



United States  
Department  
of Agriculture

Animal and  
Plant Health  
Inspection  
Service

**Veterinary  
Services**

# Part I: Reference of 1999 Table Egg Layer Management in the U.S.



## Acknowledgments

This report has been prepared from material received and analyzed by the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS) during a nationwide study of management and flock health on layer operations.

The Layers '99 study was a cooperative effort between State and Federal agricultural statisticians, animal health officials, university researchers, extension personnel, and table egg layer operators. We want to thank the industry members who helped determine the direction and objectives of this study by participating in focus groups.

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All participants are to be commended for their efforts, particularly the producers whose voluntary efforts made the Layers '99 study possible.

Dr. Nora Wineland, NAHMS Program Leader

***Contacts for Further Information:***

Questions or comments on Layers '99 study methodology or data analysis:.....Dr. Lindsey Garber  
Information on reprints or other NAHMS reports:.....Ms. Nina Stanton  
Telephone: (970) 490-8000 E-mail: NAHMSinfo@usda.gov

## Table of Contents

Introduction . . . . .	1
Terms used in this report . . . . .	2
Section I: Population Estimates. . . . .	3
A. General layer management. . . . .	3
1. Operating arrangements . . . . .	3
2. Size of farm site . . . . .	4
3. White/brown egg layers . . . . .	6
4. Feed conversion . . . . .	7
5. Feed ingredients . . . . .	8
6. Feed source . . . . .	9
7. Health management . . . . .	11
B. Pullet management . . . . .	13
1. Source of pullets . . . . .	13
2. Pullet source - on farm . . . . .	14
3. Pullet source - off farm. . . . .	14
4. General pullet rearing management . . . . .	16
5. Coccidiosis programs during the growing period . . . . .	17
6. <i>Salmonella</i> programs during the growing period . . . . .	18
7. Vaccination programs during the growing period . . . . .	19
8. Diseases and conditions during the growing period . . . . .	23
Section II: Methodology. . . . .	24
A. Needs assessment . . . . .	24
B. Sampling and estimation . . . . .	24
C. Data collection . . . . .	25
D. Data analysis . . . . .	26
Appendix I: Sample Profile . . . . .	27
A. Responding operations . . . . .	27
Appendix II: U.S. Table Egg Layers . . . . .	28

## Part I: Regional Information

Map of participating states . . . . .	1
Size of farm sites . . . . .	4
Average flock size (number of layers per flock) . . . . .	5
Obtaining feed from AFIA approved plants . . . . .	9
Obtaining feed from mills which made feed for species other than chickens . . . . .	9
Testing of finished feed or any feed ingredients for <i>Salmonella enteritidis</i> (S.e.) . . . . .	10
Primary pullet rearing facilities (percent of layers) . . . . .	16
Primary pullet rearing facilities (percent of farm sites) . . . . .	16
Methods to monitor <i>Salmonella enteritidis</i> (S.e.) in pullets at the growing operation . . . . .	18
Vaccines administered to pullets at pullet growing operations . . . . .	20

## Introduction

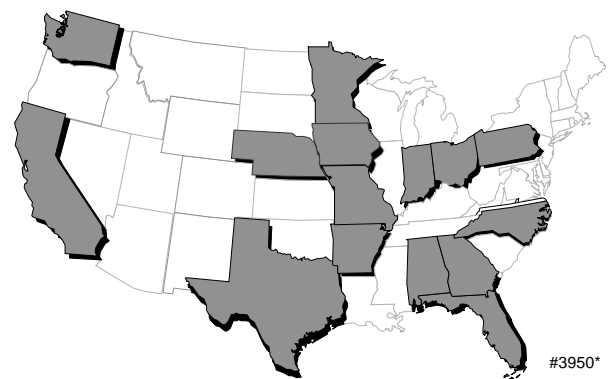
The National Animal Health Monitoring System's (NAHMS) Layers '99 study was designed to provide both participants and the industry with information on the nation's table egg layer population for education and research. NAHMS is sponsored by the USDA:APHIS:Veterinary Services (VS).

Layers '99 is the first NAHMS national study of the layer industry. NAHMS developed study objectives by exploring existing literature and contacting industry members and researchers about their informational needs and priorities. The objectives are listed inside the back cover of this report.

The USDA's National Agricultural Statistics Service (NASS) collaborated with VS to select a statistically-valid sample from 15 states for Layers '99 (see map below). The 15-state target population accounted for over three-quarters of the table egg layers in the U.S. on December 1, 1998.

NASS enumerators collected data for *Part I: Reference of 1999 Table Egg Layer Management in the U.S.* from 208 single and multiple-farm companies via a questionnaire administered February 1-26, 1999. These respondents provided information on 526 farm sites which formed the basis of this report. Information in this report is operator-reported reflecting the operator's impression, which may or may not be based on laboratory results or veterinary advice. (See methodology information in Section II beginning on page 24.)

**States Participating in the Layers '99 Study**



Results of the Layers '99 and other NAHMS studies are accessible on the World Wide Web at <http://www.aphis.usda.gov/vs/ceah/cahm>.

For questions about this report or additional Layers '99 and NAHMS results, please contact:

Centers for Epidemiology and Animal Health  
USDA:APHIS:VS, attn. NAHMS  
555 South Howes; Fort Collins, CO 80521  
Telephone: (970) 490-8000  
E-mail: NAHMSinfo@usda.gov

**[Http://www.aphis.usda.gov/vs/ceah/cahm](http://www.aphis.usda.gov/vs/ceah/cahm)**

\* Identification numbers are assigned to each graph of this report for public reference.

## Terms Used in This Report

**Bacterin:** A killed bacterial product administered to immunize the host against a specific bacterial disease.

**Company owned farm:** A category that included independent producers.

**Competitive exclusion:** Administration of a product containing bacteria that competes with *Salmonella enteritidis* (S.e.) bacteria in the digestive tract, thereby limiting growth of *Salmonella enteritidis* (S.e.) bacteria.

**Contract farm:** A farm site that produces eggs for another company. Generally, the contractee owns the farm and provides the labor.

**Contractor:** A company that contracts with a farm to produce eggs for them. Usually the contractor owns the layers and supplies the feed.

**Farm site:** A contiguous land unit that makes up a single premise. A farm site may have one or more layer houses on it.

**Flock:** A group of birds of similar age (may vary several weeks from the median age of the flock) considered as a production unit. A flock usually fills only one layer house, but it may take up more or less than one house.

**Last completed flock:** The most recent flock that completed its production cycle and was then removed from the farm.

**Layer:** A chicken that produces table eggs.

**Molt:** That period of time when birds are taken out of production (usually around 65 weeks of age) until they return approximately to their 18-week weight. After a rest period, they are returned to production for another laying cycle.

**N/A:** Not applicable.

**Population estimates:** Averages and proportions weighted to represent the population. For this report, the reference population was all company-owned and contract farms associated with (companies) operations that had 30,000 or more layers on December 1, 1998, in the 15 participating states. Most of the estimates in this report are provided with a measure of precision called the *standard error*. If the only error is sampling error, chances are 95 out of 100 that the interval created by the estimate plus or minus two standard errors will contain the true population value. In the example illustrated, an estimate of 7.5 with a standard error of 1.0 results in a range of 5.5 to 9.5 (two times the standard error above and below the estimate). The second estimate of 3.4 shows a standard error of 0.3 and results in a range of 2.8 to 4.0. Similarly, the 90 percent confidence interval would be created by multiplying the standard error by 1.65 instead of two. Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported. If there were no reports of the event, no standard error was reported.

**Pullet:** A chicken less than 20 weeks of age. A pullet placed in the laying house is called a layer.

### Regions:

**Great Lakes:** Indiana, Ohio, and Pennsylvania.

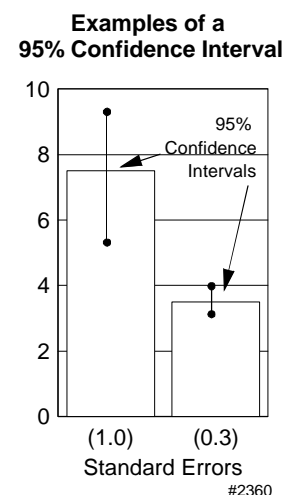
**Southeast:** Alabama, Florida, Georgia, and North Carolina.

