans	19.1	4.3	11.3	64.3	1.5
:	Corn	5.1	10.3	60.3	21.3	3.0
3-states..:	Wheat	11.8	1.8	5.1	77.0	4.2
:	Oats	9.4	24.9	37.9	25.7	2.4
:	Soybeans	8.9	1.7	16.0	71.8	1.6
:	Corn	8.2	9.0	51.6	29.6	2.0

Table 19.- Comparison of methods of estimating corn production, 1965 and 1970

Survey	Field obser- vations	Wagon- loads	Crib or bin capacity	Scale weights	Other
	Percent	Percent	Percent	Percent	Percent
1965					
3-states*..........	7.4	32.9	39.9	5.7	9.4
5-states*..........	8.8	33.4	30.6	8.3	13.4
1970*- 3-states					
Open production....	9.6	18.5	49.5	22.4	0.9
Weighted production:	8.2	9.0	51.6	29.6	2.0

* 1965 - 3-states - Iowa, Indiana, and Nebraska.
* 1965 - 5-states - Indiana, Iowa, Nebraska, Georgia, and Kentucky.
* 1970 - 3-states - Ohio, Indiana, and Nebraska

Table 20.- Farm stocks reported, percentage by kind of grain, and method of estimating amount on hand

State	Kind of grain	Methods					
		Field obser- vations	Wagon- loads	Crib or bin capacity	Scale weights	CCC measure- ments	Other
		Percent	Percent	Percent	Percent	Percent	Percent
Ohio.....:	Oats	5.0	13.2	69.0	3.7	-	9.0
	Soybeans	-	1.3	64.1	7.8	7.0	19.8
	Corn	1.0	6.0	88.3	2.9	-	1.7
Indiana..:	Oats	-	5.3	94.7	0	-	-
	Soybeans	1.2	0.3	86.0	7.9	4.6	0.1
	Corn	-	2.2	95.7	1.6	-	0.4
Nebraska.:	Oats	-	67.0	33.0	-	-	-
	Soybeans	-	41.0	19.5	0.8	39.1	-
	Corn	-	8.7	62.9	0.8	27.2	0.5
3-states.:	Oats	2.1	28.0	64.4	1.6	-	3.8
	Soybeans	0.6	6.1	69.6	6.9	10.0	6.8
	Corn	0.2	5.5	81.4	1.6	10.6	0.7

D. Reasons for Production Estimate Differences.

The reasons for respondents making incorrect production reports are summarized in Table 21. A reason for every difference the enumerator observed, between the initial report and what was determined by item 34, was recorded on the supplemental questionnaire. The differences by reason are summarized and the percentages of the total production differences are shown.

Table 21.- Percentage distribution of weighted production differences, by reason for difference, 3-state totals, by crops

Reason	Crop			
	Wheat	Oats	Soybeans	Corn
	Percent	Percent	Percent	Percent
1	1.3	1.3	2.2	21.4
2	1.6	31.7	2.6	1.8
3	62.0	-	25.6	14.2
4	14.5	31.3	31.3	9.9
5	5.9	2.9	2.1	26.0
6	-	7.5	20.9	0.5
7	12.7	13.7	8.7	5.5
8	-	10.3	1.8	-
9	1.6	1.3	1.3	6.0
10	0.3	-	3.7	0.4
Others	-	-	-	14.4

The reasons for the incorrect production reports follow:

1. The respondent did not include the landlord's share of production.

2. Respondent rounded the reported data.

3. Respondent forgot to include some production.

4. Respondent did not report any production.

5. Respondent overestimated his production.

6. Respondent made a mistake in completing the inquiry.

7. Respondent underestimated his production.

8. Respondent reported stocks instead of production.

9. Respondent included production from land rented out.

10. Respondent reported sales not production.

For wheat, it can be seen that failure to include all of the production was the most significant reason for incorrect reports. Much of this was wheat kept for seed and production from farm units not contiguous with the headquarters unit.

Rounding and failure to report any production were the two primary reasons for incorrect reports of oats production.

Failure to report some or all production and making mistakes in completing the inquiry were the leading reasons for incorrect reports of soybean production.

Twenty-six percent of the corn production difference was due to respondents overestimating their production. Not including the landlord's share of production and forgetting to include some production were also important reasons for the differences. Of the 14.4 percent other reasons, 12.0 percent was due to not including production of special purpose corn (waxey maize).

Figure 1 shows the percentage of incorrect production reports by reason for being incorrect. Each reason was classified as either positive, negative, or both. Reasons 2 and 6 as shown can be both positive or negative and their total magnitudes are the sums of the two directions. Of the ten reasons for incorrect production reports, six cause downward biased estimates, two upward biased, and two can go in either direction. Figure 1 shows the percentage of respondents by reason, not the percentage of production differences for each reason as in Table 21.
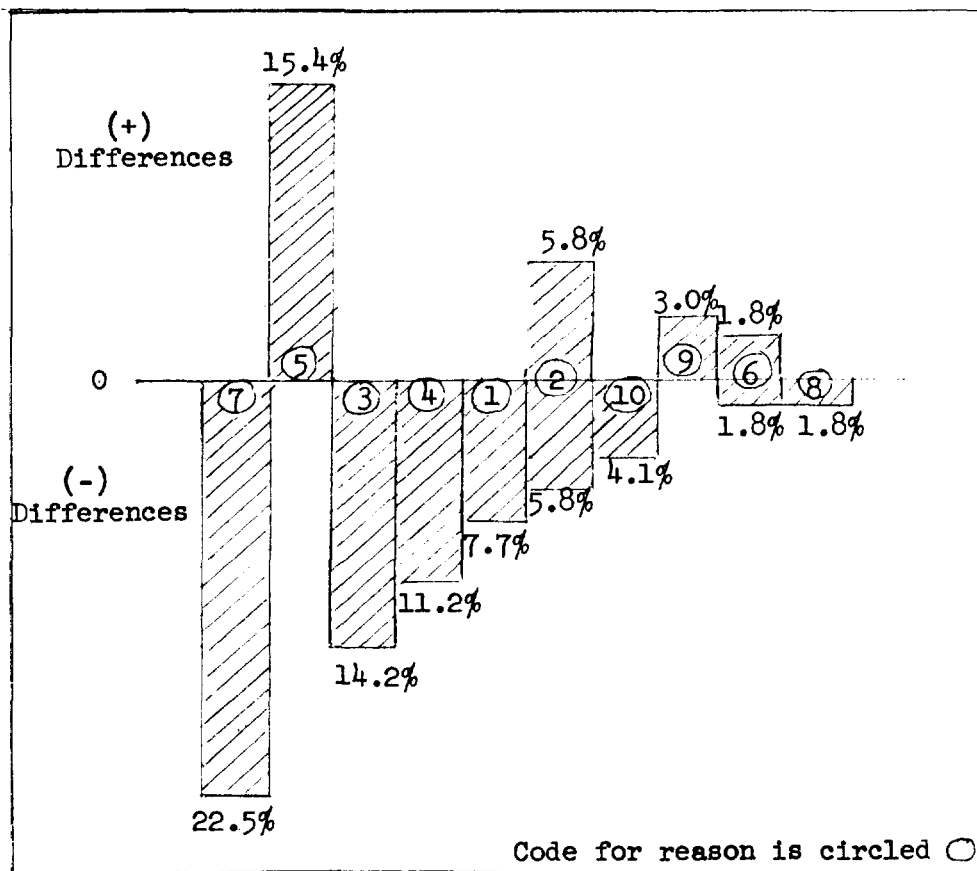
Figure 1.- Percentage of reporters that gave incorrect
production reports, by reason for difference,
all grains, 3-states

E. Reasons for Farm Stocks Estimate Differences

The reasons for respondents making incorrect estimates of stocks are summarized in Table 22. A reason for every difference the enumerator observed, between the initial report and what was determined from item 36 on the supplemental questionnaire, was recorded. The differences by reason are summarized and the percentage of the total stock differences are shown.

