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**Economic Performance of
COMMERCIAL LAYING FLOCKS
on Illinois Farms**

By R. C. Ross and W. N. Capener

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COMMERCIAL LAYING FLOCKS ON ILLINOIS FARMS

R. C. ROSS and W. N. CAPENER¹

A TREND TOWARD LARGER AND FEWER LAYING FLOCKS is taking place on Illinois farms. Between 1940 and 1954, the total number of hens changed very little — from 17.8 million to 17.7.² In 1940, 91 percent of the farmers had laying flocks that averaged 91 hens per farm; in 1954, 74 percent reported flocks that averaged 143 hens. In the latter years of this period, the trend toward larger flocks accelerated. In 1950, 1.5 percent of the flocks contained 400 hens or more; by 1954, the percentage of such flocks had increased to 5. The value of eggs produced in Illinois in 1954 was \$82 million, or 8 percent of the value of all livestock and livestock products sold and 4.6 percent of the value of all agricultural products sold.³

During recent years, many improvements have been made in poultry breeding, feeding, and management, and in methods of egg marketing. Between 1935 and 1955, egg production per hen increased from an average of 113 to 193, a 71-percent increase over the 21-year period. Volume of production is necessary to pay for the feed, labor, equipment, and other expenses, and to meet the competition from commercial laying flocks in eastern and southern states.

In order to analyze the requirements and returns of Illinois laying flocks under current practices and price levels, a cost study was undertaken in 1954 to ascertain: (1) costs and returns of flocks that are kept as a semicommercial or commercial enterprise; (2) information on flock requirements of feed, labor, buildings, and other resources; and (3) how production and marketing and size of flock affect costs and returns.

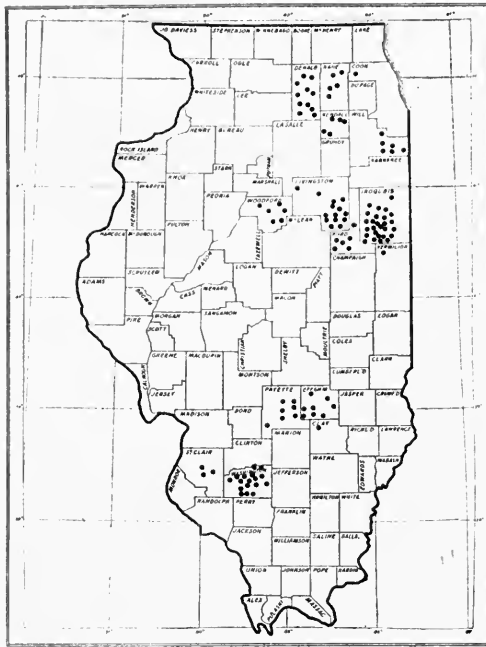
SOURCE OF DATA

In order to locate the study, census figures were examined to determine in what counties the larger poultry flocks were concentrated. Farm advisers in the counties having the highest concentration of large flocks were asked for the names of flock owners who had 400 hens or

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²U. S. Census of Agr., 1954.

³Cash Receipts From Major Farm Commodities, by States, as Percentages of State Totals, 1924-1955. U. S. Dept. Agr. Stat. Bul. 186. 1956.



Location of areas and flocks.
(Fig. 1)

more. The managers of all hatcheries in the state were asked for the names and addresses of customers who had purchased 400 or more pullet chicks in 1954. On the basis of the census figures and replies from farm advisers and hatchery operators, three areas were selected — one in northeastern Illinois, one in east-central, and one in south-central Illinois (Fig. 1).

A wide range of flocks containing more than 400 hens and a good sample of White Leghorns and hybrids was included in the study. Very few flocks of heavy breeds could be found so very few were included.

From June through September 1954, about 500 flock owners were visited in these three areas and 243 agreed to cooperate in the study. Each cooperator was revisited in the late fall and again in the early spring. The completed records were collected in the fall of 1955. The records were to be kept for 12 months unless the flock was sold before the end of the 12-month period.

Because of very low egg prices and the early sale of a number of flocks, only 118 records were completed. Of these, 28 were in the northeastern area; 54 in the east-central; and 36 in the south-central area (Fig. 1). For purposes of analysis, the flocks were classified in five groups according to size: (1) under 400 hens; (2) 400 to 649; (3) 650 to 899; (4) 900 to 1,149; and (5) 1,150 and over. These

Table 1.— Size of Flocks, Percent Pullets, Previous Experience of Operators, and Size of Farms; Three Areas; 118 Commercial Poultry Flocks; 1954-1955

Item	All areas	Three areas		
		Northern	Central	Southern
Flocks, number	118	28	54	36
Size of flocks, average number				
Under 400.....	27	6	7	14
400 to 649.....	34	7	17	10
650 to 899.....	24	6	11	7
900 to 1,149.....	18	5	9	4
1,150 and over.....	15	4	10	1
Total.....	118	28	54	36
Years of experience with laying flocks of present sizes, percent of operators				
1.....	24.6	17.9	25.9	30.5
1 to 3.....	24.6	14.3	24.1	36.1
4 to 6.....	27.1	28.6	35.2	11.1
7 to 9.....	10.2	25.0	3.7	5.6
10 and over.....	13.5	14.2	11.1	16.7
Pullets in flock, percent				
All.....	66.1	50.0	63.0	83.3
Mixed with hens.....	33.9	50.0	37.0	16.7
Size of farms, average acres	204	181	209	213

figures represent the average numbers for the record period.¹ By the end of the study, because of culling and death, the average size of flocks in these various groups was reduced to 75 to 78 percent of size at the beginning of the study.

All but eight of the flock owners were full-time farmers. While the total acres of farmland operated ranged from 1 to 470 acres, the average size of farm in the three areas was comparable, averaging 181, 209, and 213 acres (Table 1). In each area, from two-thirds to three-fourths of the cooperators were owners or part owners of the land, and one-third to one-fourth were tenants. The crops grown and the livestock kept were generally those common in the areas. A few farmers had rather large livestock enterprises of dairy cattle, feeder cattle, or hogs, but these livestock enterprises apparently had no relation to the size of the laying flock.