**Central:** Arkansas, Iowa, Minnesota, Missouri, and Nebraska.

**West:** California, Texas, and Washington.

**Sample profile:** Information that describes characteristics of the operations from which Layers '99 data were collected.

**Size of farm site:** Size groupings based on number of layers 20 weeks of age or older present on December 1, 1998. For this report, sizes of farm sites were less than 100,000 and 100,000 or more.



# Section I: Population Estimates

## A. General Layer Management

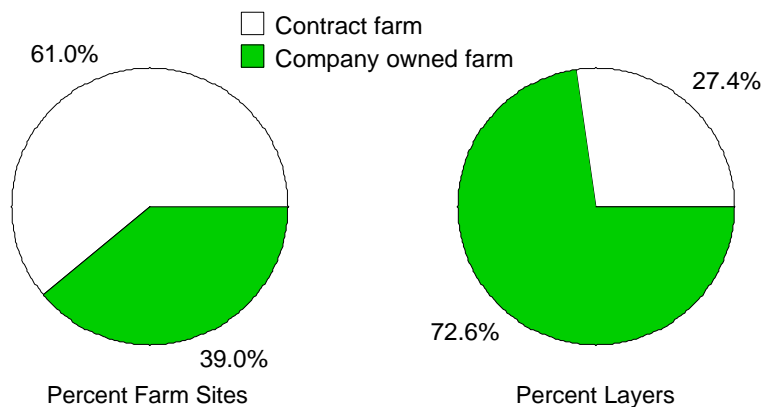
### 1. Operating arrangements

Although the majority of farm sites were contract farms (61.0 percent), the majority of birds (on hand December 1, 1998) were on company owned farms (72.6 percent), indicating that company owned farms tended to be larger than contract farms.

a. Percent of farm sites (and percent of layers on those farm sites) by operating arrangements:

Operating Arrangement	Percent Farm Sites	Standard Error	Percent Layers	Standard Error
Contract farm	61.0	(3.3)	27.4	(3.1)
Company owned farm	39.0	(3.3)	72.6	(3.1)
Total	100.0		100.0	

Percent Farm Sites (and Percent of Layers on those Farm Sites) by Operating Arrangements



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**2. Size of farm site**

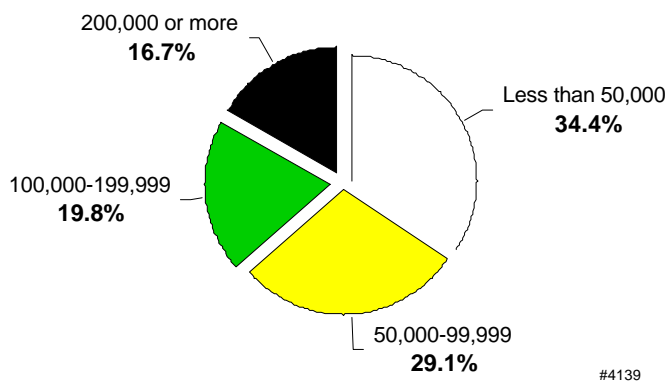
Approximately one-third (34.4 percent) of farm sites had fewer than 50,000 layers.

Note: This study was limited to companies with 30,000 or more layers on December 1, 1998. Since some companies have multiple sites, individual farm sites owned by or contracted with these companies may have had fewer layers.

a. Percent of farm sites by size of farm site (number of layers 20 weeks of age or older):

Size of Farm Site (Number Layers)	Percent Farm Sites	Standard Error
Less than 50,000	34.4	(2.4)
50,000-99,999	29.1	(2.2)
100,000-199,999	19.8	(1.5)
200,000 or more	<u>16.7</u>	(1.8)
Total	100.0	

**Percent of Farm Sites by Size of Farm Site (Number of Layers 20 Weeks of Age or Older)**



The Central region had the largest percentage (23.0 percent) of farm sites with 200,000 or more layers and also the largest percentage (40.5 percent) of farm sites with fewer than 50,000 layers.

b. Percent of farm sites by size (number of layers) and by region:

Size of Farm Site (Number Layers)	Percent Farm Sites by Region							
	Great Lakes		Southeast		Central		West	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Less than 50,000	35.2	(3.9)	30.2	(5.9)	40.5	(5.2)	32.3	(4.8)
50,000-99,999	29.8	(2.9)	41.5	(5.9)	20.0	(2.3)	23.2	(3.9)
100,000-199,999	19.6	(2.5)	16.9	(2.9)	16.5	(3.3)	25.6	(3.7)
200,000 or more	<u>15.4</u>	(3.3)	<u>11.4</u>	(2.9)	<u>23.0</u>	(3.7)	<u>18.9</u>	(2.9)
Total	100.0		100.0		100.0		100.0	

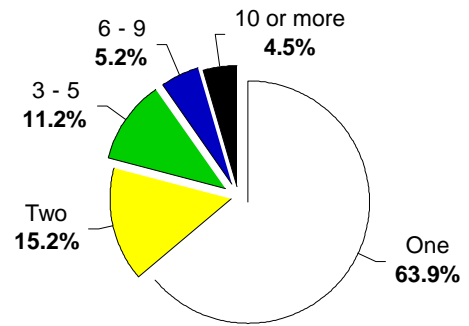


Two-thirds (63.9 percent) of farm sites had only one flock in lay or molting, and less than 10 percent of farm sites had six or more flocks.

c. Percent of farm sites by number of flocks in lay or molt on December 1, 1998:

Number Flocks	Percent Farm Sites	Standard Error
1	63.9	(2.6)
2	15.2	(1.4)
3 - 5	11.2	(1.2)
6 - 9	5.2	(0.8)
10 or more	4.5	(0.8)
Total	100.0	

Percent of Farm Sites by Number of Flocks in Lay or Molt on December 1, 1998



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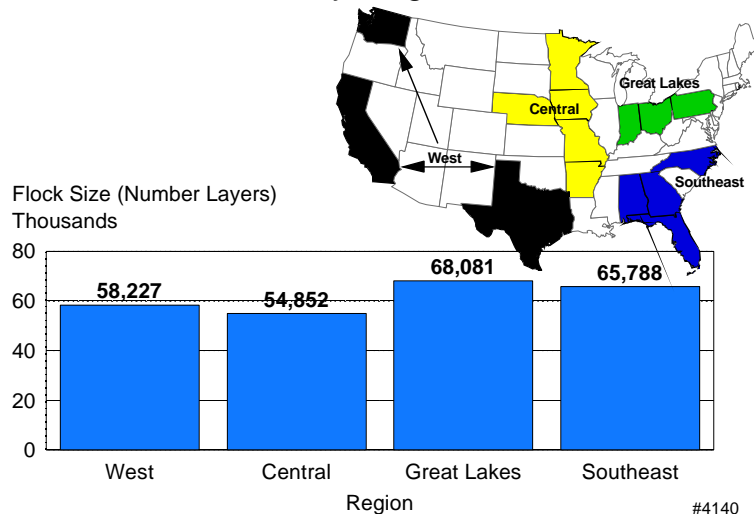
The average flock size was 63,000 layers.

d. Average flock size (number of layers per flock) by region:

Average Flock Size by Region

Great Lakes		Southeast		Central		West		All Farm Sites	
Average Number	Standard Error	Average Number	Standard Error	Average Number	Standard Error	Average Number	Standard Error	Average Number	Standard Error
68,081	(5,850)	65,788	(4,321)	54,852	(3,902)	58,227	(4,243)	63,000	(2,656)

Average Flock Size (Number Layers per Flock) by Region



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### 3. White/brown egg layers

