

RESEARCH REPORT ON
THE AMOUNT OF AGRICULTURE ASSOCIATED
WITH SEVERAL INCOMPLETE SAMPLING FRAMES

by

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THE AMOUNT OF AGRICULTURE ASSOCIATED WITH SEVERAL INCOMPLETE SAMPLING FRAMES

Summary - In the Corn Belt and South, most of the agricultural production is associated with farmers who receive mail on rural routes. In the West, on the other hand, farmers receiving mail from post office boxes and from general delivery account for substantial proportions of the agriculture. The percentage of farmers receiving mail in more than one way is quite small. Multiple frame sampling using mail delivery methods for frames, has potential for both general purpose and specialty surveys for collecting information on agricultural commodities.

Background - Norman V. Strand proposed using rural postal routes as a sampling frame for agricultural surveys. This frame was investigated in two cooperative studies between Iowa State University and the Statistical Reporting Service of the U.S. Department of Agriculture ^{1/}. List of towns and cities were available with control data recorded (number of rural route boxholders) so that cities and routes starting from the cities could be selected as first and second stage sampling units. The shape of most rural mail routes was considered efficient for sampling farms as third stage units. The completeness of the frame was unknown.

Description of Multiple Frame Concept - The population of all farms was visualized as being made up of elements of one or more sampling frames according to the way the farm operators receive mail. The frames visualized were:

- . Farmers receiving mail on city delivery routes.
- . Farmers receiving mail on rural postal routes.
- . Farmers receiving mail from post office boxes.
- . Farmers receiving mail at general delivery.

Assuming that all farm operators receive mail in at least one way, then the union of the four frames is complete (covers the population of farm operators). If the members of each frame could be sampled and if each sample farmer's association with the other frames could be determined, then the multiple frame survey method could be used in surveying this population.

Objectives - The primary objective of this project was to obtain estimates of the amount of agriculture associated with the four incomplete sampling frames mentioned above. The relative importance of agricultural production for **the four frames was not known**. Another objective was to determine the

^{1/} References: (1) Strand, Norman V. (1967), "Frame Construction Studies 1966-67," unpublished report by Statistical Laboratory, Iowa State University. (2) Strand, Norman V. and Vogel, Frederick A. (1969), "Frame for Sampling Farms by Use of Postal Rural Routes," unpublished report by Statistical Laboratory, Iowa State University.

amount of duplication (**persons who receive mail** more than one way) within and between frames.

Results - The 1968 June Enumerative Survey data for Illinois, Tennessee, Oklahoma, and New Mexico was post-stratified based on the type of mail delivery reported by each survey respondent. Direct expansion estimates were computed for the 15 possible domains which represent all possible combinations of the four potential sampling frames. Notation used to define domains was as follows:

Domain	:	Farm Operator Receives Mail at:
R	:	Rural Route only
C	:	City Route only
B	:	Post Office Box only
G	:	General Delivery only
RC	:	Rural Route and City Route
RB	:	Rural Route and P.O. Box
RG	:	Rural Route and General Delivery
CB	:	City Route and P.O. Box
CG	:	City Route and General Delivery
BG	:	P. O. Box and General Delivery
RCB	:	Rural Route, City Route and P. O. Box
RBG	:	Rural Route, P. O. Box and General Delivery
CBG	:	City Route, P. O. Box and General Delivery
RCG	:	Rural Route, City Route and General Delivery
RCBG	:	Rural Route, City Route, P. O. Box and General Delivery

All of the direct expansions for domains RCB, RBG, RCG, CBG, and RCBG were equal to zero since no farm operators in the sample received mail in more than two ways. Similarly, no operators were found in domain CG. The amount of agriculture associated with the overlaps between frames, taken two at a time, are shown in Tables 1 through 4. The amount of agriculture associated with more than one sampling frame was quite small.