The largest proportion of flocks consisting of under 400 hens and of 400 to 649 hens was in southern Illinois, as were also the largest proportion of operators who had had 3 years experience or less with

¹The average number is the average of the hens in the flock on the first of each month during the record period.

flocks of these or similar sizes, and the largest proportion of pullet flocks (Table 1). In all these respects, the northern area had the smallest proportions, and the central area was in an intermediate position. It is indicative of the increasing specialization in laying flocks in this state that one-fourth of all the cooperators were handling flocks of much larger size than they had handled in previous years.

NET MANAGEMENT EARNINGS

The following analysis will deal primarily with the differences between the 20 percent of the flocks that returned the highest net management earnings and the 20 percent that returned the lowest, and how these differences affected the five size-of-flock groups, irrespective of area of the state.

Commercial flocks differ from those kept mainly to supply eggs and meat for the farm family in that they are expected to return a profit. Various measures are used to indicate the profitableness of the enterprise. Returns above feed costs or returns above all cash outlays are frequently used. Obviously such measures do not take account of depreciation on buildings and equipment and of labor performed by the farm family. In this study the primary measure of profitableness is net management earnings.

In the calculation of net management earnings, all income and expenses, both cash and noncash, were allocated. In addition to feed, labor, and direct cash expenses such as medicines, veterinary services, purchased litter, egg cases and cartons, and egg-washing detergent, charges are calculated for depreciation and maintenance of buildings and equipment, depreciation and death loss of the flock, interest on investment, and use of tractor, truck, and car. Income includes sales, products used by the family, and credit for manure.

In order to take into account the differences in sizes of flocks, net management earnings per 100 hens are used. The effects of 11 efficiency factors on these earnings were studied (Tables 2 and 3). Four of these factors were directly related to income and seven to expenses.

The net effect on net management earnings of each of the 11 factors was estimated by a standard procedure called linear regression analysis. The net effect is the amount of change in management earnings that a unit change in one factor would cause if none of the others changed (Table 2). In practice, a change in one factor would usually also be associated with changes in other factors.

The estimates of the net effects are subject to error because of chance variations and the way the measures of each factor were computed. The adequacy of these factors as a group may be judged by

Table 2. — Net Effects of Each of Eleven Efficiency Factors on Net Management Earnings; 118 Commercial Poultry Flocks

Efficiency factor	Unit of measure	Net effect of one unit on net management earnings per 100 hens	Standard error of net regression coefficients	Net effect of one unit on net management earnings; average flock, 848 hens
Income factors				
Eggs, average price per dozen...	1 cent	\$16.0910	.4302	\$136.45
Eggs per hen, average number..	1 egg	1.9214	.1808	16.29
Records kept, number of days..	1 day	.0737	.1389	.62
Hens per flock, average number	1 hen	.0035	.0030	.03
Expense factors				
Egg cost per dozen.....	1 cent	-5.0208	.7482	-42.58
Feed cost per 100 hens.....	1 dollar	-.7116	.0585	- 6.03
Labor, hours per 100 hens.....	1 hour	-.7222	.0441	- 6.12
Building cost per 100 hens.....	1 dollar	-.8631	.2573	- 7.32
Equipment cost per 100 hens...	1 dollar	-.5670	.3256	- 4.81
Death loss.....	1 percent	.2591	.4129	2.20
Miscellaneous cash expense per 100 hens.....	1 dollar	.9725	.2107	8.25

the fact that they accounted for 96.3 percent of the difference in net management earnings of the two groups of flocks (Table 3). The amount of error due to chance is small.

The relative importance of each of the 11 efficiency factors is measured by the percent of difference in net management earnings between high- and low-earning flocks that is accounted for in the average measure of the particular factor (Tables 2 and 3).

The difference per 100 hens between these two groups was \$367.60 (Table 3). Cost of producing eggs per dozen accounted for the largest share, 25 percent. Average price per dozen eggs sold was next in importance, 20.6 percent; followed rather closely by average number of eggs produced per hen, 17.1 percent; feed cost per 100 hens, 16.6 percent; and hours of labor per 100 hens, 16.5 percent. These five factors accounted for 95.8 percent of the total difference in net management earnings. The other six factors were relatively unimportant and together accounted for only 0.5 percent of the difference. The remaining 3.7 percent could not be accounted for by these factors.

Factors Affecting Income

The average sale price of eggs per dozen was 35.7 cents for all flocks. The fifth of the operators who had the highest net management earnings received an average of 38.6 cents per dozen; in con-

Table 3.—Differences Between Net Management Earnings per 100 Hens: 24 High-Income and 24 Low-Income Flocks; 11 Efficiency Factors

Item	Average			Difference	
	High-income flocks	Low-income flocks	Difference	In net management earnings per 100 hens	Percent of total
Net management earnings per 100 hens	\$62.30	\$-305.30	\$367.60	\$367.60	....
Income factors, 100 hens					
Price of eggs, average per dozen, cents.....	38.6	33.9	4.7	75.63	20.6
Eggs per hen, average number.....	227.9	195.1	32.8	63.02	17.1
Flock kept, number of days	356.5	348.8	7.7	.57	.2
Number of hens per flock, average.....	816.3	549.6	266.7	.93	.3
Expense factors, 100 hens					
Egg cost per dozen, cents...	35.5	53.8	-18.3	91.88	25.0
Feed cost, dollars.....	346.20	431.90	-85.70	60.98	16.6
Labor, hours.....	93.5	177.4	-83.9	60.59	16.5
Buildings, dollars.....	41.00	46.70	- 5.70	4.92	1.3
Equipment, dollars.....	23.60	24.30	- .70	.40	.1
Death loss, percent.....	10.3	12.4	- 2.1	- .54	- .2
Miscellaneous cash expense, dollars.....	13.30	17.90	- 4.60	- 4.47	- 1.2
Total differences accounted for.....	....	....	....	353.91	96.3
Total differences unaccounted for.....	....	....	....	13.69	3.7

trast, the lowest fifth received 33.9 cents (Table 3). This difference of 4.7 cents per dozen accounted for 20.6 percent of the difference between these two groups, or a difference of \$75.63 in net management earnings per 100 hens. Within each group a wide range of prices appeared: in the high-income group, a range of 28 to 70 cents a dozen; in the low-income group, a range of 27 to 44 cents. In all cases in which the average price was above 36 cents a dozen, either a part or all the eggs were sold to a hatchery at a premium price or were delivered to consumers. Thus the type of market outlet had a marked influence on the price received. (This aspect of the subject will be examined further under marketing practices.)