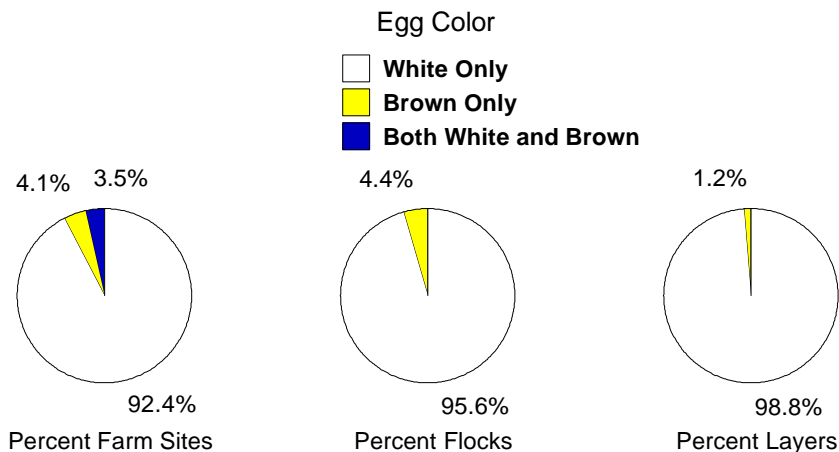
The vast majority of flocks (95.6 percent) and layers (98.8 percent) in the 15 Layers '99 states were white egg layers. Only 7.6 percent of farm sites had any brown egg layers, 4.1 percent of farm sites had brown egg layers only, and 3.5 percent of farm sites had both white and brown egg layers.

Note: These percentages were estimates for the 15 states participating in Layers '99 (see Introduction) which did not include the New England states.

a. Percent of farm sites (and percent of flocks and percent of layers on those farm sites) by egg color:

Color/Strain	Percent Farm Sites	Standard Error	Percent Flocks	Standard Error	Percent Layers	Standard Error
White egg layers only	92.4	(1.2)	95.6	(0.6)	98.8	(0.2)
Brown egg layers only	4.1	(0.9)	4.4	(0.6)	1.2	(0.2)
Both white and brown egg layers	3.5	(0.6)	N/A	--	N/A	--
Total	100.0		100.0		100.0	

Percent of Farm Sites (Flocks and Layers) by Egg Color



#4142

### 4. Feed conversion

Overall, it took 3.7 pounds of feed to produce one dozen eggs.

a. Pounds of feed fed<sup>1</sup>

i. Average pounds of feed fed per dozen eggs produced by last completed flock:

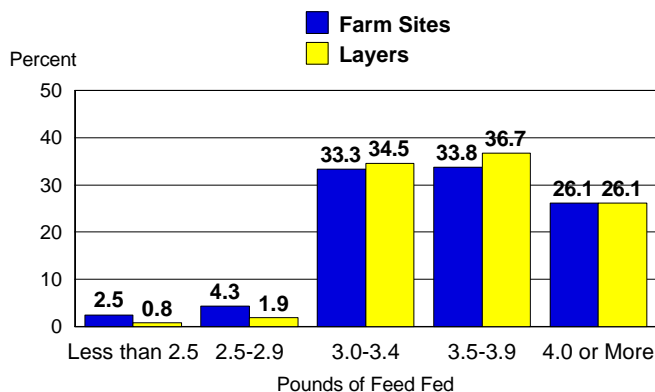
Average Pounds	Standard Error
3.7	(0.1)

About two-thirds (67.1 percent) of farm sites fed between 3.0 and 3.9 pounds of feed per dozen eggs produced. Approximately one-quarter (26.1 percent) of farm sites fed more than this amount per dozen eggs, and 6.8 percent of farm sites fed less than this amount.

ii. Percent of farm sites (and percent of layers on those farm sites) by pounds of feed fed per dozen eggs produced:

Pounds of Feed Fed	Percent Farm Sites	Standard Error	Percent Layers	Standard Error
Less than 2.5	2.5	(0.7)	0.8	(0.3)
2.5 to 2.9	4.3	(1.0)	1.9	(0.6)
3.0 to 3.4	33.3	(2.8)	34.5	(3.0)
3.5 to 3.9	33.8	(2.8)	36.7	(3.2)
4.0 or more	<u>26.1</u>	(3.8)	<u>26.1</u>	(4.4)
Total	100.0		100.0	

Percent of Farm Sites (and Layers on those Farm Sites) by Pounds of Feed Fed per Dozen Eggs Produced



#4143

<sup>1</sup> These estimates were produced by dividing the weighted sum of total pounds of feed fed to the last completed flock across all farm sites by the weighted total dozens of eggs produced by these flocks.

### 5. Feed ingredients

Poultry by-products were present in feed fed to 44.6 percent of layers, and 73.6 percent of layers received feed containing other animal products. Data on specific by-products fed were not collected during the Layers '99 study.

a. Percent of farm sites (and percent of layers on those farm sites) by feed ingredients fed to laying hens:

Feed Ingredients Fed to Laying Hens	Percent Farm Sites	Standard Error	Percent Layers	Standard Error
Poultry by-products	40.9	(4.2)	44.6	(4.7)
Other animal products	69.5	(3.5)	73.6	(3.3)

b. Percent protein fed

Farm sites provided feed containing an average of 17.7 percent protein at peak production.

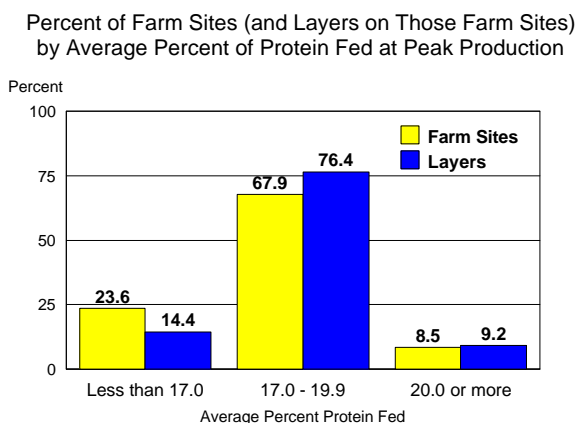
i. Average percent of protein fed at peak production by size of farm site:

Size of Farm Site (Number Layers 20 Weeks of Age or Older)	Average Percent Protein Fed	Standard Error
Less than 100,000	17.5	(0.1)
100,000 or more	18.0	(0.1)
All farm sites	17.7	(0.1)

Although 23.6 percent of farm sites provided a feed with less than 17 percent protein at peak production, these farm sites accounted for 14.4 percent of layers.

ii. Percent of farm sites (and percent of layers on those farm sites) by average percent protein fed at peak production:

Average Percent Protein Fed	Percent Farm Sites	Standard Error	Percent Layers	Standard Error
Less than 17.0	23.6	(3.8)	14.4	(2.8)
17.0 - 19.9	67.9	(3.9)	76.4	(3.1)
20.0 or more	8.5	(1.5)	9.2	(1.5)
Total	100.0		100.0	



#4144

**6. Feed source**

About three-fourths (76.4 percent) of farm sites obtained feed from an AFIA approved plant.

- a. Percent of farm sites that obtained feed from an American Feed Industry Association (AFIA) approved plant by region:

Percent Farm Sites by Region

Great Lakes		Southeast		Central		West		All Farm Sites	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
80.6	(4.6)	92.6	(2.7)	64.7	(7.3)	62.6	(6.7)	76.4	(3.1)

About two-thirds (64.1 percent) of farm sites obtained feed from a mill that made feed for other species.