The duplication within frames was minor. Of nearly 6000 agricultural tract operators sampled in the four states, three farmers reported that they were on two different rural mail routes. This was the only within frame duplication in the sample. One of these individuals also received mail at a city address and another had a post office box in one of the towns. The sample detected no duplication within the other three frames.

Several simple domains were grouped for additional analysis as follows:

Grouped domains	Simple domains
Rural Route	R + RC + RB + RG + RCB + RCG + RBG + RCBG
City Route	C
Post Office Box	B + CB + BG + CBG
General Delivery	G + CG

The grouped domains do not differ greatly from the simple domains R, C, B and G since, for most items, the overlap domains were small. A fifth category for analysis consisted of those where the method of mail delivery was unknown. In the survey, the enumerators sometimes failed to ask the questions (see questionnaire in appendix) and the respondents occasionally declined to answer.

Tables 5 through 8 show the percent of agricultural production associated with the four grouped domains. **In Illinois and Tennessee, most of the agriculture is associated with the rural route domain.** Thus, in the Corn Belt and South, most of the resources for a survey should be allocated to sampling rural routes. Smaller amounts of money should be used for sampling the other three frames. The situation is different in Western areas where a larger proportion of the agriculture is associated with city routes, post office boxes and general delivery. This indicates that, in the West, survey resources should be more equally allocated to the four frames. The difference between areas is due to different mail delivery patterns.

The data presented in these tables should be helpful in designing samples for agricultural surveys utilizing the four incomplete sampling frames discussed above.

Future Applications - The post office directory provides lists of rural routes, post office boxes, and towns with city delivery. The rural route frame has been tested on a small scale. This report shows that considerable amounts of the agricultural production are associated with the post office box, city delivery and general delivery frames. These three frames are more important agriculturally in the West than in the Midwest and the South. Pilot studies are needed to see if it is reasonable to use these frames to survey farmers receiving mail from post office boxes, city delivery and general delivery. Farmers receiving mail on city postal routes might be the most expensive group to sample. Only rural routes were studied in the two previous cooperative projects.

There are no apparent obstacles to sampling the frames at the first stage. The first stage frames (lists from post office directory) are updated and published yearly. The number of post office boxes and the number of rural boxes served by each post office are shown. Cities, providing city delivery service, are identified. The number of residences for cities are not shown. Population data could be used as an indication of the number of residences. Each of the frames could be stratified by size and geographic location.

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Rural Route	R + RC + RB + RG + RCB + RCG + RBG + RCBG
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The Post Office Department has maintained that the names and addresses of their patrons are confidential. It might be possible for them to waive this rule in releasing names to another federal agency. This problem would have to be solved since the second and third stages of sampling require obtaining the patrons' names and addresses.

The sampling scheme has potential for both general purpose and specialty surveys. One method would be to screen a sample from each frame for farm operators. The commodities produced and telephone numbers would be recorded during the screening. Subsamples could be drawn for whatever specialty survey was needed. Various combinations of mail, telephone and personal contacts could be used to collect the survey data economically. The partial frames could be updated rather easily during the surveys. Essentially, the same procedures would apply for general purpose agriculture surveys and for surveys of non-farm populations.

Table 1.--Estimated percent of agricultural commodities and items (livestock numbers, crop acres, number of farms) associated with overlap domains, Illinois June 1968

Type of estimate and item	Percent of commodity or item associated with:				
	Domain RC	Domain RB	Domain RG	Domain CB	Domain BG
	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>
Open segment estimates					
Hogs	--	--	--	--	--
Cattle	--	--	.1	--	--
Milk cows	--	--	--	--	--
Sheep	--	--	--	--	--
Hens	--	--	--	--	--
Closed segment estimates					
Hogs	--	.3	--	--	--
Cattle	--	.3	.1	--	--
Milk cows	--	--	--	--	--
Sheep	--	--	--	--	--
Hens	--	--	--	--	--
Corn planted	.1	.3	--	--	--
Wheat for harvest	--	1.4	--	--	--
Oats planted	--	.8	--	--	--
Soybeans planted	--	.5	--	.3	--
Sorghum planted	--	--	--	--	--
Lespedeza hay	--	--	--	--	--
Alfalfa hay	--	1.1	--	--	--
Grain hay	--	--	--	--	--
Land area	.02	.4	.005	.1	--
Number of farms	--	--	.3	--	--