Table 22.- Percentage distribution of weighted stock differences, by reason for difference, 3-state totals, by crop

Reason	Crop			
	Wheat	Oats	Soybeans	Corn
	Percent	Percent	Percent	Percent
1	0.8	4.5	-	19.2
2	30.5	7.8	-	-
3	10.7	3.7	8.5	10.9
4	15.1	16.8	49.7	20.3
5	-	14.5	1.0	5.5
6	-	1.4	1.3	4.9
7	5.4	5.8	13.2	9.6
8	--	-	-	6.9
9	--	-	7.0	-
10	5.8	-	-	-
11	0.2	1.8	-	2.0
12	-	4.8	-	-
13	-	3.0	-	1.3
14	-	10.4	4.2	1.3
15	-	7.2	-	-
16	-	8.4	1.2	-
17	21.2	4.2	1.9	-
18	-	-	-	2.5
19	-	-	11.3	2.8
20	2.0	4.4	-	-
21	-	-	-	1.2
22	-	-	-	1.0
23	-	-	-	5.7
Other	3.6	1.3	0.9	4.9

The reasons for incorrect stock reports are:

1. Did not include previous year's crop.

2. Did not understand question.

3. Reported production instead of stocks.

4. Grain stored off-the-farm reported as on-the-farm.

5. Respondent overestimated stocks.

6. Landlord's share of stocks not reported.

7. Respondent underestimated stocks.

8. Did not include CCC grain stored on farm.

9. Did not include reseal grain.

10. Did not include purchased grain.

11. Underestimated amount fed since harvest.

12. Rounding.

13. Did not allow for any grain fed.

14. Stocks were sold before January 1.

15. Underestimated production.

16. Failed to consider all of the production.

17. Did not include grain kept for seed.

18. Did not include stocks from land rented in.

19. Did not include unharvested grain.

20. Did not report any grain on hand.

21. Reported only shelled corn.

22. Did not include special purpose corn (waxey maize).

23. Included stocks on land rented out.

24. Did not include grain belonging to someone else but stored on respondent's farm.

For wheat it can be seen that 30.5 percent of the stocks difference occurred because the reporters did not understand the question. Failure to report wheat stored for seed purposes was cause for another 21.2 percent of the difference. About 15 percent of the difference resulted from reporting grain stored off-farm as being on-farm at the time of the report. Reporting production as stocks accounted for 10.7 percent of the stocks difference.

In oats the most significant reason, 16.8 percent, was due to including off-farm storage in the on-farm report. Overestimation of stocks accounted for 14.5 percent of the difference and 10.4 percent of the difference was from stocks included in the January 1 report that had already been sold and removed from the farm.

Almost 50 percent of the difference in soybean stocks reports was because off-farm stocks were included in the on-farm stocks report. In addition, 13.2 percent was due to underestimating stocks on hand and 11.3 percent because unharvested grain was not included.

For corn stocks difference it was found that 20.3 percent was due to off-farm stored corn being reported as on-farm. Not including previous year's corn stored accounted for 19.2 percent of the stocks difference. Almost 11 percent of the difference was due to reporting production instead of stocks.

Overall, it appears that the most serious error in reporting stocks is the tendency of respondents to include in the on-farm report grain that is stored off-farm. Much of this off-farm storage is in commercial mills and elevators. Respondents tend to underestimate stocks on hand January 1 and many report production for stocks. As was shown in Tables 1-16, the observed differences of reported stocks are compensating; i.e., the over-reports and underreports cancel each other. This must be kept in mind if an attempt is made to eliminate or reduce differences. If only reasons causing negative biases are eliminated an overestimate of stocks would result and conversely an underestimate would result. Any attempt to reduce differences must be directed to all of the reasons.

Figure 2 shows the percentage of incorrect stocks reports by reason for
being incorrect. Each reason was classified as either positive, negative,
or both and the total magnitude is the sum of the two directions. Of the
thirteen reasons shown, seven are downward biased, five are upward biased,
and one (No. 12) can be either positive or negative. Figure 2 shows the
percentage of respondents by reason not the percentage of stock differences
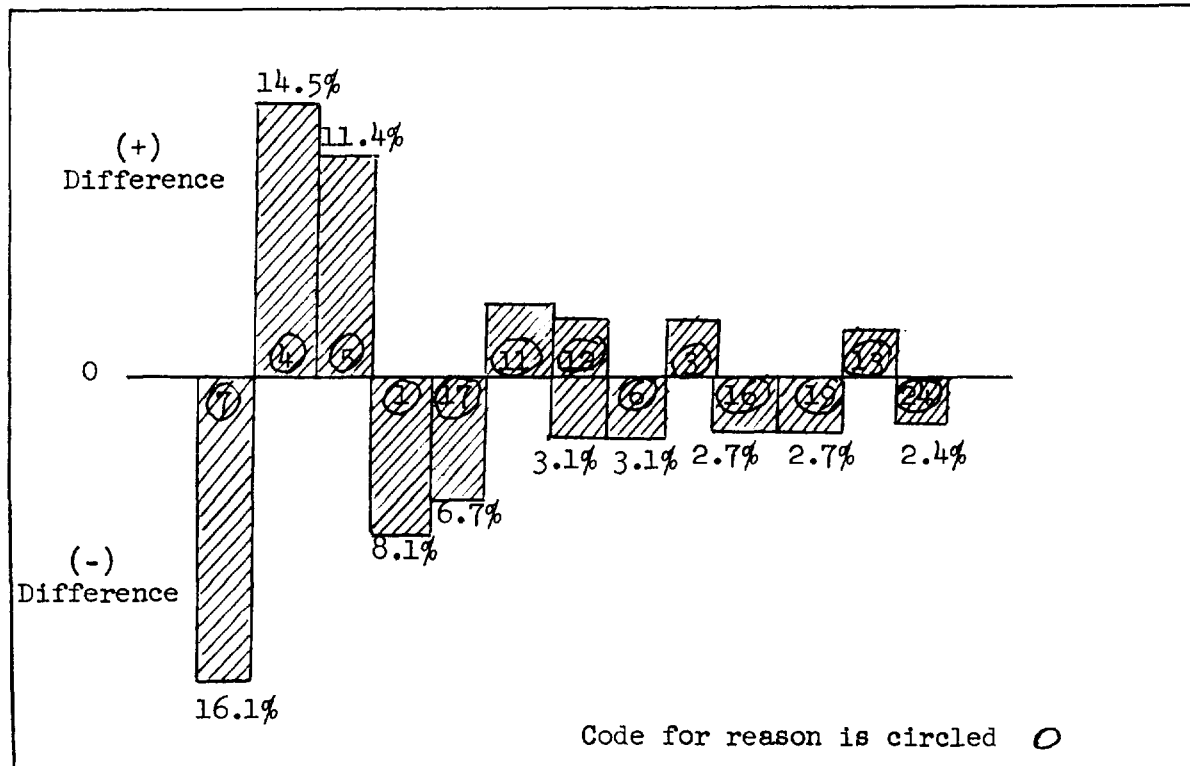for each reason as in Table 22.