Early production of pullet flocks sells at a discount because the eggs are small. Quality of eggs as measured by grading standards is likewise important from a price standpoint.

Since egg prices follow a seasonal trend, the time of year when production is heaviest reduces the price per dozen. The average estimated prices for eggs and the index of monthly production for all flocks in the study are given below.

Month and year	Egg prices per dozen	Index, monthly production	Month and year	Egg prices per dozen	Index, monthly production
1954 ^a			1955 ^a		
August	38.1	73	January	32.6	107
September	33.4	80	February	45.0	99
October	30.0	92	March	43.7	120
November	32.6	95	April	38.5	121
December	32.6	104	May	36.0	119
			June	33.4	99
			July	32.6	89
			Average	35.7	...

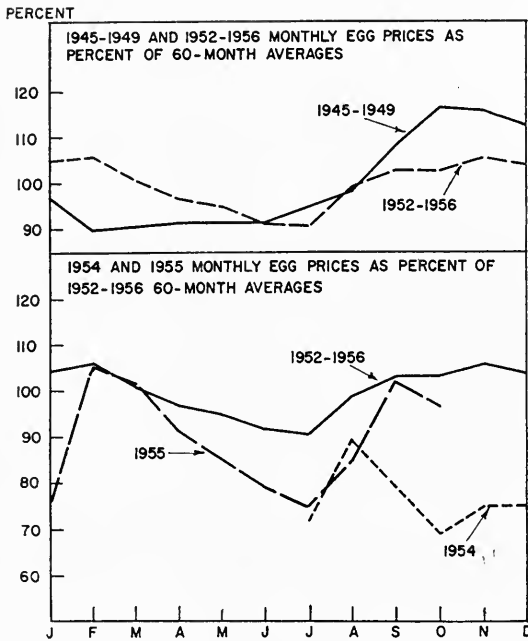
^a Based on Illinois Agricultural Statistics, 1956. Estimated prices are 25 percent higher than those received at local markets, as given in Table 10, because of the special outlets used by many of the cooperators.

The seasonal pattern of egg prices appears to be becoming much less pronounced as improved methods of production become more widespread. In the prewar period of 1935-1939, the spread between the low-price month (March) and the high-price month (November) equalled 53 percent of the average price for the 60-month period. In the 1945-1949 period, the maximum monthly spread of egg prices in Illinois (February to October) was only 27 percent of the average for the 60-month period (Fig. 2).¹ During 1952-1956, the maximum spread (July to November) was 15 percent of the average of that 60-month period.

During the period in which egg sales were studied—July, 1954 through October, 1955—the price pattern was very different from the average for 1952-1956, being at a much lower level in all but two months, the spread being 36 percent of the average for that 60-month period (Fig. 2). This unfavorable price situation reduced receipts much below what would normally have been expected and caused many cooperators to discontinue their record keeping. During the period of the study, highest monthly egg prices were received in February and March, 1955, and lowest prices in October, 1954.

In number of eggs produced per hen, the difference between the high- and low-income groups was 32.8 and accounted for a difference of 17.1 percent in net management earnings, or \$63.02 per 100 hens

¹ Agricultural Outlook Charts, 1958. U. S. Dept. Agr., p. 87.



During the 1954-1955 period, the price spread was wider and the level lower than in either the 1945-1949 or 1952-1956 periods. Source: U. S. Dept. of Agr. (Fig. 2)

Table 4.—Egg Cost per Dozen and Number of Eggs per Hen; 24 High-Income and 24 Low-Income Flocks

Egg cost per dozen	High-income flocks	Low-income flocks	Eggs per hen	High-income flocks	Low-income flocks
<i>cents</i>	<i>no.</i>	<i>no.</i>	<i>no.</i>	<i>no.</i>	<i>no.</i>
20 to 24.	1	..	Under 140	..	1
25 to 29.	2	..	140 to 149	..	1
30 to 34.	10	..	150 to 159	..	1
35 to 39.	7	1	160 to 169	1	1
40 to 44.	1	..	170 to 179	2	3
45 to 49.	1	8	180 to 189	..	1
50 to 54.	1	8	190 to 199	2	5
55 to 59.	..	3	200 to 209	1	4
60 to 64.	1	1	210 to 219	..	4
65 to 69.	..	1	220 to 229	5	1
70 to 74.	..	..	230 to 239	5	..
75 to 79.	..	1	240 to 249	1	..
80 to 84.	..	1	250 to 259	4	1
			260 to 269	2	..
			270 to 279	1	1
Average, high-income flocks, 35.5	..	..	Average, high-income flocks, 227.9	..	..
Average, low-income flocks, 53.8	..	..	Average, low-income flocks, 195.1	..	..

(Table 3). The number of eggs per hen in the high-income group averaged 227.9 and ranged from 166 to 273; the number in the low-income group averaged 195.1 and ranged from 104 to 270 (Table 4). Since 97 percent of the gross income was from the sale of eggs, it is obvious that the number of eggs per hen and the price of eggs sold largely determined income from the flock.¹

The rate of egg production is the result of many management practices in handling the flock and the length of time the flock is kept. For all flocks in the study, production per hen in general was higher for the larger flocks than for the smaller, as the figures below show.

Size of flocks	Number of flocks	Eggs per hen	Size of flocks	Number of flocks	Eggs per hen
Under 400.....	27	202	900 to 1,149.....	18	223
400 to 649.....	34	218	1,150 and over....	15	226
650 to 899.....	24	202	Total and average.....	118	213

In number of days the flock was kept after the records² were started, the difference of 7.7 days was not significant in relation to net management earnings (Table 3). This was true even though egg production was lowered as the period shortened because a large percentage of the expenses were lowered in proportion to the reduction in time.

On 95 percent of the total number of flocks, the records were started during the 5-month period of July through November, and 67 percent were kept for the full year. The shorter periods reduced the production per hen as follows.

Number of days flock was kept	Number of flocks	Eggs produced per hen
Less than 325.....	9	155
326-344.....	11	199
345 to 364.....	19	210
365.....	79	222
Total and average.....	118	213

The average number of hens per flock, after adjustment for other factors was made, was not important in relation to net management

¹ In this study, the value of hens culled from the flock and sold or remaining on hand at the end of the record year was deducted from the flock depreciation rather than being listed as a receipt item.