Source: Statistical Reporting Service, June Enumerative Survey, 1968

Table 2.--Estimated percent of agricultural commodities and items (livestock numbers, crop acres, number of farms) associated with overlap domains, Tennessee June 1968

Type of estimate and item	Percent of commodity or item associated with:				
	Domain RC	Domain RB	Domain RG	Domain CB	Domain BG
	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>
Open segment estimates					
Hogs	--	--	.1	.2	--
Cattle	--	.03	--	--	--
Milk cows	--	.1	--	--	--
Sheep	--	--	--	--	--
Hens	--	2.8	.01	.1	--
Closed segment estimates					
Hogs	--	--	.1	--	--
Cattle	.8	.3	--	--	--
Milk cows	3.5	.1	--	--	--
Sheep	--	--	--	--	--
Hens	--	4.6	.02	--	--
Corn planted	3.3	1.3	.3	--	--
Wheat for harvest	1.3	--	--	--	--
Oats planted	--	--	--	--	--
Soybeans planted	.8	.4	.1	--	--
Sorghum planted	--	21.4	--	--	--
Lesepedeza hay	--	--	--	--	--
Alfalfa hay	--	--	--	--	--
Grain hay	--	--	--	--	--
Land area	.3	.2	.02	.001	--
Number of farms	--	.3	.1	.2	--

Source: Statistical Reporting Service, June Enumerative Survey, 1968

Table 3.--Estimated percent of agricultural commodities and items (livestock numbers, crop acres, number of farms) associated with overlap domains, Oklahoma June 1968

Type of estimate and item	Percent of commodity or item associated with:				
	Domain RC	Domain RB	Domain RG	Domain CB	Domain BG
	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>
Open segment estimates					
Hogs	--	.7	--	2.8	--
Cattle	--	.1	--	--	--
Milk cows	--	--	--	--	--
Sheep	--	--	--	--	--
Hens	--	.1	--	--	--
Closed segment estimates					
Hogs	--	.4	--	1.7	--
Cattle	.1	.1	.1	.1	.1
Milk cows	--	--	--	--	--
Sheep	--	--	--	--	--
Hens	--	.1	--	--	--
Corn planted	--	--	--	--	--
Wheat for harvest	.3	.1	--	.3	--
Oats planted	--	--	--	--	--
Soybeans planted	--	--	--	--	--
Sorghum planted	--	.2	--	.8	--
Lespedeza hay	--	--	--	--	--
Alfalfa hay	--	--	--	--	--
Grain hay	--	--	--	--	--
Land area	.1	.1	.04	.1	.04
Number of farms	--	.1	--	2.8	--

Source: Statistical Reporting Service, June Enumerative Survey, 1968

Table 4.--Estimated percent of agricultural commodities and items (livestock numbers, crop acres, number of farms) associated with overlap domains, New Mexico
June 1968

Type of estimate and item	Percent of commodity or item associated with:				
	Domain RC	Domain RB	Domain RG	Domain CB	Domain BG
	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>
Open segment estimates					
Hogs	--	1.9	--	32.7	--
Cattle	--	--	--	--	--
Milk cows	--	--	--	--	--
Sheep	--	--	--	--	--
Hens	--	--	--	--	--
Closed segment estimates					
Hogs	--	1.7	--	28.8	--
Cattle	--	4.7	.3	--	--
Milk cows	--	.2	--	--	--
Sheep	--	--	--	--	--
Hens	--	--	--	--	--
Corn planted	--	--	--	--	--
Wheat for harvest	1.2	--	--	--	--
Oats planted	--	--	--	--	--
Soybeans planted	--	--	--	--	--
Sorghum planted	--	.3	--	--	--
Lespedeza hay	--	--	--	--	--
Alfalfa hay	--	--	--	--	--
Grain hay	--	--	--	--	--
Land area	.8	2.2	.2	.01	--
Number of farms	--	--	--	--	--