Figure 2.- Percentage of reporters that gave biased stocks reports,
by reason for bias, all grains, 3-states

F. Enumerator Effect

Utilizing the interpenetrating subsample technique made it possible to analyze a single effect analysis of variance for each enumerator area. A separate AOV was calculated for both the observed and absolute differences for each crop.

Twenty-four AOV's were calculated and only one showed a significant difference ($\sigma = .05$) between enumerators. This was for absolute differences of oats in Nebraska. This was due to one large difference in one enumerator area with little oats production.

Since enumerator areas and strata were overlapping, the model is:

$$d_{ehj} = \mu + \alpha_h + \beta_e + \varepsilon_{ehj}$$

where d_{ehj} is the difference found in segment j which is in the hth stratum and enumerated by l^{th} enumerator e. By adjusting d_{ehj} for stratum effect the model becomes:

$$d^*_{ej} = \mu + \beta_e + \varepsilon_{ej}$$

The analysis of the single effect AOV for each enumerator area tested the H_0: $\beta_e = 0$. If the H_0: $\beta_e = 0$ was not rejected then it was assumed that estimates of reporting error in this study were not biased by enumerator effect.

G. Evaluation of High Moisture Corn

High moisture corn is supposed to be included in the on-farm stocks report. In this study, five farmers reported high moisture corn on hand and all five had included it in the January 1 grain stocks report.

The 3-state estimate for high moisture corn is 15,091,589 bushels with an average moisture content of 24.7 percent. The standard error of the estimate is 8,875,176 bushels. The estimate is 2.6 percent of the reported stocks for the 3-states.

H. Grain Not Yet Harvested

Grain not yet harvested is supposed to be included in the on-farm stocks report. In this study, eight farmers reported unharvested soybeans on the supplement with six not including them in their initial report. Eighteen farmers had unharvested corn January 1 but eight did not report it.

The 3-state estimate of unharvested corn is 9,989,108 bushels with an estimate of standard error of 4,353,330 bushels. The 3-state estimate of unharvested corn not included in the report is 2,955,979 bushels which is 29.6 percent of the total unharvested corn. The estimated standard error of the unharvested corn not included is 1,937,934 bushels. About 0.3 percent of the total stocks would be unharvested corn not included in the January 1 report.

The 3-state estimate of soybeans not yet harvested is 1,528,216 bushels. Of this estimate, 1,415,626 bushels (92.6 percent) were not included in the January 1 report. About 3.7 percent of the total soybean stocks as of January 1 were not included because they were unharvested. The standard error of the estimate is 2,464,765 bushels.

I. Comparison of Reported Grain in Storage with Comparable Measured and Weighted Data

One procedure proposed to assess accuracy of reports was to measure the volume of grain in a storage unit. Next, a weight slip was to be obtained when the grain was sold and this amount treated as a true value for that unit.

Bitter cold and snowy weather during the survey caused many problems for enumerators in measuring storage units. Many units were not measured. For those that were measured only fifteen weight slips were obtained later in the summer. Farmers said they either had lost the weight slips, not sold the grain yet, fed the grain, or just didn't want to cooperate.

No inferences will be made about accuracy of bin measurements due to sample selectivity. Looking at the fifteen completed returns it can be seen that the average difference between the weighed grain and the measured volume is:

$$\hat{A} = \frac{1}{n} \sum_{1}^{15} (measured - weighed)$$

$$\hat{A} = 316 \text{ bushels.}$$

The average difference between the reported grain and weighed grain for the same fifteen returns is:

$$\hat{C} = \frac{1}{n} \sum_{1}^{15} (reported - weighed)$$

$$\hat{C} = -31 \text{ bushels.}$$

The average absolute differences were:

$$\hat{A} = \frac{1}{n} \sum_1^{15} (\text{measured} - \text{weighed})$$

$$\hat{A} = 484 \text{ bushels.}$$

$$\hat{C} = \frac{1}{n} \sum_1^{15} (\text{reported} - \text{weighed})$$

$$\hat{C} = 186.$$

Considering weighed grain as a true value, it appears that the farmers reported more accurately than the enumerators can measure the grain.

J. Comparison of Estimators

Four estimators of on-farm stocks were calculated for each crop.

$\hat{S}_1$ = the direct expansion of total farm stocks for those farms with headquarters inside the sample segment.

$\hat{S}_2$ = the direct expansion of prorated farm stocks for all farms with land inside the sample segment. Total farm stocks were prorated by multiplying by the ratio of

$$\frac{\text{acres of farm inside segment}}{\text{total farm acres operated}}$$

$\hat{S}_3 = \hat{R} \cdot X$ where:

$$\hat{R} = \frac{\hat{S}_1 \text{ reported}}{\text{open direct expansion of reported production}}$$

$X = 1969$ Board production.

$\hat{S}_4 = \hat{R} \cdot X$ where:

$$\hat{R} = \frac{\hat{S}_2 \text{ reported}}{\text{weighted direct expansion of production}}$$

$X = 1969$ Board production.

The estimates are summarized by crops in Table 23. The estimates are for stocks as reported on the initial interview and for adjusted reports based on the adjustments made using the supplemental questionnaire. The adjusted estimate for the purposes of this project is considered as an unbiased or "true" report. Also shown in the table are estimates for variance, bias, and the mean square error.

The reader is cautioned about comparing these estimates of stocks-on-farms with published estimates. The former are biased downward because data for refusals or questionnaires not completed were not edited-in. The same data was used to generate the four estimators; therefore, comparisons $\hat{S}_1$ vs. $\hat{S}_2$ and $\hat{S}_3$ vs. $\hat{S}_4$ are valid.

Table 23.- Comparison of estimators and mean square errors for on-farm stocks, by crops, 3-states

Crop	Estimator	Reported	Adjusted	Estimated Variance $\times 10^9$	Estimated Bias^2 $\times 10^9$	Estimated MSE $\times 10^9$
		Bushels	Bushels	Bushels	Bushels	Bushels
Wheat...	S_1	7,837,803	6,677,518	17,319	1,346	18,665
	S_2	21,523,103	20,275,976	1,198	1,555	2,753
	S_3	16,653,104	14,091,088	16,343	6,564	22,907
	S_4	37,309,591	35,868,448	106,171	2,076	108,247
Oats....	S_1	33,427,204	34,869,235	148,993	2,079	151,072
	S_2	31,988,078	32,207,396	44,356	48	44,404
	S_3	37,707,904	39,000,312	122,857	1,670	124,527
	S_4	38,088,024	37,859,952	38,416	52	38,468
Soybeans	S_1	56,002,668	54,538,100	326,162	2,145	328,307
	S_2	36,380,809	34,241,892	39,226	4,575	43,801
	S_3	60,908,805	58,712,094	309,942	4,826	314,768
	S_4	44,733,024	41,138,406	39,455	12,921	52,376
Corn....	S_1	689,251,333	703,751,076	17,647,000	210,000	17,857,000
	S_2	578,383,502	594,842,547	3,410,000	271,000	3,681,000
	S_3	767,676,750	781,027,650	17,607,000	178,000	17,785,000
	S_4	702,034,825	717,610,875	3,426,000	243,000	3,669,000

The differences between the estimates for the open direct expansion $(\hat{S}_1)$ and the weighted direct expansion $(\hat{S}_2)$ appear to be considerably different. However, the hypothesis that $\hat{S}_1 = \hat{S}_2$ or $\hat{S}_3 = \hat{S}_4$ cannot be rejected at the 95 percent level of significance. This is primarily due to the small sample size and the resulting large sampling error.