- b. Percent of farm sites that obtained feed from a mill which made feed for species other than chickens by region:

Percent Farm Sites by Region

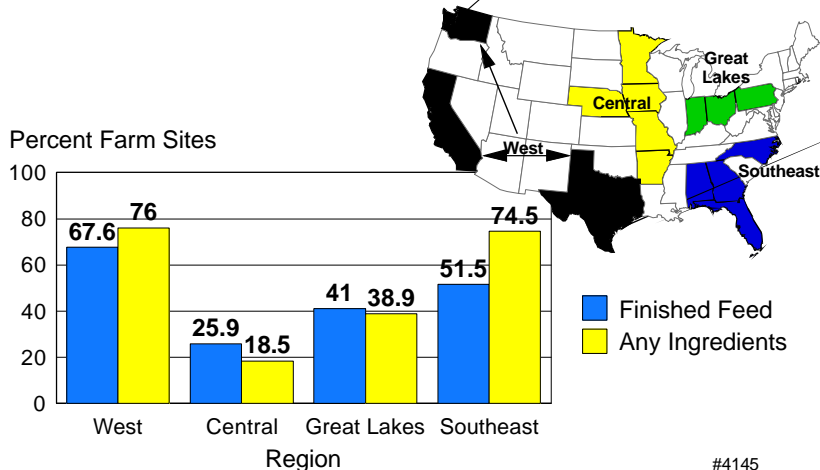
Great Lakes		Southeast		Central		West		All Farm Sites	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
60.0	(8.2)	72.1	(7.8)	63.3	(6.7)	64.3	(5.2)	64.1	(4.0)

The percentages of farm sites where finished feed was tested for *Salmonella enteritidis* (S.e.) ranged from 25.9 percent of farm sites in the Central region to 67.6 percent of farm sites in the West. Testing of feed ingredients was most common for farm sites in the West (76.0 percent) and Southeast (74.5 percent) regions.

c. Percent of farm sites that routinely tested finished feed or any feed ingredients for *Salmonella enteritidis* (S.e.) by region:

Item Tested for S.e.	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Finished feed	41.0	(7.8)	51.5	(9.9)	25.9	(4.9)	67.6	(5.1)	46.8	(4.1)
Any feed ingredients	38.9	(7.7)	74.5	(6.7)	18.5	(4.5)	76.0	(3.8)	51.6	(4.0)

Percent of Farm Sites that Routinely Tested Finished Feed or Any Feed Ingredients for *Salmonella enteritidis* by Region



#4145

## 7. Health management

Almost all (92.5 percent) farm sites used some type of health service provider during 1998, with the most common being a company service person/veterinarian (78.8 percent) and technical service provider (64.0 percent). Use of private veterinarians, State diagnostic laboratories, technical service, and extension services increased with size of farm site.

a. Percent of farm sites by health service provider used during 1998 and by size of farm site:

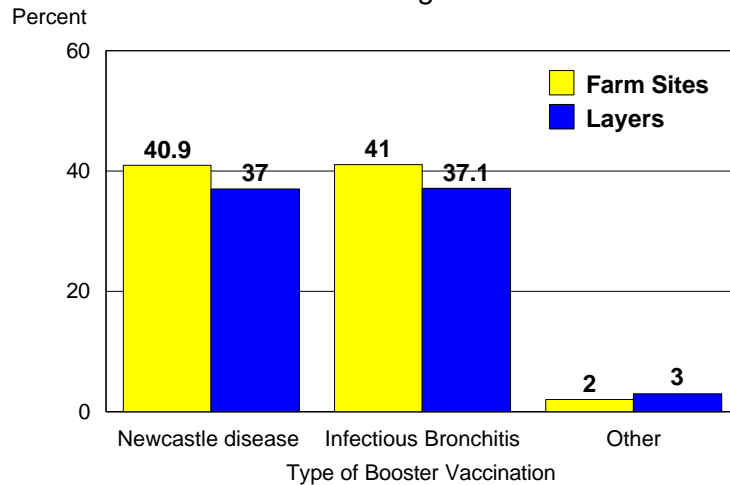
Health Service Provider Used	Percent by Size of Farm Site (Number Layers)					
	Less than 100,000		100,000 or More		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Company service person/company veterinarian	81.2	(3.0)	74.8	(2.8)	78.8	(2.4)
Private veterinarian	13.5	(3.5)	27.9	(3.1)	18.8	(2.9)
State diagnostic laboratory	37.6	(4.6)	65.2	(3.6)	47.8	(3.9)
Technical service (e.g., feed, vaccine, breeder company)	58.6	(4.9)	73.1	(3.2)	64.0	(3.8)
University Extension Service	25.9	(4.1)	41.1	(3.5)	31.5	(3.3)
Other	5.2	(1.4)	3.3	(0.8)	4.5	(1.0)
Any	90.8	(2.3)	95.4	(1.1)	92.5	(1.6)

Vaccinations against Newcastle disease and Infectious Bronchitis were given in lay (boosting) on less than half the farm sites each (40.9 percent and 41.0 percent, respectively).

b. Percent of farm sites (and percent of layers on those farm sites) by type of booster vaccination given to layers 20 weeks of age and older:

Type of Booster Vaccination	Percent Farm Sites	Standard Error	Percent Layers	Standard Error
Newcastle disease	40.9	(3.9)	37.0	(4.0)
Infectious Bronchitis	41.0	(3.9)	37.1	(4.0)
Other	2.0	(0.5)	3.0	(1.1)

Percent of Farm Sites (and Layers on Those Farm Sites) by Type of Booster Vaccination Given to Layers 20 Weeks of Age and Older



#4147



## B. Pullet Management

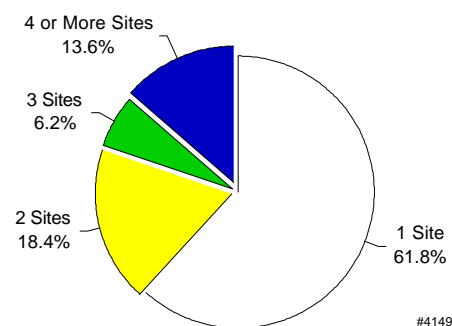
### 1. Source of pullets

Almost two-thirds (61.8 percent) of farm sites got all of their most recently placed pullets from a single pullet raising site, while 13.6 percent of farm sites assembled their most recently placed flock from four or more different farm sites.

a. Percent of layer farm sites by number of different pullet-raising sites from which pullets for the most recently placed flock originated:

Number Pullet Sites	Percent Farm Sites	Standard Error
1	61.8	(3.4)
2	18.4	(2.5)
3	6.2	(2.1)
4 or more	<u>13.6</u>	(3.0)
Total	100.0	

Percent Farm Sites by Number of Different Pullet-Raising Sites from Which Pullets for the Most Recently Placed Flock Originated



Nearly all (94.5 percent) replacement pullets came from NPIP monitored breeder flocks. The Layers '99 study did not determine whether or not these NPIP breeder flocks were monitored for *Salmonella enteritidis* (S.e.).

b. Percent of farm sites (and percent of layers on those farm sites) where **all** replacement pullets came as chicks from National Poultry Improvement Program (NPIP) monitored breeder flocks:

Percent Farm Sites	Standard Error	Percent Layers	Standard Error
94.6	(1.4)	94.5	(1.8)

Nearly three out of four farm sites (72.6 percent) obtained their pullets from their own company, but a different farm site. Only 6.6 percent of layer farm sites raised any pullets on their own farm site, accounting for 14.1 percent of layers.

c. Percent of farm sites (and percent of layers placed) by source of replacement pullets:

Source of Pullets	Percent Farm Sites	Standard Error	Percent Layers	Standard Error
Different company	28.5	(3.2)	13.0	(1.6)
Same company, different farm site	72.6	(2.7)	72.9	(2.9)
Raised on this farm site	6.6	(0.9)	<u>14.1</u>	(2.5)
Total	--		100.0	

**2. Pullet source - on farm**

While few layer farm sites raised their own pullets (6.6 percent, see Table B.1.c.), pullet houses were 1,000 or more feet away from the nearest laying house on the majority of these farm sites (60.6 percent).

a. For farm sites where any replacement pullets for the most recently placed layer flock were raised on this farm site, percent of farm sites by distance (in feet) between the pullet house and the nearest layer house:

Distance (Feet)	Percent Farm Sites	Standard Error
0 - 99	8.7	(2.8)
100 - 999	30.7	(4.8)
1,000 or more	<u>60.6</u>	(5.3)
Total	100.0	

**3. Pullet source - off farm**

One out of five (20.9 percent) farm sites where pullets were raised off farm obtained their pullets from out of state.

a. For farm sites where any replacement pullets for the most recently placed layer flock were raised off the farm site, percent of farm sites where any pullets were raised in a different state:

Percent Farm Sites	Standard Error
20.9	(2.8)

The average distance replacement pullets were transported was under 100 miles.

b. For farm sites where any replacement pullets for the most recently placed layer flock were raised off the farm site, average distance (in miles) pullets were transported to the farm site:

Average Distance (Miles)	Standard Error
95.1	(8.3)

Pullets were transported less than 5 miles to 4.6 percent of farm sites and transported 100 or more miles to 23.4 percent of farm sites. The median distance transported was 35 miles. The mean distance transported (95.1 miles, Table B.3.b) was much greater than the median because some farms transported long distances (over 1,000 miles).

c. For farm sites where any replacement pullets for the most recently placed layer flock were raised off the farm site, percent of farm sites by distance (in miles) pullets were transported to the farm site:

Distance (Miles)	Percent Farm Sites	Standard Error
0.1 - 4.9	4.6	(0.9)
5.0 - 19.9	28.0	(3.7)
20.0 - 99.9	44.0	(3.3)
100.0 or more	<u>23.4</u>	(3.1)
Total	100.0	

About one-third (33.4 percent) of farm sites transported pullets in company-owned trucks, while 9.9 percent of farm sites received their pullets in trucks owned by the pullet operation. Over one-half (56.7 percent) of the farm sites used an independent trucker.

d. For farm sites where any replacement pullets for the most recently placed layer flock were raised off the farm site, percent of farm sites by means of pullet transportation to the layer house:

Means of Transportation	Percent Farm Sites	Standard Error
Truck owned by company	33.4	(4.1)
Truck owned by pullet operation	9.9	(1.5)
Truck owned by independent trucker/contractor	<u>56.7</u>	(4.1)
Total	100.0	

The majority of farm sites used trucks that were decontaminated between flocks, regardless of who trucked them.

e. For farm sites where any replacement pullets for the most recently placed layer flock were raised off the farm site, percent of farm sites for which pullets were transported in coops and trucks that were decontaminated between flocks by means of transportation:

Means of Transportation	Percent Farm Sites	Standard Error
Truck owned by company	99.7	(0.1)
Truck owned by pullet operation	88.7	(5.8)
Truck owned by independent trucker/contractor	97.5	(0.9)
Any means	97.4	(0.8)

#### 4. General pullet rearing management

About three-fourths (78.7 percent) of layers originated from primarily caged pullet rearing facilities and 21.3 percent of layers originated from primarily floor rearing facilities. The percentage of layers originating from floor reared facilities ranged from 6.3 percent in the Central region to 62.9 percent in the Southeast region.

a. Percent of layers by *primary* method reared as pullets and by region:

Primary Method	Percent Layers by Region									
	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Cage reared	88.3	(4.9)	37.1	(9.1)	93.7	(3.3)	76.4	(4.4)	78.7	(3.2)
Floor reared	<u>11.7</u>	(4.9)	<u>62.9</u>	(9.1)	<u>6.3</u>	(3.3)	<u>23.6</u>	(4.4)	<u>21.3</u>	(3.2)
Total	100.0		100.0		100.0		100.0		100.0	

Some farm sites (5.7 percent) obtained pullets from both cage reared facilities and floor reared facilities, while the majority of farm sites (71.3 percent) obtained *all* their replacement pullets from cage reared facilities. The percentage of farms where all layers had been primarily floor reared ranged from 9.6 percent of farm sites in the Great Lakes region to 62.1 percent in the Southeast region.

b. Percent of farm sites where all pullets for the farm site were primarily cage reared, primarily floor-reared, or where pullets came from both cage- and floor-reared facilities:

Primary Method	Percent Farm Sites by Region									
	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
All pullets cage reared	89.9	(2.8)	36.0	(7.7)	82.0	(3.3)	66.3	(5.3)	71.3	(3.2)
All pullets floor reared	9.6	(2.8)	62.1	(7.9)	12.0	(2.2)	16.4	(3.7)	23.0	(3.2)
Some pullets cage reared and some floor reared	<u>0.5</u>	(0.3)	<u>1.9</u>	(1.0)	<u>6.0</u>	(1.9)	<u>17.3</u>	(3.9)	<u>5.7</u>	(1.1)
Total	100.0		100.0		100.0		100.0		100.0	

Layers placed on nearly all (93.9 percent) farm sites had their beaks trimmed before being placed.

c. Percent of farm sites where the following procedures were performed on *all* pullets before entering the layer operation:

Pullet Management Practice	Percent Farm Sites	Standard Error
Beak trim	93.9	(1.5)
Dub comb	13.5	(2.1)
Toe trim	4.7	(1.1)
Any of the above	96.5	(1.3)

## 5. Coccidiosis programs during the growing period

Layers on 64.1 percent of farm sites came from pullet raising operations that employed some form of coccidiosis program. The most common programs were use of a coccidiostat as prevention and treatment in response to a problem (over 30 percent of farm sites each).

Note: Less than 4 percent of producers did not know whether or not these coccidiosis programs were administered at the pullet farms.

### a. Percent of layer farm sites by coccidiosis programs used for pullets at the growing operation:

Coccidiosis Program	Percent Farm Sites						Total
	Yes		Don't Know		No		
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
Preventive coccidiostat	30.7	(2.9)	3.9	(1.0)	65.4	(3.0)	100.0
Vaccination	22.4	(3.1)	3.4	(0.9)	74.2	(3.2)	100.0
Treatment only in response to a problem	30.1	(3.2)	3.7	(1.0)	66.2	(3.3)	100.0
Other	0.2	(0.1)	3.5	(1.0)	96.3	(1.0)	100.0
	<u>Don't Know or No</u>						
			Percent		Standard Error		
Any	64.1	(3.9)	35.9		(3.9)		100.0

About one-half of the farm sites where all pullets came from primarily cage reared facilities had a coccidiosis program, the most common being treatment in response to a problem. Nearly all (93.1 percent) farm sites where all pullets came from primarily floor reared facilities had a coccidiosis program, with the most common being coccidiostats as a preventive measure.

### i. Percent of layer farm sites by coccidiosis programs used for pullets and by *primary* method of pullet rearing at the growing operation:

Coccidiosis Program	Percent Farm Sites by Primary Rearing Method					
	All Pullets Cage Reared		All Pullets Floor Reared		Some Pullets Cage Reared and Some Floor Reared	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Preventive coccidiostat	14.1	(1.9)	71.2	(8.7)	84.3	(4.7)
Vaccination	19.4	(2.8)	34.7	(8.9)	12.6	(4.7)
Treatment only in response to a problem	34.7	(4.2)	19.1	(4.9)	25.1	(8.7)
Other	0.0	--	0.5	(0.2)	2.1	(1.3)
Any	53.3	(4.9)	93.1	(3.2)	97.1	(1.3)

**6. Salmonella programs during the growing period**

Overall, layers on 69.6 percent of farm sites came from pullet facilities that monitored for *Salmonella enteritidis* (S.e.) The West region had the largest percent of farm sites (83.0 percent) that obtained their layers from *Salmonella enteritidis* (S.e.) monitored pullet facilities.