Source: Statistical Reporting Service, June Enumerative Survey, 1968

Table 5.--Estimated percent of agricultural commodities and items (livestock numbers, crop acres, number of farms) associated with grouped domains, Illinois
June 1968

Type of estimate and item	Percent of commodity or item associated with:				
	Rural : routes	City : routes	Post office : boxes	General : delivery	Unknown
	percent	percent	percent	percent	percent
Open segment estimates					
Hogs	93.3	3.5	2.9	.1	.3
Cattle	98.1	.1	1.6	.0	.2
Milk cows	92.3	.3	7.5	--	--
Sheep	98.3	1.7	--	--	--
Hens	60.2	35.7	3.8	.2	.1
Closed segment estimates					
Hogs	96.2	1.7	1.8	.1	.2
Cattle	95.1	3.0	1.3	.5	.1
Milk cows	99.7	.3	--	--	--
sheep	97.1	2.3	.6	--	--
Hens	61.0	35.0	3.7	.2	.1
Corn planted	94.4	2.9	1.4	1.0	.2
Wheat for harvest	91.1	2.6	3.6	2.3	--
Oats planted	94.4	4.0	1.0	--	.6
Soybeans planted	90.0	5.5	1.8	2.4	.1
Sorghum planted	100.0	--	--	--	--
Lespedeza hay	100.0	--	--	--	--
Alfalfa hay	91.4	7.8	.8	--	--
Grain hay	100.0	--	--	--	--
Land area	83.6	4.0	1.6	1.6	9.1
Number of farms	89.8	5.5	3.5	.8	.4

Note: Percentages may not add to 100.0 because of rounding.

Source: Statistical Reporting Service, June Enumerative Survey, 1968

Table 6.--Estimated percent of agricultural commodities and items (livestock numbers, crop acres, number of farms) associated with grouped domains, ~~Tennessee~~ June 1968

Type of estimate and item	Percent of commodity or item associated with:				
	Rural routes	City routes	Post office boxes	General delivery	Unknown
	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>
Open segment estimates					
Hogs	91.1	.8	6.3	1.5	.2
Cattle	93.2	1.5	4.5	.8	.1
Milk cows	95.2	2.2	2.3	.0	.3
Sheep	92.6	7.4	--	--	--
Hens	93.0	2.9	4.0	--	.0
Closed segment estimates					
Hogs	95.3	3.2	1.1	.2	.2
Cattle	87.8	7.7	2.5	1.9	.1
Milk cows	87.3	2.2	.3	10.0	.2
sheep	100.0	--	--	--	--
Hens	88.3	4.9	6.8	.1	.1
Corn planted	95.5	3.1	1.1	.2	--
Wheat for harvest	69.4	10.5	9.7	10.4	--
Oats planted	96.2	1.4	--	2.4	--
Soybeans planted	77.3	8.2	8.7	5.7	--
Sorghum planted	100.0	--	--	--	--
Lespedeza hay	92.0	5.7	.1	2.2	--
Alfalfa hay	96.0	4.0	--	--	--
Grain hay	93.4	2.8	--	3.7	--
Land area	58.3	5.0	2.7	1.1	32.9
Number of farms	94.0	1.9	2.8	.7	.6

Note: Percentages may not add to 100.0 because of rounding.