The variances associated with the estimators are different for each pair ($\sigma_1^2 \neq \sigma_2^2$ and $\sigma_3^2 \neq \sigma_4^2$). The hypothesis of $\sigma_i^2 = \sigma_j^2$ was tested using the F-ratio as the appropriate statistic.

$$F = \frac{\text{larger sample variance}}{\text{smaller sample variance}}$$

The hypothesis is rejected if $F \geq F_{(1-\alpha)(n_1, n_2)}$. In this study the hypothesis was rejected as $\sigma_1^2 \neq \sigma_2^2$ and $\sigma_3^2 \neq \sigma_4^2$ for each crop.

The mean square error (MSE) which is a criterion of accuracy of an estimate was generally lowest for either the weighted direct expansion or for the weighted ratio expansion. From this it can be concluded that the weighted expansions are more accurate. The exception shown in Table 23 under wheat is for $\hat{S}_4$ which has an extremely large variance. This again was due to the small sampling fraction and a large report of wheat stocks for one farm. The weighted expansions are not only more accurate, they are more precise because the variances of the estimators are also smaller.

OFF-FARM GRAIN STOCKS

Analysis

A. List Incompleteness

Mill and elevator stocks are estimated assuming a fairly current and complete list of storage establishments. One objective of this study was to estimate the amount of incompleteness in the Mill and Elevator List. This was done by sampling an area frame with 40 townships (sample units) being selected in each of the 3-states. Enumerators thoroughly screened each of the sample townships (primary sample units) listing all off-farm grain storage sites (see Appendix 6). The screening lists were then matched with the Mill and Elevator List in the state office and names not on the state's Mill and Elevator List were flagged for a followup interview.

Enumerators in Ohio found 41 off-farm storage firms in the sample townships. Four of these firms were not on the State's active Mill and Elevator List. Of these four, two were known and included with other small firms for estimating purposes. The other two firms did not handle grain. It can be assumed that the active Mill and Elevator List, which is based on a tabulation of all firms licensed to handle grain, is virtually complete.

In Indiana, 30 off-farm storage units were located in the sample townships. Three of these were not on the current Mill and Elevator List. Of the three, one elevator was being used for on-farm storage and another was a small feed store that handled mostly processed feeds. The third unit was a large seed company that handled a sizeable volume of seed corn. This company was known to the state office, but it was not included on the active Mill and Elevator List. No attempt was made to complete an interview with this firm to determine their actual volume of seed grain on hand. In Indiana, we can also assume the list is virtually complete except for dealers handling only seed grain.

Nebraska enumerators located 16 off-farm storage sites in the sample townships. Six of these were not on the active Mill and Elevator List. Two of the six handled seed grain only; one was a small retail seed store; the other was a large hybrid seed dealer. Two others of the six were primarily feed stores with one having sizeable off-farm storage capacity. Another of the six was a mobile feed service that didn't have any stored grains. The last was a new firm just coming into the grain handling business. This firm had applied for a grain dealer's license so in all likelihood would have been added to the active Mill and Elevator List at the next list update.

Questionnaires were completed on the six non-list firms and are summarized in Table 24 by location of the corn. The reported bushels were expanded to estimate the total state volume. Amounts of grains other than corn were insignificant.

Table 24.- Location of nonlist off-farm grain (Nebraska)

Location	List incompleteness (corn)		
	Bushels	Percent of incompleteness	Percent of Jan. 1 board stocks
Mill & elevators.:	1,839,500	63.2	1.48
In transit.......:	0	0	0
Feed stores......:	11,900	.4	.01
Seed dealers.....:	1,060,500	36.4	.85
Total...........:	2,911,900	100.0	2.34

The coefficient of variation of the estimate of total bushels is 9.7 percent and the standard error of the estimator is 44,391 bushels.

Total list incompleteness in Nebraska amounted to 2.34 percent of January 1 board off-farm corn stocks estimate. Considering only mills and elevators, there is 1.6 percent incompleteness in the Board estimate for Nebraska. Using the results from the 3-states, the incompleteness in the Mill and Elevator List is approximately 0.7 percent of the January 1 board off-farm estimate of corn stocks.

As brought out by this study, the states need more explicit instructions regarding the inclusion of seed dealers on their lists.

B. Characteristics of Mill and Elevator Reports

An objective of this study was to look at some of the characteristics of the Mill and Elevator Report. Specific items of interest were milled and mixed grains, grain in transit, government owned grain, determination of storage capacity, and how a reporter estimates grain on hand.

In each state (Ohio, Indiana, Nebraska) a simple random sample of 40 mills and elevators was selected from the respondents to the January 1, 1970 grain stocks questionnaire. Each respondent was interviewed during January and early February to complete the "Supplement to Mill and Elevator Questionnaire." (See Appendix 8.)

Instructions to the January 1 Grain Stocks Report are "to report total stocks in storages operated by you. Include grain you own and grain stored for farmers, millers, processors, and the Government--CCC Questions 1-8b on the supplement attempt to evaluate how well the instructions are understood and followed, and what respondents actually include or exclude from their reports.

> (1) Did you have in storage on January 1 and CCC-owned grain
>   or grain under CCC loan or reseal?
>   If Yes ask(2).

> (2) Did you include all of this government grain in your Mill
>   and Elevator Report?

A summary of the responses to these two questions follow in Table 25. Almost one-half of the firms reporting in the 3-states said they stored government-owned grain. All said they included the grain in their reports.

Table 25.- Government-owned grain in privately owned storage

State	Reporting 'yes' to question 1	Standard error	Included CCC grain (question 2)
	Percent	Percent	Percent
Ohio............:	25.0	6.53	100
Indiana.........:	27.5	6.73	100
Nebraska........:	85.0	5.44	100
3-states.......:	47.8	7.00	100

The standard error of the percentage reporting in Tables 25, 26, 28, and 31 were calculated by:

$$S.E. = \sqrt{\frac{N-n}{N} \cdot \frac{pq}{n-1}}$$

where

N = total number of Mill and Elevator Reports received from the regular January 1 survey

n = sample size

$p = \frac{a}{n}$ where a = number reporting characteristic

q = 1-p

Questions 4 and 5 were designed to determine if mixed or milled grains were being included in the report. Responses are summarized in Table 26.

(4) On January 1, did you have any grain at this location which had been milled or mixed with other grains or feed products? If Yes ask (5).

(5) Did you include any of this milled or mixed grain in your Mill and Elevator Report?

Table 26.- Milled or mixed grains in storage

State	Reporting 'yes' to question 4	Standard error	Including mixed grain in report	Standard error
	Percent	Percent	Percent	Percent
Ohio...........:	34.2	7.16	2.63	2.41
Indiana.......:	27.5	6.73	2.50	2.38
Nebraska......:	37.5	7.36	7.50	4.02
3-states.....:	33.3	7.11	4.38	3.08

In the 3-states approximately one-third of the respondents to the January 1 Grain Stocks Report had milled or mixed grain on hand on the reporting date. Only 4.38 percent of the respondents included mixed or milled grains in their reports. The null hypothesis that the true proportion of respondents including milled or mixed grains in their reports is equal to zero is not rejected at the 95 percent level of significance.

The total amounts of milled or mixed grains included in the reports are summarized in Table 27 as percents of the total amount reported by the 361 respondents in Ohio, 362 in Indiana, and 419 in Nebraska.