Note: Estimates for farm sites that monitored for *Salmonella enteritidis* (S.e.) may be low because about 4 percent of producers overall (20 percent of producers in the Central region) did not know whether or not these procedures were done. These farm sites were included among those farm sites where monitoring was not done.

a. Percent of layer farm sites that used the following methods to monitor *Salmonella enteritidis* (S.e.) in pullets at the growing operation by region:

<i>Salmonella enteritidis</i> (S.e.) Monitoring Methods	Percent Farm Sites by Region*									
	Great Lakes		Southeast		Central*		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Dead chick/chick paper testing	41.5	(7.4)	41.3	(9.5)	13.9	(2.8)	70.6	(4.2)	43.5	(3.9)
Environmental/manure culture	55.6	(8.1)	54.7	(9.4)	54.0	(6.7)	43.8	(5.6)	52.4	(4.1)
Bird culture	4.2	(1.2)	1.7	(0.8)	8.2	(2.3)	23.9	(4.1)	8.9	(1.2)
Serology	4.6	(1.6)	17.0	(4.9)	13.4	(3.1)	49.3	(6.5)	19.2	(2.7)
Any of the above	63.6	(8.4)	69.1	(7.7)	65.1	(6.0)	83.0	(2.6)	69.6	(3.9)

\* Producers on 20 percent of farm sites in the Central region did not know if these procedures were done. The remaining regions had less than 2 percent of producers who did not know.

Ten percent of farm sites obtained replacement pullets from facilities that used a competitive exclusion product in pullets. An additional 20.5 percent of farm sites did not know whether or not a competitive exclusion product was used.

b. Percent of layer farm sites on which a competitive exclusion product was used to reduce *Salmonella enteritidis* (S.e.) in pullets at the pullet growing operation:

Use of Competitive Exclusion Product	Percent Farm Sites	Standard Error
Yes	10.3	(2.9)
Didn't know	20.5	(3.3)
No	<u>69.2</u>	(3.9)
Total	100.0	

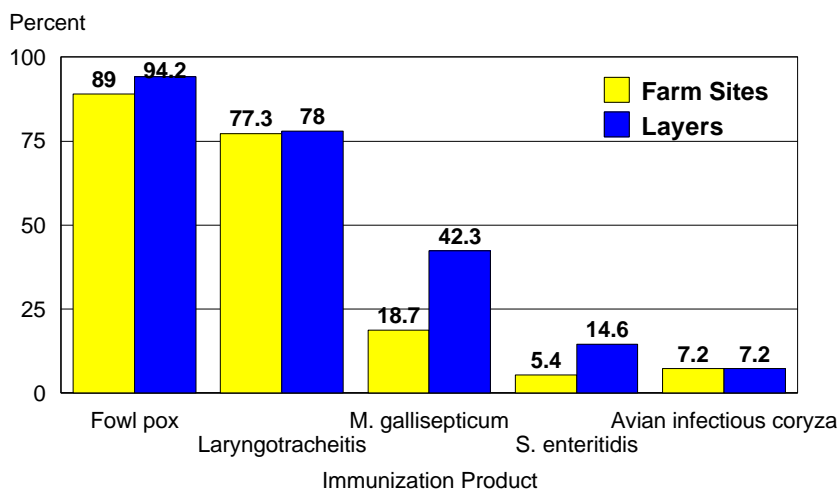
### 7. Vaccination programs during the growing period

A total of 14.6 percent of layers (on 5.4 percent of farm sites) were vaccinated against *Salmonella enteritidis* (S.e.) as pullets, with an additional 5.4 percent of layers for which vaccination status was unknown. Layers '99 data did not determine if immunization products used against *Salmonella enteritidis* (S.e.) were bacterin or live vaccine.

a. Percent of layer farm sites (and percent of layers on those farm sites) by immunization products administered at the pullet growing operation (for the most recently placed flock):

Immunization Product	Percent Farm Sites and Layers by Immunization Products Administered						Total
	Yes		Didn't Know		No		
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
<b>Farm Sites</b>							
Laryngotracheitis (LT)	77.3	(3.2)	9.6	(1.8)	13.1	(2.7)	100.0
<i>Mycoplasma gallisepticum</i> (MG)	18.7	(2.0)	10.1	(1.9)	71.2	(2.8)	100.0
Fowl pox	89.0	(1.8)	9.5	(1.8)	1.5	(0.3)	100.0
<i>Salmonella enteritidis</i> (S.e.)	5.4	(0.9)	10.4	(1.8)	84.2	(2.1)	100.0
Avian infectious coryza	7.2	(1.7)	13.4	(2.0)	79.4	(2.6)	100.0
<b>Layers</b>							
Laryngotracheitis (LT)	78.0	(3.2)	7.3	(2.3)	14.7	(2.3)	100.0
<i>Mycoplasma gallisepticum</i> (MG)	42.3	(4.5)	6.3	(1.1)	51.4	(4.3)	100.0
Fowl pox	94.2	(0.9)	4.6	(0.8)	1.2	(0.3)	100.0
<i>Salmonella enteritidis</i> (S.e.)	14.6	(3.0)	5.4	(0.9)	80.0	(3.1)	100.0
Avian infectious coryza	7.2	(1.5)	12.6	(2.8)	80.2	(3.1)	100.0

**Percent of Farm Sites (and Layers on Those Farm Sites)\*  
by Immunization Products  
Administered to Pullets at Growing Operations**



\*Most recently placed flock.

#4151

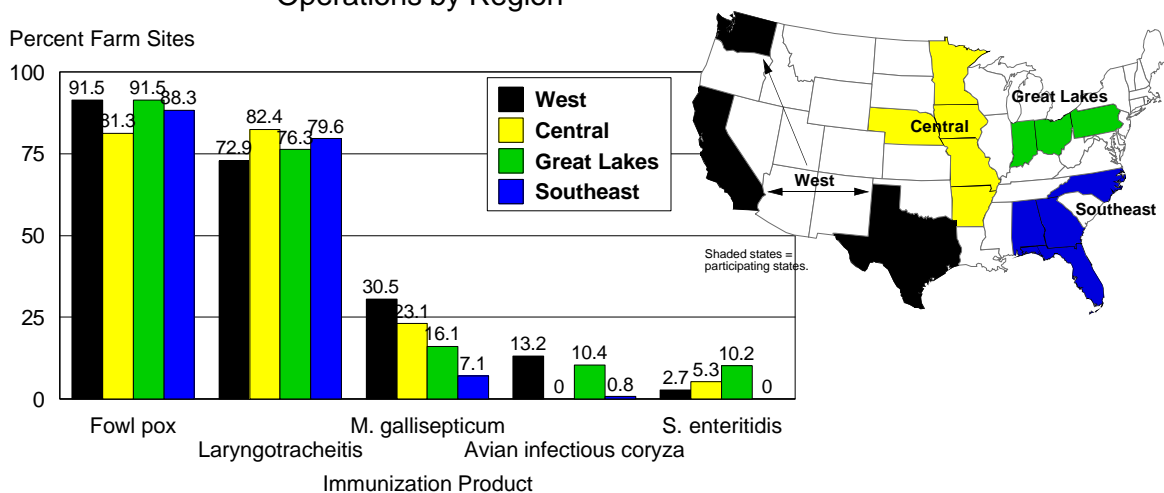
The Great Lakes region had the highest percentage of farm sites where layers had been vaccinated against *Salmonella enteritidis* (S.e.) as pullets (10.2 percent of layer farm sites). Vaccination against MG ranged from 7.1 percent of farm sites in the Southeast region to 30.5 percent of farm sites in the West.

i. Percent of layer farm sites where immunization products had been administered to pullets at the pullet growing operation (most recently placed flock) by region:

Percent Farm Sites by Region

Immunization Product	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Laryngotracheitis (LT)	76.3	(6.7)	79.6	(7.0)	82.4	(5.1)	72.9	(3.9)	77.3	(3.2)
<i>Mycoplasma gallisepticum</i> (MG)	16.1	(3.3)	7.1	(2.0)	23.1	(5.3)	30.5	(4.2)	18.7	(2.0)
Fowl pox	91.5	(2.0)	88.3	(6.1)	81.3	(5.1)	91.5	(1.7)	89.0	(1.8)
<i>Salmonella enteritidis</i> (S.e.)	10.2	(2.5)	0.0	(--)	5.3	(1.3)	2.7	(0.8)	5.4	(0.9)
Avian infectious coryza	10.4	(4.1)	0.8	(0.5)	0.0	(--)	13.2	(3.1)	7.2	(1.7)

**Percent of Farm Sites\* Where Immunization Products Had Been Administered to Pullets at Growing Operations by Region**



\*Most recently placed flock.