² Flock owners were instructed to start the record at the time pullets raised on the range were housed at the beginning of the production period, and to start it for those raised in confinement when egg production reached 10 to 20 percent. Records were to be carried for a year unless the flock was sold earlier.

earnings per 100 hens. The flocks in the high-income group averaged almost 50 percent larger than those in the low-income group.

Laying flocks are subject to losses because of death and because birds that have ceased laying are culled. The extent of these losses is shown below.

Item	Average size of flocks					
	Under 400	400- 649	650- 899	900- 1,149	1,150 and over	All flocks
Flocks, number	27	34	24	18	15	118
Hens at beginning of year, number	398	678	1,014	1,286	3,194	1,095
Death loss, percent	15	12	11	11	10	12
Culled, percent	36	34	39	38	46	38
Hens at end of year, number	195	366	507	656	1,405	550
Average number	310	516	790	990	2,493	848

In most cases, replacements were made once a year. The change in the size of flocks creates a real housing and equipment problem. If these facilities are adequate for the size of the flock at the beginning of the year, they are not fully used after the size of the flock has been considerably reduced.

Factors Affecting Expenses

Cost of producing a dozen eggs was the most important factor in accounting for the difference between the high- and low-income groups, 35.5 cents as against 53.8. It accounted for 25 percent of the difference, or \$91.88 per 100 hens (Table 3).

A wide range occurred in the cost of producing a dozen eggs in both groups (Table 4). Obviously the cost per dozen depends both on the various costs of keeping the flock and on the number of dozen eggs over which these costs can be distributed. The number of eggs per hen likewise showed a wide range within each of the two groups, the averages being 227.9 and 195.1 respectively. Some operators in the high-income group maintained their position, despite high costs or low production, because of special outlets that returned higher than average prices.

Feed cost per 100 hens accounted for 16.6 percent of the difference between the high- and low-income groups, or \$60.98 (Table 3). Feed was the largest item of cost (Table 5) and represented 52 percent of total cost for all 118 flocks. It amounted to \$384 per 100 hens, or 22.2 cents per dozen eggs (Table 6). Feed costs per dozen eggs decreased somewhat as the size of the flock increased.

Flock owners used both purchased feed and home-grown grains. All purchased feed was charged at net cost; home-grown grains were charged at the average price received at local markets. An average of 6.2 pounds of feed was required to produce a dozen eggs. Corn, oats, and laying mash were the major kinds of feed used. The 72 flocks that produced only market eggs averaged 105 pounds of feed per hen; the 46 flocks that produced hatching eggs averaged 115 pounds, including feed for males. Eight flocks that produced hatching eggs were heavy-breeds. They averaged 108 pounds of feed. The record period on these flocks of heavy breeds was 320 days. The record period for all other flocks was 358 days.

Table 5. — Annual Costs*

	Size of flocks					
	Under 400	400- 649	650- 849	900- 1,149	1,500 and over	All flocks
Flocks, number.....	27	34	24	18	15	118
Hens, average number....	310	516	790	990	2,493	848
Fixed costs, dollars						
Depreciation, buildings	61	78	119	168	311	126
Depreciation, equipment	50	81	133	201	577	165
Property taxes ^b	12	16	28	41	83	29
Insurance ^b	5	7	12	17	37	13
Interest, investment ^b ...	59	82	130	193	405	145
Total.....	187	264	422	620	1,413	478
Variable costs, dollars						
Feed.....	1,196	2,028	2,874	3,914	9,238	3,214
Laying flock expense....	486	806	1,162	1,596	3,566	1,277
Labor.....	451	629	933	917	2,127	884
Auto, truck, tractor....	55	71	71	134	252	100
Upkeep, buildings.....	30	39	64	94	179	68
Upkeep, equipment.....	9	15	25	37	108	31
Miscellaneous.....	39	77	96	197	462	139
Total.....	2,266	3,665	5,225	6,889	15,932	5,713
Total annual costs, dollars	2,453	3,929	5,647	7,509	17,345	6,191
Costs per 100 hens, dollars						
Fixed.....	60	51	54	61	55	57
Variable.....	739	716	651	702	650	693
Total.....	799	767	705	763	705	750
Costs per dozen eggs, cents						
Fixed.....	3.8	2.8	3.2	3.3	3.1	3.3
Variable.....	44.3	40.2	39.6	37.9	35.1	40.0
Total.....	48.1	43.0	42.8	41.2	38.2	43.3

* Throughout this study all flocks within a group are given equal weight, regardless of size.

^b Includes buildings, equipment, and laying flock.

Table 6. — Feed Fed per Hen and Feed Cost

	Size of flocks					All flocks
	Under 400	400-649	650-899	900-1,149	1,150 and over	
Flocks, number.	27	34	24	18	15	118
Feed, pounds						
Corn.	21	28	27	29	33	26
Oats.	21	15	27	20	22	23
Other grain ^a	2	1	0	3	1	2
Laying mash.	56	50	46	51	48	51
Total grain and mash.	100	104	100	103	104	102
Oyster shell.	3	4	3	4	4	3
Grit.	1	1	1	2	1	1
Condensed whey.	^b	^b	1	^b	1	1
Total.	104	109	105	109	110	107
Feed cost per 100 hens, dollars.	400	396	364	394	377	384
Feed cost per dozen eggs, cents.	23.5	22.2	22.2	21.4	20.4	22.2

^a Includes wheat, barley, rye, soybeans, and sunflower seed.

^b Less than one-half pound.

Hours of labor per 100 hens represented 16.5 percent of the difference between high- and low-income groups, or \$60.59 (Table 3). The low-income group used almost 90 percent more labor per 100 hens than the high-income group.

Flock owners were asked to record to the nearest 5 minutes, the labor required on routine daily work for one day each week, or oftener if a change occurred in labor requirements. Routine daily work was divided into two categories: (1) time spent in feeding, watering, and gathering eggs; and (2) time used in cleaning and packing eggs. Time spent on other types of work was recorded as it occurred; major jobs of this type included culling, delivering eggs, cleaning the laying house, and preparing and hauling feed.