Table 27.- Milled or mixed grain as a percent of total grain reported by respondents to January 1, 1970 Mill and Elevator Report

State	Wheat	Soybeans	Corn	Oats
	Percent	Percent	Percent	Percent
Ohio.........:	*	0	*	*
Indiana......:	0	0	*	.6
Nebraska.....:	*	0	*	2.0

* Less than .1 percent.

Some oats in Nebraska and Indiana were included. These oats had been ground or crimped but not mixed with other feed grains. All other grains had negligible amounts of milled or mixed products included.

(7) Did you own any grain on January 1 that was in transit on that date?

Table 28.- Grain in transit reported in storage

State	Reporting 'yes' to question 7	Standard error	Including grain/transit in report	Standard error
	Percent	Percent	Percent	Percent
Ohio.........:	7.89	4.08	2.63	2.41
Indiana......:	20.00	6.27	5.00	3.29
Nebraska.....:	20.00	6.09	5.00	3.29
3-states.....:	16.17	5.60	4.25	3.04

Over 16 percent of the respondents to the supplemental questionnaire reported they owned grain in transit. Grain in transit is defined as that moving by rail, truck, barge, etc., at the time of report. The null hypothesis that the true proportion of respondents including grain in transit in their report equals zero is not rejected at the 95 percent level of significance.

The amount of grain in transit reported by the respondents that was included in the Mill and Elevator Report is shown in Table 29.

Table 29.- Grain in transit included as a percent of the total amount reported

State	:	Wheat	:	Soybeans	:	Corn	:	Oats
	:	Percent	:	Percent	:	Percent	:	Percent
Ohio.........:		O		O		*		O
Indiana......:		O		*		*		O
Nebraska.....:		*		O		*		O

* Less than .5 percent

Table 30 shows the amount of grain in transit that was not included in the Mill and Elevator Report. This grain probably would not have a chance of being in the SRS January 1 grain stocks estimate.

Table 30.- Grain in transit not included as a percent of the total amount reported

State	:	Wheat	:	Soybeans	:	Corn	:	Oats
	:	Percent	:	Percent	:	Percent	:	Percent
Ohio.........:		O		O		*		*
Indiana......:		O		*		7.3/4.6		O
Nebraska.....:		O		1.0/14.7		4.0/2.4		O

* Less than .5 percent.   Estimate/standard error of estimate.

A second objective of the supplement to the Mill and Elevator Question-naire was to investigate methods used by mill and elevator operators to determine storage capacity and amount of grain currently in storage. We also tried to get some reaction from these respondents about an alternative to using bushels as a reporting unit.

(9) Would you rather report grain stocks using a unit other than bushels?

Table 31.- Alternative reporting units

State	Reporting 'yes' to question 9	Standard error
	Percent	Percent
Ohio..........:	0	0
Indiana.......:	7.5	3.98
Nebraska.....:	25.0	6.59
3-states.....:	11.6	4.58

The respondents answering they would like to report in a unit other than bushels were 11.6 percent. All 11.6 percent indicated that hundredweight (cwt.) would be the preferable unit.

(10) How did you determine your bulk storage capacity?

Table 32.- Methods of determining bulk storage capacity

Method	Ohio	Indiana	Nebraska	3-state
	Percent	Percent	Percent	Percent
1 - Manufacturers' specs....:	13.2	27.5	15.0	18.4
2 - Measured volume.........:	65.8	50.0	67.5	61.4
3 - Regulatory agency.......:	2.6	2.5	17.5	8.0
4 - Recording amount of grain:	13.2	10.0	0	7.3
5 - Guess...................:	2.6	5.0	0	2.4
6 - Not determined..........:	0	2.5	0	.8
7 - No bulk storage.........:	2.6	2.5	0	1.6

(11) How did you determine your sacked storage capacity?

Table 33.- Methods of determining sacked storage capacity

Method	Ohio	Indiana	Nebraska	3-state
	Percent	Percent	Percent	Percent
1 - Manufacturers' specs........:	0	0	10.0	3.7
2 - Measured volume.............:	5.3	15.0	47.5	23.9
3 - Guess.......................:	2.6	2.5	0	1.6
4 - Count sacks every month.....:	2.6	5.0	0	2.4
5 - Noting amt. grain when full.:	0	5.0	0	1.6
6 - Not determined..............:	0	2.5	0	.8
7 - Number sacked storage.......:	89.5	70.0	42.5	66.1

Bulk storage capacity is largely determined by a fixed volume measure. Methods 1, 2, 3, and 4 are all measured determinations of volume and could be assumed accurate. In Ohio 97.4 percent of the bulk storage capacity was measured; 92.5 percent in Indiana was measured; and 100 percent in Nebraska was measured.

Many of the respondents reported they did not have sacked grain storage facilities. This ranged from 42.5 percent in Nebraska to 89.5 percent in Ohio. For those reporting sacked storage capacity, 50 percent in Ohio reported measured volume. About 67 percent in Indiana and 100 percent in Nebraska of the sacked capacity could be considered measured volume.

The estimated capacity for bulk storage is a more accurate estimate than the estimate for sacked capacity.

(12) How did you estimate the amount of grain in storage?

Table 34.- Methods of estimating grain in storage

Method	Ohio	Indiana	Nebraska	3-states
	Percent	Percent	Percent	Percent
Percent of capacity......:	26.3	25.0	12.5	20.8
Measured volume..........:	31.6	22.5	0	17.1
Weighed grain............:	36.8	50.0	87.5	59.6
Guessed..................:	2.6	2.5	0	1.6
No answer................:	2.6	0	0	.8

The respondents generally based their estimates on measured data with only a small (1.6) percentage guessing the amount of grain they had in storage. The largest proportion reported they made their estimates from weighed grain. From comments on the supplemental questionnaire, it appears that weighed grain is readily available from the daily position record that most of the respondents keep. In other words, a continual inventory is maintained by weighing all incoming and outgoing grain.

CLOSED SEGMENT MAILED QUESTIONNAIRE

The purpose of this phase of the project was to determine whether farm operators could accurately report closed segment information by mail.

The farm operator selected for the closed segment experiment was identified by the enumerator during the screening phase of the project. The enumerator was directed to identify the operator of the northeast corner of the adjacent section east of the sample segment. The adjacent section was then outlined on the map as the sample segment and sent in the mail to the farm operator.

A regular Farm Grain Stocks Inquiry was mailed. Attached to it was a page showing a portion of a county highway map with the outlined segment containing all or part of the farm operation (Appendix 4). On the reverse of the attached page were four questions designed to determine the amount of grain stored inside the segment boundaries.

After allowing adequate time for mail returns, enumerators were sent out to interview all sample units. A questionnaire (Appendix 5) was used to evaluate all respondents and nonrespondents reactions to the mailed inquiry. A question-by-question summary of the results follow.

1. Do you remember receiving a copy of the Grain Stocks Inquiry and Supplement A by mail?

    Sixty-eight people were interviewed and asked if they had received the inquiry.

    60.2 percent reported receiving inquiry
    28.1 percent reported they did not receive inquiry
    11.7 percent could not be contacted or refused

2. Of those that remembered receiving the inquiry - "Did you complete and return the inquiry?"

    57.6 percent reported returning the inquiry
    42.4 percent said they did not return it

4. Why didn't you complete this questionnaire?

The 42 tract operators who had not returned the questionnaire were asked this question. Ranked in order of frequency reported are the reasons given for not completing the questionnaire.