#4152



## b. Laryngotracheitis (LT) vaccine

About one-fifth of farm sites where replacement pullets had been vaccinated against laryngotracheitis (LT) did not know the type of vaccine used.

i. For farm sites on which pullets at the growing operation received a laryngotracheitis (LT) vaccine, percent of layer farm sites by type of LT vaccine administered:

Type of LT Vaccine	Percent Farm Sites						Total Percent
	Yes		Didn't Know		No		
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
Chick embryo origin (CEO)	43.6	(4.7)	20.4	(2.9)	36.0	(4.9)	100.0
Tissue culture (TC)	27.8	(4.6)	21.9	(3.0)	50.3	(4.8)	100.0

Producers were more aware of the method of laryngotracheitis (LT) vaccination used than the type (see Table B.7.b.i). Eye drop vaccination was the most common method used.

ii. For farm sites on which pullets at the growing operation received a laryngotracheitis (LT) vaccine, percent of layer farm sites by method of LT vaccine administration:

Method of LT Vaccine Administration	Percent Farm Sites						Total Percent
	Yes		Didn't Know		No		
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
Spray	29.2	(4.5)	6.0	(1.0)	64.8	(4.5)	100.0
Eyedropper	79.9	(3.3)	4.5	(0.8)	15.6	(3.3)	100.0
Drinking water	12.9	(3.2)	6.0	(1.0)	81.1	(3.2)	100.0

About one-third of farm sites where replacement pullets had been vaccinated against *Mycoplasma gallisepticum* (MG) did not know the type of immunization product used.

c. For farm sites on which pullets at the growing operation received a *Mycoplasma gallisepticum* (MG) immunization product, percent of layer farm sites by type of MG immunization product administered:

Type of MG Immunization Product Administered	Percent Farm Sites						Total Percent
	Yes		Didn't Know		No		
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
Bacterin	23.9	(4.3)	29.9	(4.1)	46.2	(5.1)	100.0
Live vaccine	46.1	(5.1)	30.6	(4.2)	23.3	(4.3)	100.0

Fowl pox vaccine was used for almost twice as many farm sites as pigeon pox vaccine, for those farm sites whose replacement pullets had been vaccinated against fowl pox. A combination of fowl pox and pigeon pox was used by 30.8 percent of farm sites that vaccinated against fowl pox.

d. For farm sites on which pullets at the growing operation received a fowl pox vaccine, percent of layer farm sites by type of fowl pox vaccine administered:

Type of Fowl Pox Vaccine Administered	Percent Farm Sites						Total Percent
	Yes		Didn't Know		No		
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
Fowl pox	83.6	(3.4)	5.0	(1.0)	11.4	(3.5)	100.0
Pigeon pox	42.1	(4.4)	5.6	(1.0)	52.3	(4.5)	100.0

### 8. Diseases and conditions during the growing period

Layers '99 producers were asked about the laying flock most recently placed in the laying house and what diseases or conditions occurred in these birds before they were placed during the growing period. The following estimates were based on producer-reported data that may or may not have been laboratory confirmed.

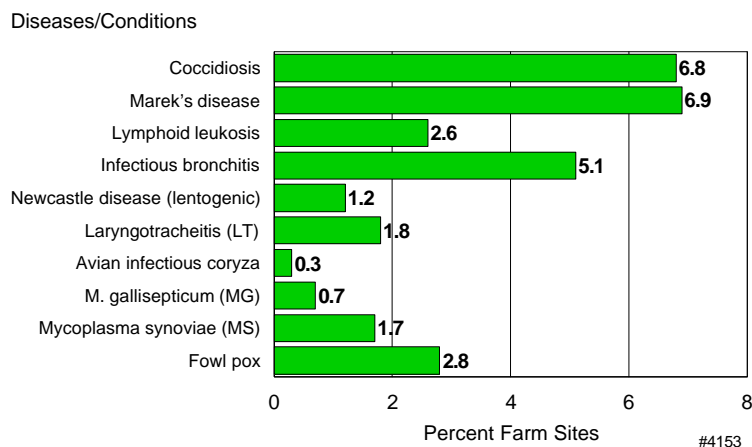
Less than 1 percent of farm sites obtained replacement pullets that had had problems with avian infectious coryza or *Mycoplasma gallisepticum* (MG). More than 5 percent of farm sites obtained replacement pullets that had had problems with coccidiosis (6.8 percent), Marek's disease (6.9 percent), or infectious bronchitis (5.1 percent).

Note: Laboratory isolations of Laryngotracheitis (LT), Newcastle disease, and infectious bronchitis could have been due to vaccine virus. There have been no reports of virulent Newcastle disease in commercial chicken operations in the United States since 1975.

a. For the last placed laying flock, percent of farm sites by diseases and/or conditions that occurred *during the growing period*:

Diseases/Conditions	Percent Farm Sites						Total
	Yes		Didn't Know		No		
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
Coccidiosis	6.8	(1.3)	3.6	(1.0)	89.6	(1.6)	100.0
Marek's disease	6.9	(1.1)	4.6	(1.0)	88.5	(1.6)	100.0
Lymphoid leukosis	2.6	(0.6)	4.2	(1.0)	93.2	(1.1)	100.0
Infectious bronchitis	5.1	(1.4)	8.8	(3.1)	86.1	(3.2)	100.0
Newcastle disease (lentogenic)	1.2	(0.4)	3.8	(0.9)	95.0	(1.1)	100.0
Laryngotracheitis (LT)	1.8	(0.7)	3.8	(1.0)	94.4	(1.3)	100.0
Avian infectious coryza	0.3	(0.1)	3.6	(0.9)	96.1	(1.0)	100.0
<i>Mycoplasma gallisepticum</i> (MG)	0.7	(0.3)	3.8	(0.9)	95.5	(1.0)	100.0
<i>Mycoplasma synoviae</i> (MS)	1.7	(0.4)	9.0	(3.1)	89.3	(3.1)	100.0
Fowl pox	2.8	(0.6)	3.6	(0.9)	93.6	(1.2)	100.0

Percent Farm Sites by Diseases and/or Conditions that Occurred During the Growing Period



## Section II: Methodology

### A. Needs assessment

NAHMS was approached by United Egg Producers and U.S. Poultry and Egg with a request for a national table egg layer study addressing the issue of *Salmonella enteritidis* (S.e.). To further identify information needs, four focus groups were assembled to represent a broad spectrum of information users. These focus groups represented researchers/academia, industry, state and federal government, and West coast interests. Conference calls were held to brainstorm potential study topics. Focus group members then voted on topics to set the study objectives. Key participants from each focus group continued to provide advice on the study objectives and to provide guidance throughout the study design, implementation, and analysis. These individuals met twice in person and communicated regularly via telephone and e-mail discussions.

### B. Sampling and estimation

#### 1. State selection

The goal for NAHMS national studies is to include states that account for at least 70 percent of the animal and farm population in the U.S. The National Agricultural Statistics Service (NASS) Layers and Egg Production, 1997 Summary (released January 1998) was used to determine state ranking for table egg layers. All states with 4.0 percent or more of the U.S. table egg layers were included in the study. In addition, five states were added to provide better geographic coverage (Missouri, Washington, North Carolina, Arkansas, Alabama), resulting in a total of 15 states participating, representing 82 percent of 1997 U.S. table egg layers. NASS does not publish the total number of layer farms (some data were received from the 1992 Census of Agriculture), and therefore, number of layer farms per state did not contribute to state selection for this study.