An hourly wage of 90 cents, the approximate rate paid for part-time hired labor on Illinois farms in 1955, was used as the standard charge. While most labor was performed by the farm operator or members of the farm family, all labor, both hired and unpaid family labor, was charged at the same rate.

Flocks in the study required an average of 130 hours of labor per 100 hens during the production period, as the figures on page 15 show.

Small flocks required the most labor per 100 hens; hours of labor

	Size of flocks					All flocks
	Under 400	400-649	650-899	900-1,149	1,150 and over	
Number of flocks.....	27	34	24	18	15	118
Hours of routine daily labor to:						
Feed, water, and gather eggs.....	81	65	60	48	42	62
Clean and pack eggs....	47	49	42	46	41	46
Total.....	128	114	102	94	83	108
Hours of occasional labor	28	24	17	18	17	22
Total, all labor.....	156	138	119	112	100	130
Labor cost per 100 hens, dollars.....	\$140	\$124	\$107	\$101	\$ 90	\$117
Labor cost per dozen eggs, cents.....	8.5	7.0	6.4	5.4	4.8	6.7

decreased as the size of the flock increased. Labor used in feeding and watering the flock and gathering the eggs averaged 62 hours, or 48 percent of the total. The amount of labor used in these ways decreased markedly as size of flock increased. The group having the largest flocks used only 52 percent as much labor per 100 hens as that having the smallest. Increased mechanization of feeding and watering as size of flock increased accounted for much of this saving in labor.

Labor used to clean and pack eggs averaged 46 hours per 100 hens or 35 percent of the total. Little relationship existed between this type of work and the size of the flock. Differences in the percent of eggs cleaned, the system of cleaning, and whether the eggs were candled, graded, or cartoned influenced the amount of time required.

Total routine daily labor amounted to 83 percent of the total. The remaining 17 percent was used on occasional work. The time required for occasional work varied a great deal and depended on the types of work performed and their frequency. For details, see the figures on page 16.

Flock owners who delivered eggs twice a week to distant markets spent the most time on this operation. Total labor costs averaged \$117 per 100 hens and 6.7 cents per dozen eggs (see figures above). Labor costs per dozen eggs were 56 percent as large for the largest flocks as for the smallest.¹

Building expense per 100 hens combines some items of both fixed and variable costs (Table 5). Depreciation, upkeep, interest on invest-

¹For a more complete discussion of the different types of equipment and work methods on labor requirements, see Illinois Circular 785, Less Labor in Egg Production.

	Flocks reported		Hours of labor per 100 hens, flocks reported	
	Number	Percent	Average	Range
Delivering eggs.....	79	67	11	Under ½ to 107
Preparing and hauling feed..	95	80	5	Under ½ to 21
Culling flock.....	92	78	15	2 to 99
Preparing and hauling litter.	28	24	2	Under ½ to 4
Stirring and adding litter...	70	59	2	Under ½ to 25
Cleaning laying house.....	115	97	6	1 to 19
Controlling disease.....	58	49	1	Under ½ to 7
Other labor ^a	74	63	2	Under ½ to 14

^a Included making repairs, thawing water pipes, cleaning feeders and waterers, and adding flock replacements.

ment, taxes, and insurance are included. These items combined represented only 1.3 percent or \$4.92 of the difference between the high- and low-income groups (Table 3).

For all flocks in the study, building costs averaged \$41 per 100 hens and 2.5 cents per dozen eggs (Table 7). The 118 farms had 206 laying houses, of which two-thirds were constructed specifically for poultry flocks. Forty of the oldest laying houses were converted barns, which usually had from two to four stories used by the laying flock. Of all the buildings, 14 percent were new in 1954; 24 percent were 1 to 5 years old; 18 percent 6 to 10 years old; and 44 percent were more than 10 years old.

To estimate the investment in laying houses, four grades or levels of construction were identified for each main part of the building—foundation, framing, walls, and roof.¹ A rating of 1 indicated the highest quality of materials and the best construction and a rating of 4 the poorest. These four ratings were totaled to get the structural level that was used as a basis for estimating the rate of depreciation. This total also indicated which one of a scale of unit costs should be applied to the floor space of the building to get the reproduction cost of the structural shell. Unit costs were developed for such extras as insulation, floors, feed and egg rooms, ventilating facilities, electrical wiring, and water piping. The value of such extras was added to get the total investment in the building. The percent value of each building was then calculated on the basis of age, rate of depreciation appropriate for the structural level, and present condition of structural elements. This method eliminated the effect of changes in price levels and made building investments comparable throughout the study.

¹ Bases for construction and unit costs of such extras as insulation, floors, egg and feed rooms, etc., were developed by James O. Curtis of the Department of Agricultural Engineering.

Table 7.—Building and Equipment Costs

	Size of flocks					
	Under 400	400- 649	650- 899	900- 1,149	1,150 and over	All flocks
Flocks, number.....	27	34	24	18	15	118
Hens, number.....	310	516	790	990	2,493	848
Building costs						
Investment.....	\$1,985	\$2,630	\$4,255	\$6,254	\$11,927	\$4,548
Depreciation.....	61	78	119	168	311	126
Upkeep.....	30	39	64	94	179	68
Interest ^a	50	66	106	156	298	114
Taxes ^b	11	15	24	36	69	26
Insurance ^c	5	7	11	16	31	12
Total costs.....	157	205	324	470	888	346
Cost per 100 hens.....	51	40	41	47	36	41
Cost per dozen eggs, cents	3.2	2.2	2.5	2.6	2.0	2.5
Equipment costs						
Investment.....	376	614	990	1,486	4,326	1,241
Depreciation.....	50	81	133	201	577	166
Upkeep.....	9	15	25	37	108	31
Interest, investment ^a	9	15	25	37	108	31
Taxes ^d	1	1	3	4	14	4
Insurance ^e	0	0	1	1	4	1
Total costs.....	69	112	187	280	811	233
Cost per 100 hens.....	22	22	24	28	33	27

^a Based on one-half of replacement cost at 5 percent.

^b Two dollars per \$100 valuation applied to 45 percent of depreciated value.

^c Fifty cents per \$100 valuation applied to 80 percent of depreciated value. Depreciated value equalled 65 percent of replacement cost.

^d Two dollars per \$100 valuation based on 65 percent of original cost.