Percent	Reason
20.9	Just not completed yet
18.8	Not important to farmer—just helps buyers and brokers
11.4	Did not understand the questionnaire
10.7	Refused (no other reason)
10.6	Did not understand closed segment concept
9.7	Screening error by enumerator
8.0	Could not contact the operator
7.4	Field office did not include a return envelope
2.5	Completed but not yet mailed

6. The enumerators observed or reviewed the work of 65 tract operators completing the questionnaire. They assessed the respondents understanding of the regular mail inquiry. These assessments are ranked in order of frequency reported.

Percent	Enumerator's comment
82.2	Understood very well
13.9	Generally did not understand
1.6	Reported stocks in pounds, not bushels
.7	Reported managed acreage as rented acreage
.7	Reported production in terms of value
.7	Did not include grain on the farm that belonged to others

7. <u>Was this questionnaire difficult for you to complete?</u>

Sixty-four respondents were asked if the questionnaire was difficult to complete. Their comments are ranked in order of frequency reported.

Percent	Comment
58.0	Understood questionnaire very well
14.9	Had minor boundary problems with closed segment approach
14.4	Would need help or further instruction to complete
9.8	Did not understand closed segment idea or questionnaire
2.9	Could not read the map or relate it to the ground

Because of the small sample size, precise inferences cannot be made about data in this section. However, the above frequency distribution suggests that securing closed segment data by mail has practical limitations.

UNITED STATES DEPARTMENT OF AGRICULTURE
Statistical Reporting Service

State	District	Segment No.

COUNTY _____

SCREENING SHEET _____ OF _____

JANUARY 1970

GRAIN STORAGE

RESEARCH PROJECT

Sketch:
Sketch boundaries of each tract using information from persons living in segment or from nearest residents outside segment. Enter a ▲ at location of each possible grain storage location.

L I N E	T R A C T	Draw off land operated inside the segment. Check	Person in charge of this tract. Name and Mailing Address
1	2	3	4
1			Tel. _____ ZIP
2			Tel. _____ ZIP
3			Tel. _____ ZIP
4			Tel. _____ ZIP
5			Tel. _____ ZIP
6			Tel. _____ ZIP
7			Tel. _____ ZIP

LAND WITH OCCUPIED DWELLING

8			Tel. _____ ZIP
9			Tel. _____ ZIP
10			Tel. _____ ZIP
11			Tel. _____ ZIP
12			Tel. _____ ZIP
13			Tel. _____ ZIP
14			Tel. _____ ZIP

LAND WITH NO OCCUPIED DWELLING

L I N E	Do you operate a farm or ranch at any location?	Are you growing any crops this year?	Do you have any cattle, hogs, sheep or poultry?	During 1969 did you sell any agricultural products or receive government farm payments?	On the land you now operate, do you have any facilities to store grain.	
	6	7	8	9	10	
1	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
2	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
3	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	*END INTERVIEW After first " YES " or after " NO " to all Columns 6–10.*
4	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
5	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
6	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
7	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	

8	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
9	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
10	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	*After first YES, skip to Column 11 on page 4. If NO in all Columns 6–10, END INTERVIEW.*
11	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
12	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
13	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	
14	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	Yes ( ) No ( )	

Record Date of Each Visit
to Segment Here:

Month	Day

Name of Enumerator _____

LINE	Describe how to best locate the operator for future contacts
	11
8	
9	
10	
11	
12	
13	
14	

UNITED STATES DEPARTMENT OF AGRICULTURE
Statistical Reporting Service
2-A

FARM GRAIN STOCKS INQUIRY - JANUARY 1, 1970

*Please make corrections in name, address, and ZIP Code,
if necessary*

OFFICE USE			
State	District	Segment	Tract
Stratum	Response M 1 I 3 T 2 E 4		Acres

SECTION I. LAND OPERATED JANUARY 1, 1970

(Include cropland, woodland, wasteland and non-agricultural land)

1. **Acres you OWN January 1, 1970** .... ——————— Acres

2. **Acres you RENT FROM OTHERS**
    *(Include land you rent from others for a
    share of the crop)* .... ——————— Acres

3. **Acres you MANAGE FOR OTHERS** .... ——————— Acres

4. **Total owned, rented from others and managed
    for others** *(add lines 1, 2 and 3)* .... ——————— Acres

5. **Acres you RENT TO OTHERS**
    *(Include land worked by others for a share
    of the crop)* .... ——————— Acres

6. **Land you OPERATE**
    (Subtract line 5 from line 4) .... ——————— Acres

SECTION II. STOCKS OF GRAIN JANUARY 1, 1970

Include all grain on land you operate:

```
*From 1969 and earlier years (include 1969 grain yet to be harvested)
*Regardless of ownership
   .grain you own
   .grain owned by landlord and others
   .grain under CCC loan or reseal programs
*Regardless of intended use
   .feed
   .seed
   .sales
```

Quantity on Hand January 1, 1970

7.   **ALL WHEAT** *(including durum)* .... ——————— 60 lb. Bushels

8.   **DURUM WHEAT** .... ——————— 60 lb. Bushels

9.   **OATS** .... ——————— 32 lb. Bushels

10. **BARLEY** .... ——————— 48 lb. Bushels

11. **RYE** .... ——————— 56 lb. Bushels

12. **SORGHUM GRAIN** .... ——————— 56 lb. Bushels

13. **SOYBEANS** .... ——————— 60 lb. Bushels

14. **FLAXSEED** .... ——————— 56 lb. Bushels

15. **CORN** .... ——————— 70 lb. ear Bushels or
                                                      56 lb. shelled Bushels

16. **How much of the stored corn reported on
     line 15 is under CCC loan, including reseal?** .. ——————— Bushels

SECTION III. LAND OPERATED JUNE 1, 1969

17. Is the land you operate on JANUARY 1, 1970 *(Item 6)* the same land you operated on JUNE 1, 1969? *Check One:*

YES [____]   NO [____]   OFFICE USE [____]

If YES, Go to Item 23 and copy entry in Item 6 to Item 23.   *If NO, answer Items 18 to 23.*

18. Acres you OWNED June 1, 1969................. _____ Acres

19. Acres you RENTED FROM OTHERS
(Include land you rented from others for a share of the crop)........................ _____ Acres

20. Acres you MANAGED FOR OTHERS................. _____ Acres

21. Total owned, rented from others, and managed for others *(add lines 18, 19, and 20)*.................................... _____ Acres

22. Acres you RENTED TO OTHERS
(Include land worked by others for a share of the crop)................................. _____ Acres

23. Land you OPERATED June 1, 1969
(Subtract line 22 from line 21).............. _____ Acres

SECTION IV. GRAIN PRODUCTION IN 1969 ON LAND OPERATED JUNE 1, 1969

Please report below the amount of grain you produced in 1969 on the acres you operated as shown in Item 23. Include any 1969 crop grain not yet harvested that you expect to harvest.

24. ALL WHEAT *(Including durum)*.......... _____ 60 lb. Bushels

25. DURUM WHEAT......................... _____ 60 lb. Bushels

26. OATS................................ _____ 32 lb. Bushels

27. BARLEY.............................. _____ 48 lb. Bushels

28. RYE................................. _____ 56 lb. Bushels

29. SORGHUM GRAIN....................... _____ 56 lb. Bushels

30. SOYBEANS............................ _____ 60 lb. Bushels

31. FLAXSEED............................ _____ 56 lb. Bushels

32. CORN................................ _____ 70 lb. ear Bushels or
                                                      56 lb. shelled Bushels

33. REPORTED BY _____

     COUNTY _____ DATE _____

REMARKS:

SUPPLEMENT TO FARM GRAIN STOCKS INQUIRY

JANUARY 1. 1970

SECTION I: TOTAL FARM

You completed the January 1, 1970 Farm Grain Stocks Inquiry. We are studying how farmers account for farm grain stocks. This will enable us to determine the effectiveness of the Inquiry. You can help us in this research program by answering the following questions.