Source: Statistical Reporting Service, June Enumerative Survey, 1968

Table 7.--Estimated percent of agricultural commodities and items (livestock numbers, crop acres, number of farms) associated with grouped domains, ~~Oklahoma~~ June 1968

Type of estimate and item	Percent of commodity or item associated with:				
	Rural routes	City routes	Post office boxes	General delivery	Unknown
	percent	percent	percent	percent	percent
Open segment estimates					
Hogs	74.1	6.6	10.7	--	8.6
Cattle	80.3	7.6	4.8	.3	7.0
Milk cows	96.8	--	1.1	.2	1.8
Sheep	93.0	.5	6.5	--	--
Hens	69.0	2.9	1.3	.2	26.5
Closed segment estimates					
Hogs	56.7	27.0	11.0	.1	5.3
Cattle	60.3	8.5	24.3	2.9	4.0
Milk cows	75.9	11.4	11.4	.3	.9
sheep	92.0	.6	7.4	--	--
Hens	54.0	22.7	3.6	.2	19.4
Corn planted	78.6	4.4	16.9	--	--
Wheat for harvest	74.7	14.7	7.5	2.5	.6
Oats planted	86.7	7.2	5.5	.6	--
Soybeans planted	72.9	7.0	20.1	--	--
Sorghum planted	79.1	4.2	14.4	2.3	--
Lespedeza hay	100.0	--	--	--	--
Alfalfa hay	83.6	6.9	6.9	2.7	--
Grain hay	74.8	15.8	4.3	5.2	--
Land area	64.7	9.6	8.6	2.6	14.5
Number of farms	75.3	16.8	7.4	.4	.1

Note: Percentages may not add to 100.0 because of rounding.

Source: Statistical Reporting Service, June-Enumerative Survey, 1968

Table 8.--Estimated percent of agricultural commodities and items (livestock numbers, crop acres, number of farms) associated with grouped domains, **New Mexico**
June 1968

Type of estimate and item	Percent of commodity or item associated with:				
	Rural routes	City routes	Post office boxes	General delivery	Unknown
	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>	<u>percent</u>
Open segment estimates					
Hogs	45.1	1.1	51.4	2.0	.4
Cattle	19.8	4.6	26.0	48.3	1.3
Milk cows	60.7	.3	24.4	14.6	--
Sheep	1.7	.0	76.2	5.6	16.5
Hens	7.2	29.1	53.1	10.5	.0
Closed segment estimates					
Hogs	37.9	10.4	47.7	4.0	--
Cattle	22.2	17.2	24.1	35.4	.8
Milk cows	17.3	.2	28.1	54.4	--
sheep	2.6	.1	25.2	32.9	39.3
Hens	7.3	27.6	50.9	14.2	.0
Corn planted	33.6	3.4	36.7	26.2	--
Wheat for harvest	51.7	6.7	3.8	37.8	--
Oats planted	7.1	3.5	2.6	86.8	.1
Soybeans planted	100.0	--	--	--	--
Sorghum planted	47.8	3.6	8.6	40.0	--
Lespedeza hay	--	--	--	--	--
Alfalfa hay	45.1	17.0	16.2	21.7	.0
Grain hay	14.7	21.1	22.3	41.5	.4
Land area	15.7	9.9	21.2	38.2	14.8
Number of farms	43.5	5.4	24.7	25.9	.6

Note: Percentages may not add to 100.0 because of rounding.

Source: Statistical Reporting Service, June Enumerative Survey, 1968

UNITED STATES DEPARTMENT OF AGRICULTURE
Statistical Reporting Service
Budget Bureau No. - 40-R2766
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STATE	DISTRICT	SEGMENT NO.	TRACT NO.

SUPPLEMENTAL MAIL ADDRESS QUESTIONNAIRE

1. How do you receive mail?

List all places the respondent receives mail

(If rural or star route)..... (a) Route _____ Box _____

City or town _____

Zip _____

(b) Route _____ Box _____

City or town _____

Zip _____

If city delivery (office or residence)

(a) Street Address _____

City or town _____

Zip _____

(If post office box)..... Post office box _____

City or town _____

Zip _____

(If general delivery)..... City or town _____

Zip _____

(If any other source, give details) _____