#### 2. Operation selection

NASS maintains a list of all egg-laying operations with 30,000 or more laying hens which is the basis for estimating monthly egg production. An operation may have one farm or multiple farms. Farms from multiple-farm operations may be company owned or contract farms. The individual farms may have fewer than 30,000 layers, but to be enumerated by NASS, the total layers for all farms associated with a company must equal or exceed 30,000. All operations (companies) that had 30,000 or more laying hens (20 weeks of age or older) in the 15 selected states were eligible to participate.

#### 3. Farm selection

NASS enumerators made the first personal contact to the operations. Enumerators visited company headquarters except for single-farm operations, where the farm was visited. If a company had farms in more than one state, each state was treated as a separate operation (assigned a unique operation identification code), and the NASS enumerator contacted the person who reported for the company in that state. The NASS enumerator selected a random sample of farms to participate. All farms were selected for operations with 10 or fewer farms. If the operation had 11 to 29 farms, 10 farms were selected. If there were 30 or more farms, 15 farms were selected.

#### **4. Population inferences**

All operations (companies) that had 30,000 or more laying hens (20 weeks of age or older) in the 15 selected states were eligible to participate in the NAHMS Layers '99 study. Therefore, the probability of selection (selection weight) was one for all operations. This selection weight was adjusted for non-response within state and size group strata. For each participating farm, a farm-level weight was created, equal to the operation weight multiplied by an expansion factor (number of farms in the operation divided by number of the operation's farms participating).

### **C. Data collection**

#### **1. Marketing**

NASS mailed a pre-survey letter, letters of support from the U.S. Poultry & Egg Association and United Egg Producers, and information on the NAHMS Layers '99 study to each eligible operation (company). Additional information about NAHMS and the Layers '99 study were delivered at the time of the first personal contact. Some focus group participants made additional contacts to encourage participation.

#### **2. Layers Management Report, February 1 - 26, 1999**

The NASS enumerator administered a Layers Management Report. This questionnaire was limited to items that could more readily be answered by company headquarters than by personnel on farm (e.g., pullet sources, feed sources). Practices that were expected to be the same on every farm were asked once of the operation, whereas a separate questionnaire for each farm was completed for those practices that may differ among farms. If an operation was willing to continue to the next stage of the study, a consent form was signed. The Layers '99 Part I report is from this phase of the Layers '99 study.

#### **3. Initial VS Visit, March 22 - April 30, 1999**

Farms for which the operation had signed a consent form were turned over to Veterinary Services (VS) for the second phase (on-farm) of the study. Veterinary Medical Officers (VMO's) contacted each farm for participating operations, explained the program, and administered a questionnaire that could most readily be answered by farm personnel (e.g., housing, biosecurity). Although these questionnaires were scheduled to be completed by April 30, some states were given an extension in order to increase the number of participants. The last questionnaire was completed July 14, 1999. Layers '99 Part II will report results of this phase of the Layers '99 study.

#### **4. Environmental sampling, May 3 - September 30, 1999**

Environmental culturing was offered to all farms. Up to two houses per farm were randomly selected for culturing, including manure (five samples per house), egg belts (five samples per house), elevators (five samples per house), and walkways (two samples per house). If the house did not have egg belts or elevators, then 10 samples were collected from cage floors. Each sample consisted of two swabs. Samples were placed in whirl-pak bags containing skim milk, and shipped overnight on ice to the Agriculture Research Service in Athens, GA, for culture and serogrouping. Group D isolates were then sent to National Veterinary Services Laboratories (NVSL) in Ames, IA, for serotyping. Information about the flocks and houses being sampled was recorded on a Clinical Evaluation Record.

### **5. Rodent collection**

Rodent collection was offered to 150 farms that also participated in environmental sampling. Twelve traps were placed per house. VMO's returned 4 to 7 days later to count the number of rodents caught. Rodents were euthanized using dry ice. House mice were placed in large whirl-pak bags and shipped overnight on ice to NVSL for culture. The number of rodents trapped, number submitted, trap location, and whether the trap had functioned properly were recorded on a rodent submission form.

### **6. Egg Yolk Antibody**

Egg yolk collection was offered to 100 farms that also participated in environmental sampling and rodent collection. There were 150 eggs collected per farm. The egg yolks were aspirated from the eggs and shipped overnight on ice to the University of Minnesota for testing for presence of antibody to *Salmonella enteritidis* (S.e.).

## **D. Data analysis**

### **1. Editing and estimation**

Initial data entry and editing for the Layers '99 Part I report were performed in each individual NASS state office. Data were entered into a SAS data set. NAHMS personnel performed additional data edits on the entire data set after data from all states were combined.

Data entry and editing for Part II were done by the NAHMS national staff in Fort Collins, CO. VS field staff followed up with producers where necessary. Summarization and estimation for Part I and Part II were performed by NAHMS national staff using SUDAAN software (1996. Research Triangle Park, NC).

### **2. Response rates**

The sample for Part I included 341 operations, of which 328 were considered eligible to participate. Thirteen operations in the sample were ineligible (e.g., broiler operations, or pullet growers). Of the 328 eligible operations, 208 operations agreed to participate (63 percent). These 208 operations provided information on 526 individual farms. Consent was given to contact 393 of these farms for the second phase of the study (75 percent). Of the 393 farms turned over to VS, 11 were ineligible (no longer in business). Of the 382 eligible farms, 251 participated in the VS phase of the study (65 percent).

## Appendix I: Sample Profile

### A. Responding Operations

#### 1. Size

Size of Farm Site (Number Layers)	Number Responding Farm Sites
Less than 50,000	162
50,000-99,999	143
100,000-199,999	116
200,000 or more	<u>105</u>
Total	526

#### 2. Region

Region	Number Responding Farm Sites
Great Lakes	142
Southeast	90
Central	138
West	<u>156</u>
Total	526

## Appendix II: U.S. Table Egg Layers

During the Month of December 1998 in Flocks with 30,000 and Above\*

Region	State	Table Egg Layers (Thousand)
Central	Arkansas	4,565
	Iowa	24,261
	Minnesota	11,403
	Missouri	5,179
	Nebraska	<u>10,522</u>
	Total	55,930
Great Lakes	Indiana	21,265
	Ohio	28,839
	Pennsylvania	<u>21,389</u>
	Total	71,493
Southeast	Alabama	4,325
	Florida	9,893
	Georgia	11,892
	North Carolina	<u>3,847</u>
	Total	29,957
West	California	25,657
	Texas	13,719
	Washington	<u>4,893</u>
	Total	44,269
Total (15 states)		201,649 (78.5% of US)
Total U.S. (50 states)		256,867

\* There were 262,935,000 table egg layers during December 1999 in flocks of all sizes.

Source: National Agricultural Statistics Service (NASS), Chickens and Eggs, February 23, 1999.





## Outputs and Related Study Objectives

**1. Describe baseline health and management practices used by the U.S. layer industry**, such as disposal methods for manure/waste/dead birds/spent hens, pest control (rodents, birds, flies), molting practices, vaccination/preventive practices, and housing/ventilation.

ó *Part I: Reference of 1999 Table Egg Layer Management in the U.S.*, October 1999

ó Part II: Reference of 1999 Table Egg Layer Management in the U.S., expected December 1999

**2. Estimate the national prevalence of *Salmonella enteritidis*** in layer flocks by testing the environment and other sources of contamination on layer operations.

ó Interpretive report, expected Fall 2000

**3. Identify potential risk factors associated with the presence of *S. enteritidis*** to support and enhance quality assurance programs.

ó Interpretive report, expected Fall 2000

**4. Describe biosecurity practices** used in the layer industry and how they benefit flock health.

ó Part II: Reference of 1999 Table Egg Layer Management in the U.S., expected December 1999

ó Biosecurity on U.S. Table Egg Layer Farm Sites (info sheet), expected December 1999

Centers for Epidemiology and Animal Health

USDA:APHIS:VS, attn. NAHMS

2150 Centre Ave., Bldg. B, MS 2E7

Fort Collins, CO 80526-8117

(970) 494-7000

NAHMSinfo@usda.gov

**<http://www.aphis.usda.gov/vs/ceah/cahm>**

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