> *(ENUMERATOR — Review Production reported on the Stocks Inquiry.
> If no grain produced in 1969, go to item 36.)*

34. When you reported the quantity of grain *PRODUCED*, how did you determine this quantity? Let's begin with the first crop you reported and include all of the 1969 production regardless of ownership; landlord, CCC, local elevators, etc.

KIND OF GRAIN AND AMOUNT BY METHOD ESTIMATED

Determination of quantity produced *	Wheat (bu.)	Oats (bu.)	Barley (bu.)	Rye (bu.)	Sorghum Grain (bu.)	Soybeans (bu.)	Corn (bu.)
By field observations							
By number of loads hauled							
Estimated from crib or storage bin capacity							
By scale weights							
Other *(specify)*							
Total 1969 Production							

> *(ENUMERATOR — Item 34 Totals must agree with Mail Inquiry items 24–32 unless omissions were entered or corrections made in item 34.)*

*EXPLAIN: Basis of field estimates – or – how farmer converted loads, storage volume, or weights to bushels.

_____

_____

_____

_____

_____

_____

State _____

Enumerator _____

State	District	Segment	Tract

35. Now I would like to ask about what you did with the grains *PRODUCED* in 1969.

KIND OF GRAIN AND DISPOSITION

Disposition of 1969 Production		Wheat (bu.)	Oats (bu.)	Barley (bu.)	Rye (bu.)	Sorghum Grain (bu.)	Soybeans (bu.)	Corn (bu.)
Grain now off the (Item 6) acres you operate	sold and off farm							
	under CCC loan off farm							
	other 1969 production stored off the farm							
Fed to your livestock								
Losses due to rodents, spoilage, etc.								
Cracked, ground or rolled now on hand								
Total of above								

Complete item 36 and determine reason for differences between Indicated and Reported Stocks. DO NOT change any previously entered answers.

36. Now I would like to determine the stocks of grain now on hand.

KIND OF GRAIN, INDICATED AND REPORTED STOCKS

	Wheat (bu.)	Oats (bu.)	Barley (bu.)	Rye (bu.)	Sorghum Grain (bu.)	Soybeans (bu.)	Corn (bu.)
1969 production, regardless of ownership *(copy from item 34)*							
1968 and earlier production, regardless of ownership, now stored on these ___ acres							
Purchases now on hand; grain not grown on these ___ acres							
Any other grain stored on these ___ acres							
Total *(sum of entries above)*							
Total Disposition of 1969 production *(copy from total in item 35)*							
Subtract Total Disposition from sum of entries to obtain Indicated Stocks							
REPORTED Stocks *(copy from items 7–15 of Inquiry)*							
Note any difference between Indicated and Reported Stocks *(check grain(s) and explain on following page)*							

36. (cont'u)

*List Grain and explain EACH difference between indicated and reported stocks in item 36.
Examples: Indicated Oats stocks, 1200 bu. less than reported; 1000 bu. were sold and
200 bu. were fed since January 1.   Corn, indicated stocks 600 bu. more than reported;
600 bu. bought for feed since January 1.   Wheat, indicated stocks 50 bu. more than
reported; forgot to include seed wheat.*

_____

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_____

SECTION II: SAMPLE SEGMENT

We are now interested in grain stocks in the area shown in the map below. Draw in the boundaries of the total acres in your operation. Use (X) to show location of farm headquarters. If you operate separate parcels of land outside area shown below, indicate by an arrow on the map showing the direction and approximate mileage to each of these parcels.

ENUMERATOR: In RED, draw in the sample segment

We are now interested in talking about the specific area which I have outlined in red (the sample segment).

37. How many of the _____ acres that you operate are located in this segment (within the red boundary)? _____ACRES

    ENUMERATOR: The map used in screening indicates the tract has approximately _____ acres inside the segment. Does this agree with the acreage in item 37?

        YES ( ) Go to item 39

        NO ( ) Enter correct tract acres _____. If necessary, correct tract boundaries. If acres are zero, ask item 38 and conclude interview. If additional operators are located, draw in tract, add to screening sheet and ask items 6—10. Enumerate those qualifying.

38. Can you tell me who operates and who has any grain, if any, stored on this parcel of land inside the sample segment?

    COMMENTS: _____

    _____

    _____

39. How much grain – regardless of ownership – was stored on January 1, 1970 on land you operate inside this segment? List each bin, crib, or other storage in the segment that contained grain on January 1, 1970.

Type of crib or bin	Assign number and locate on enlarged segment sketch (number)	What kind of grain was stored there January 1, 1970?	Check ✔ if under loan	How much grain is NOW stored there? (bu.)	How much grain was stored there January 1, 1970? (bu.)	Basis for estimating January 1 grain Code 1/

1/ Code for Basis of Estimating amount stored on January 1.

    a. Field observation   d. Scale weights
    b. By number of loads hauled   e. CCC measurements
    c. Estimate based on bin or crib capacity   f. Other

40. Were all January 1 grain stocks you just told me about included in the January 1, report?

        YES ( )   NO ( )

        If NO, explain: _____

        _____

        _____

SECTION III: GENERAL

41. Could you report more accurately the grain you have in storage using a unit of measure other than bushels?

        YES ( )   NO ( ) Continue

        If YES, explain: _____

        _____

        _____

42. How much of the grain you owned on January 1, 1970 was in transit at that time?

    (kind and bushels) _____

43. Did you include this grain in your January 1 Report?

        YES ( )   NO ( )

44. Did you have any high moisture corn stored in silos on January 1?

        ( ) YES   ( ) NO - Go to item 48.

45. Give quantity and moisture test of high moisture corn stored as:

	Quantity	Unit	Moisture Test %
(a) Ear corn?............................			
(b) Shelled corn?........................			
(c) Milled (cracked, ground)............			

46. Was this high moisture corn included on your January 1 Farm Grain Stocks Inquiry?

        ( ) YES   ( ) NO

47. How did you determine the quantity of high moisture corn reported in item 45?

    COMMENTS: _____

    _____

    _____

    _____

    _____

48. Does any of your 1969 grain remain to be harvested?

       YES ( ) Continue   NO ( ) Go to item 51

49. For the 1969 crop which is YET to be harvested for GRAIN, enter the expected production for:

       Sorghum Grain........... _____ bushels

       Soybeans.. .... _____ bushels

       Corn. ... . _____ bushels

50. Was this unharvested grain included in the January 1 stocks report?

       YES ( )   NO ( )

       If NO, explain: _____

                       _____

                       _____

51. In order to get more information about grain storage on farms, I would like to measure the storages listed in the sample segment. May I have your permission to make the measurements?

       YES ( )   NO ( ) CONCLUDE INTERVIEW

       Sketch each storage facility below and on the next page and record measurements needed to compute volume of the grain in storage locations listed in item 39 and ask item 52.

52. Finally, we would like to measure the relationship between the measured grain volume and the weight of the grain. To do this would require the weight from your sales slip for those storage units in the sample segment from which you intend to sell all the grain. Would you be willing to provide us that information if we called on you after the grain is sold?

        YES ( )   NO ( ) *CONCLUDE INTERVIEW*

When do you intend to sell the grain?