^e Fifty cents per \$100 valuation applied to 80 percent of depreciated value.

Equipment expense per 100 hens was not important in accounting for differences in net management earnings between the high- and low-income groups (Table 3). Equipment, however, represented a considerable investment for flocks in all groups, the annual costs averaging \$27 per 100 hens (Table 7). Both investment and costs tended to increase faster than size of flock, because the larger flocks used labor-saving equipment that would not pay in smaller flocks. This tendency is illustrated by the number and size of flocks with which various kinds of equipment were used (Table 8).

A detailed listing of all equipment used for each flock was made. Estimates of original cost and estimated life of purchased equipment were based upon data secured from retail stores, manufacturers, and distributors of poultry equipment. For equipment constructed by the

Table 8. — Selected Items of Equipment and Equipment Investment per 100 Hens

Equipment	Number of flocks	Median size of flocks	Median investment per 100 hens
Feeders			
Mechanical.....	20	1,010	\$ 56
Drum-type and tube self.....	15	579	16
Trough.....	83	519	19
All flocks.....	118	628	19
Feed preparation and handling			
Grinding and mixing.....	24	788	17
Feed handling ^a	17	983	14
Waterers			
Automatic.....	56	788	15
Hand-filled.....	36	484	18
Both types.....	26	713	20
Nests			
Individual, prefabricated.....	35	669	34
Individual, wooden.....	13	399	22
Individual prefabricated rollaway.....	9	771	51
Prefabricated community rollaway.....	7	704	29
Wooden community rollaway.....	6	549	22
Two or more types.....	48	710	31
All flocks.....	118	628	31
Egg processing and cooling			
Mechanical egg washers.....	32	978	16
Mechanical egg graders.....	6	1,005	16
Gravity flow egg graders.....	9	771	3
Mechanical refrigeration.....	11	1,125	21
Other equipment^b	117	626	30
All equipment^c	118	628	121

^a Includes feed elevators, feed blowers, and self-unloading wagons.

^b Includes roosts, dropping pits or boards, heat tapes, cables and lamps, light timers, marketing coops, and sprayers.

^c The types of equipment listed were not available to all flocks and therefore values will not add to this total.

flock owner, unit costs and estimated life were applied as developed by the agricultural engineer who assisted with the study. Such items included dropping pits, roosts, nests, and feed troughs.

The difference in death loss (2.1 percent) between the high- and low-income groups was not important in relation to net management earnings (Table 3).

The heaviest average death loss was in the smallest flocks, losses decreasing as size of flock increased. Death loss is caused primarily by disease, and disease does not affect flocks uniformly. For 46 percent of the flocks, death loss amounted to less than 10 percent of the

number of hens in the flock when the record was started and for 14 percent it amounted to 20 percent or more, as the figures below show.

Death loss, percent	Flocks, number	Flocks, percent
Under 5.....	8	7
5 to 9.....	46	39
10 to 14.....	33	28
15 to 19.....	14	12
20 to 24.....	9	8
25 to 29.....	4	3
30 and over.....	4	3
Total.....	118	100

Miscellaneous cash expense per 100 hens of the 24 flocks in the high-income group averaged \$4.60 less than the expense of the 24 flocks in the low-income group (Table 3). In Table 3, the high-income farms appear at a disadvantage because of lower miscellaneous cash expenses. Under the method used, a shift in another factor may result in a negative relationship in a minor item such as miscellaneous cash expense, even though the actual expense per 100 hens favors the high-income group.

Miscellaneous cash expense included the following items in decreasing order of amount: electricity; veterinary services and medicines; egg cases and cartons; litter; lime; and detergent-sanitizer. These items together averaged \$17 per 100 hens for flocks of all sizes.

Laying flock expense was not considered separately in accounting for the difference in net management earnings between the high- and low-income groups. This item constitutes a part of the cost of producing a dozen eggs as given in Table 3. Laying flock expense consists of depreciation, taxes, insurance, and interest on the investment in the laying flock.

Most flock owners bought day-old chicks and raised their own replacements, but no attempt was made to ascertain costs of raising replacements. To eliminate variation in the value of replacements, all pullets were valued at \$1.85 at the beginning of the production period. This value was based on the sale price of a few pullet flocks in the area of the study. Hens held over from a previous year were valued at 75 cents, and this rate was applied to all hens on hand at the end of the season. The value of those culled out and sold or used was credited to the flock. The loss from birds that died and the decline in value of the remaining flock constituted depreciation, which was 95 percent of total laying flock expense (Table 9).

Table 9. — Laying Flock Expense and Capital Investment

Item	Size of flocks					
	Under 400	400- 649	650- 899	900- 1,149	1,150 and over	All flocks
Number of flocks.....	27	34	24	18	15	118
Number of hens.....	310	516	790	990	2,493	848
Expense						
Depreciation.....	\$ 463	\$ 768	\$1,106	\$1,524	\$ 3,389	\$1,216
Taxes ^a	1	2	2	3	8	3
Insurance ^b	2	3	4	5	10	4
Interest on investment ^c ..	20	33	50	64	159	54
Total.....	486	806	1,162	1,596	3,566	1,277
Per 100 hens.....	157	156	147	161	143	151
Per dozen eggs, cents....	9.6	8.7	9.0	8.7	7.9	8.8
Capital investment						
Buildings.....	\$1,985	\$2,630	\$4,255	\$6,254	\$11,927	\$4,548
Equipment.....	376	614	990	1,486	4,326	1,241
Laying flock.....	723	1,157	1,720	2,102	5,100	1,894
Total.....	3,084	4,401	6,965	9,842	21,353	7,683
Per 100 hens						
Buildings.....	653	512	543	632	511	567
Equipment.....	124	119	125	150	169	133
Laying flock.....	233	224	218	212	205	223
Total.....	1,010	855	886	994	885	923
Pullets in flock, percent..	97	87	86	89	77	89

^a Rate of \$2.00 per \$100 valuation based on 20 percent of average value through the year.

^b Rate of 50 cents per \$100 valuation based on 80 percent of average investment.

^c Based on 5 percent of average investment.

Capital invested in the laying flock ranged by size of flocks from \$855 to \$1,010 per 100 hens (Table 9). These figures include: investment in buildings, 61.4 percent; equipment, 14.4 percent; and laying flock, 24.2 percent. The investment in the laying flock represents the full value at the beginning of the season. Inasmuch as a part of the investment is returned through the sale of culled hens during the year, this part of the investment is somewhat overstated. These figures represent the amounts of capital needed as evidenced by the experience of 118 flock owners. To the extent that available buildings and equipment can be used, the necessary outlay is reduced.

Price Relationships During the Study

The relative profitableness of a poultry enterprise is influenced by the prices received for eggs and poultry and the prices paid for feed and other items of expense. Since feed made up 52 percent of total

costs and a much larger proportion of the current cash outlay, the ratio of feed costs to egg prices serves as a convenient basis for comparing profitableness in different periods.

During the 7-year period preceding the study, 1947 to 1953, Illinois farmers received an average of 38.2 cents a dozen for eggs (Table 10). Laying mash averaged \$4.99 per 100 pounds; corn, \$2.80 per 100 pounds or \$1.57 a bushel; and oats, \$2.46 per 100 pounds or 97 cents a bushel. The egg-feed ratio averaged 10.7. The average price per pound for farm chickens was 24.8 cents. For the calendar year 1953, egg prices averaged 41.4 cents a dozen and chickens 21.2 cents a pound, and the egg-feed ratio was 11.9. For the last 6 months of the

Table 10. — Average Yearly Prices Received by Illinois Farmers for Eggs and Chickens and Yearly Egg-Feed Ratios, 1947-1955; and Monthly Prices Received for Eggs and Chickens and Monthly Egg-Feed Ratios, July 1954 Through October 1955^a

Date	Prices received ^b		Egg-feed ratio ^c
	Eggs, per dozen	Chickens, per pound	
	<i>cents</i>	<i>cents</i>	
Years			
1947.....	40.0	26.8	10.3
1948.....	40.9	31.5	10.6
1949.....	39.7	25.5	12.9
1950.....	30.5	22.0	9.4
1951.....	41.2	24.3	10.9
1952.....	34.6	22.1	9.1
1953.....	41.4	21.2	11.9
1954.....	30.1	15.6	8.4
1955.....	32.0	17.9	9.9
Average 1947-1953.....	38.2	24.8	10.7
Months, 1954-1955			
July.....	25.0	14.5	7.0
August.....	30.5	15.0	8.5
September.....	27.0	14.0	7.5
October.....	24.0	14.0	6.9
November.....	26.0	13.0	7.5
December.....	26.0	13.0	7.5
January.....	26.0	14.0	7.4
February.....	36.0	17.0	10.3
March.....	35.0	20.0	10.2
April.....	31.0	18.0	9.1
May.....	29.0	19.0	8.5
June.....	27.0	19.0	8.0
July.....	26.0	19.0	7.9
August.....	29.0	17.0	9.3
September.....	35.0	18.0	11.4
October.....	33.3	18.0	10.9
Average.....	29.1	16.4	8.6

^a Crops and Markets, Agricultural Marketing Service, U. S. Dept. Agr. 24-33, 1947-1956.

^b On 15th day of each month.

^c Pounds of poultry ration equivalent in value to 1 dozen eggs.

year when owners were developing plans for buying chicks and producing pullets for production in the fall of 1954 and in 1955, the egg-feed ratio was 12.2. This favorable background accounts in part for the expansion of laying flocks in 1954.

From a price standpoint, the period covered by the study — July, 1954 through October, 1955 — was very unfavorable for Illinois poultrymen. During the fall months of 1954, egg prices declined to a low of 24 cents a dozen and for the entire 16 months averaged 29.1 cents a dozen, or 24 percent below the 1947-1953 average (Table 10).

Laying mash during this period averaged \$4.91 per 100 pounds; corn, \$2.46 per 100 pounds or \$1.38 a bushel; and oats, \$2.06 per 100 pounds or 66 cents a bushel. The egg-feed ratio averaged 8.6. The price of farm chickens, which determines the value of culls sold for meat, averaged 16.4 a pound, or 33 percent below the 1947-1953 average.

Under these conditions, it is not surprising that most flock owners lost money on their flocks, because of an economic condition beyond their control. A large part of the information obtained in the study relates to physical quantities of inputs and outputs and hence is not closely dependent on current prices. Data on costs will be valid until price levels change and even then they may form the basis for calculating adjustments.

Egg Production and Returns

Under the price relationships that existed during the study, the average net management return for the flocks of various sizes showed a loss of \$31 to \$200 per 100 hens, or 1.9 to 11.5 cents per dozen eggs (Table 11). Twenty-one flocks or 18 percent of the total number more than broke even. For all flocks, egg sales made up 97 percent of the returns. Other income items were eggs used, manure credit, and dividends and refunds. Eggs used were credited at a flat rate of 32 cents a dozen. Poultry manure production was estimated at 4,000 pounds per 100 hens and was valued at \$4.50 a ton.¹

MANAGEMENT PRACTICES

As might be expected, the 118 flocks included in the study were handled under a wide variety of conditions. Flock-to-flock variations occurred in the way the hens were housed; in the practices and equip-

¹ Poultry Manure: Its Nature, Care and Use. Conn. Agr. Exp. Sta. Bul. 272. 1950. Each ton of poultry manure was estimated to contain 20 pounds of nitrogen, 8 pounds of phosphoric acid, and 7 pounds of potash. These amounts of fertilizer materials as bought commercially by Illinois farmers in 1955 cost \$4.50.