Bin No. From item 39	Approximate date of sale
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

FARM GRAIN STOCKS INQUIRY – PAGE 3

SECTION V.   LAND OPERATED INSIDE RED BOUNDARY

Please answer questions on the next page about only that portion of your operation which is inside the red boundary shown on the map below.

34. Are the Item 6 _____ acres you operate:
    (Check)

    ☐   a.   Totally inside the red boundary shown on page 3.

    ☐   b.   Totally outside the red boundary shown on page 3.

    ☐   c.   Partially inside the red boundary shown on page 3.

    If 34 a or 34 b is checked, skip remaining questions.

    If 34 c is checked, Continue

35. Draw boundaries on the map showing land you operate inside the red boundary.

36. How many acres do you operate inside the red boundary?.................... Acres _____

37. How much of the January 1, 1970 grain stocks reported in Items 7 to 15, was stored
    on the land you operate INSIDE the red boundary:

    WHEAT................ _____ Bushels

    OATS................. _____ Bushels

    BARLEY............... _____ Bushels

    RYE.................. _____ Bushels

    SORGHUM GRAIN........ _____ Bushels

    SOYBEANS............. _____ Bushels

    CORN................. _____ Bushels

Supplement to Section V of Farm Grain Stocks Inquiry

If checked, ☐ *the respondent returned the questionnaire by mail.*
Go to item 6.

1. Do you remember receiving a copy of the Grain Stocks Inquiry and
   Supplement A by mail? *(Show a copy of the Inquiry)*

   YES ( ) Continue   NO ( ) Ask respondent to complete a questionnaire.
   Make notes on any difficulties encountered
   and go to item 6.

2. Did you complete and return this questionnaire?

   YES ( ) Continue   NO ( ) Go to item 4

3. Evidently we didn't receive this completed questionnaire in our office.
   Could we complete another one?

   Observe as respondent completes questionnaire. Make notes on any
   difficulties encountered and go to item 6.

4. Why didn't you complete this questionnaire?

   Explain _____

   _____

   _____

   _____

   _____

5. Would you complete the questionnaire now so I could get your reaction to it?

6. *ENUMERATOR: Complete the following check list.*

   Did the respondent understand the regular mail questionnaire?

   Comment _____

   _____

   _____

   Verify entries in making corrections on the questionnaire as necessary:

   Section I   Item 1 + 2 + 3 = 4 ( ); 4 - 5 = 6 ( )

   Section II   All entries are in bushel units ( )

                  Item 16 is all under CCC loan ( )

                  All grain is stored on the land he operates ( )

Section III   Item 17 checked ( ) if no entries in 18-23

If yes item 6 entry copied to item 23 ( )

Section IV   All entries in bushel units ( )

Entries are total production and not remaining stocks ( )

Section V   Boundaries drawn on map correctly ( )

Item 34 answered correctly ( )

Item 37 entries correct and reported in bushel units ( )

7. Was this questionnaire difficult for you to complete?

Explain _____

_____

_____

_____

_____

_____

JANUARY 1 GRAIN STORAGE RESEARCH PROJECT

SCREENING TOWNSHIPS AND SEGMENTS WITHIN THESE TOWNSHIPS

Three States (Ohio, Indiana, and Nebraska) are included in the Grain Storage Research Project. The first phase of this project is the screening of 40 townships in each of the three States for off-farm grain storages.

Within each township one segment approximately one section in size will be selected. These segments will be screened for tract operators who might possibly qualify as farm operators or who may have grain storage facilities. A sketch of this segment will be made. Each separate operation in this segment will be drawn off and given a tract code. Screening questions will be asked about each operation, but we will contact only the minimum number of respondents required to obtain information to draw off boundaries and record names and addresses.

> A red X has been entered on the map approximately one mile away from each segment. List this tract X on Line 14 of the yellow Screening Sheet for the segment and obtain the same information for this tract or for all the tracts inside the segment. The operator of Tract X will receive a special grain stocks questionnaire.

Townships are to be screened for off-farm grain storages. These off-farm facilities include mills, elevators, warehouses, terminals, all seed processors, breweries, distilleries, and other commercial off-farm storages. Any of these storages storing whole grain (grain that has not been processed in any way) should be included. This would include both ear corn and shelled corn. They may also store formula mixed feed or grain that has been processed in addition to whole grain. Include storages even though they may be empty at the time of interview unless it is known that they will not be used for grain storage in the future.

You will be given a copy of a county map showin each township. Use this map to indicate the areas you have already screened by (1) lightly shading the areas as you screen or (2) drawing off boundaries of each area you screen in the twonship or (3) using diagonal lines to indicate the area you have screened. This will help prevent you from screening an area twice or from missing an area in your coverage yellow pages of the phone book may be useful as a check on screening completeness.

Indicate the approximate location of each off-farm grain storage you located by entering a number at this position on the map. Enter 1 for the first storage found, 2 for the second, etc.

UNITED STATES DEPARTMENT OF AGRICULTURE
Statistical Reporting Service
Budget Bureau No. - 40-S69106
Approval Expires - 2/28/70

STATE	DISTRICT	SEGMENT NO.

County _____

SUPPLEMENT TO MILL AND ELEVATOR QUESTIONNAIRE

Firm _____

Address _____

_____

Respondent _____

Title _____

Telephone _____

1. Did you have in storage on January 1 any CCC-owned grain or grain under CCC loan or reseal?

   ( ) YES – Ask 2   ( ) NO – Go to 4

2. Did you include all of this government grain in your Mill and Elevator Report?

   ( ) YES – Go to 4   ( ) NO – Ask 3 ———————————————————————

4. On January 1, did you have any grain at this location which had been milled or mixed with other grains or feed products?

   ( ) YES – Ask 5   ( ) NO – Go to 7

5. Did you include any of this milled or mixed grain in your Mill and Elevator Report?

   ( ) NO – Go to 7   ( ) YES – Ask 6 ———————————————————

7. Did you own any grain on January 1 that was in transit on that date?

   ( ) NO – Go to 9   ( ) YES – Ask 8 ——————————————————————

* * * * *

Wheat		Rye	Soybeans	Flaxseed	Corn, Shelled or Ear	Oats	Barley Grain	Sorghum Grain
Durum	Other Spring and Winter							
(bu.)	(bu.)	(bu.)	(bu.)	(bu.)	(bu.)	(bu.)	(bu.)	(bu.)

→ 3. Report here the government grain which was not reported in the Mill and Elevator Report.

→ 6. Report here all milled or mixed grain which was stored on January 1 and was included in Mill and Elevator Report.

→ 8a. Report here all grain owned by you which was in transit on January 1 and was included in Mill and Elevator Report.

8b. Report here all grain owned by you which was in transit on January 1 and was not included in Mill and Elevator Report.

9. Would you rather report grain stocks using a unit other than bushels?

( ) *YES - What Unit?* _____

( ) *NO*

10. How did you determine your BULK storage capacity? (Check)

( ) *Manufacturers specifications*

( ) *Measured Volume*

( ) *Other (EXPLAIN)* _____
_____

11. How did you determine your sacked storage capacity? (Check)

( ) *Manufacturers specifications*

( ) *Measured Volume*

( ) *Other (EXPLAIN)* _____
_____

12. How did you estimate the amount of grain in storage (Check)

( ) *Percent of capacity*

( ) *Measured Volume (explain conversion to bushels)* _____
_____

( ) *Weighed (EXPLAIN)* _____

( ) *Other (EXPLAIN)* _____