Table 11.—Egg Production and Returns

	Size of flocks					
	Under 400	400- 649	650- 899	900- 1,149	1,150 and over	All flocks
Flocks, number.....	27	34	24	18	15	118
Hens, average number...	310	516	790	990	2,493	848
Egg production						
Eggs per hen, number...	202	218	202	223	226	213
Eggs sold, dozens.....	5,069	9,165	12,974	18,110	44,975	14,919
Eggs used, dozens.....	156	197	282	232	249	217
Total sold and used...	5,225	9,362	13,256	18,342	45,224	15,136
Returns^a						
Eggs sold.....	\$1,807	\$3,272	\$4,476	\$6,428	\$16,551	\$5,351
Eggs used.....	50	63	90	74	80	69
Manure credit.....	28	47	72	93	224	77
Dividends and refunds...	0	2	1	32	0	6
Total.....	1,885	3,384	4,639	6,627	16,855	5,503
Total costs.....	2,453	3,929	5,647	7,509	17,345	6,191
Net returns.....	-568	-545	-1,008	-882	-490	-688
Total cost per 100 hens..	799	767	705	763	705	750
Total returns per 100 hens	599	660	586	668	674	634
Net returns per 100 hens	-200	-107	-119	-95	-31	-116
Net returns per dozen eggs, cents.....	-11.5	-6.0	-7.9	-5.4	-1.9	-7.1
Returns above feed cost per 100 hens.....	185	212	178	212	243	203

^a The value of hens on hand at the end of the record year or used in the household, and income from hens and roosters sold was used to reduce the depreciation on the laying flock.

ment used in providing feed, water, and nests; in frequency of culling; and in methods of handling and marketing eggs. All of these management practices are obviously related to the results secured—that is, to the number of eggs produced, to costs, and returns. With so many variable items in management, it is seldom possible to relate the results definitely to specific practices.

Raising Flocks

Raising pullets for the laying flock did not come within the scope of this study; limited data, however, were obtained regarding the practices used. All but one owner purchased day-old chicks from a hatchery. Chicks were obtained from 47 hatcheries, all but 6 of which were located in Illinois. Eighty-three of the owners purchased only pullet chicks; the others purchased part or all of their replacements as straight-run chicks.

The earliest chicks were started in November, 1953, and the latest

in June, 1954. February was the month in which the largest number of flocks was started. The month and year in which chicks were started are given below.

	First lot		Second lot		Third lot	
	Flocks, number	Percent	Flocks, number	Percent	Flocks, number	Percent
1953						
November.....	3	3	..	..	..	..
December.....	1	1	..	..	..	..
1954						
January.....	21	18	3	3	..	..
February.....	44	37	3	3	..	..
March.....	31	26	8	7	1	1
April.....	13	11	3	3	1	1
May.....	4	3	5	4	2	2
June.....	1	1	1	1	..	..
Total.....	118	100	23	21	4	4

Owners who raised more than one lot staggered the time at which they started lots so that pullets would come into production in such a way as to even out egg supply in quantity and size. These operators generally sold eggs directly to consumers who wanted uniform quantity and size throughout the year.

Twenty-six owners raised poultry in confinement. Ninety owners raised pullets on the range, generally a field of legumes, grass, or grass and legume mixtures, located at some distance from the laying house. Ranges were equipped with portable shelters and range feeders and waterers. The use of range and the age at which flocks could be placed on it was influenced by the time of year chicks were started. Baby chicks were placed on the range at ages of one day to 15 weeks, the average being 7 weeks. Those started in January were put on the range at an average of 9.1 weeks; those started in April, at an average of 4.3 weeks.

Vaccination for disease varied, 61 percent of the owners vaccinating pullet flocks for fowl pox, 57 percent for Newcastle disease, and 28 percent for bronchitis. Fowl pox vaccinations were usually given when pullets were between 10 and 16 weeks old. Twenty flocks were given two vaccinations for Newcastle disease, one when chicks were one day old, and the second at between 10 and 20 weeks. Flocks receiving only one vaccination were treated between 12 and 16 weeks old. Vaccination for Newcastle disease and fowl pox were given in combination to 25 flocks. Vaccination for bronchitis was generally given

at 12 to 16 weeks. Twenty-nine percent of flock owners did not vaccinate for disease.

Pullets come into production when they are about 5 to 6 months old. The first eggs produced are small, some too small to market through regular channels. The size of the eggs gradually increases and in about two months reaches large size (24 through 26 ounces per dozen). For two-thirds of the flocks, the records were started when pullets were 5 to 7 months of age. Not all flock owners housed pullets at the same stage of production. Some took them off the range as soon as they started laying; others, because of the pressure of other work, waited several weeks before they put the pullets in the laying house and started to keep records. In this study, the age of the pullets at housing time had no appreciable effect on the number of eggs laid during the record period.

Housing

Housing, as indicated earlier, was of many types and sizes and of various ages. The dimensions varied greatly. Some were old-style laying houses, some converted garages, and others large remodeled barns. Thirty-eight houses were 20 feet wide; 34 were 28 feet wide; and 34 were 30 feet wide. Thirty houses represented the most common length, 40 feet. The most widely used prefabricated laying houses were 28 feet wide and of varying lengths, since such houses are available in 8-foot sections.

The type of building affected labor requirements, particularly in handling feed and removing litter and manure. Many of the newer single-story houses had wide doorways in each end to permit cleaning with tractor equipment. In others, litter and manure were carried by hand or wheelbarrow to a window or doorway and thrown into a manure spreader outside the building.

Ventilation. Laying houses in Illinois should provide for free air movement in the summer and protection against excessive cold in the winter. Controlled experiments have indicated that egg production decreases at temperatures below 45° F. and above 65°. Production dropped 25 percent when air temperature was increased from 65° to 85° F., and dropped 12 percent when air temperatures were lowered from 45° to 37° F. As temperatures decreased, feed consumption increased.¹ Ventilation assists in maintaining favorable temperatures, although temperatures cannot be held within the optimum range throughout the year.

¹Houses and Equipment for Laying Hens. U. S. Dept. Agr. Misc. Pub. 728. 1956.

Ventilation also provides fresh air and carries off moisture, odors, and airborne disease organisms. One-half to two-thirds a pint of water per hen per day must be removed by ventilation to avoid wet litter. This moisture arises from the hens' breath, evaporation from droppings, and water spilled from drinking fountains.¹ Wet litter creates a sanitation problem and also increases the number of dirty eggs.

In this study, ventilation was provided by natural or gravity air movement in 89 percent of the buildings used for laying flocks. In 50 percent of the buildings some type of gravity air vent was provided and was most commonly located at the ridge of the roof. In other buildings doors and windows were used for ventilation. In 11 percent of the houses, one or more exhaust fans were used.

Lights. Artificial electric lighting to supplement daylight was used on all except five flocks. Fifteen percent of the flock owners used lights 24 hours a day, and 74 percent provided 14 hours or more of light a day. The largest proportion used artificial light for 6 or 7 months during the fall and winter months, as the following figures show.

	Number of months lights were used											
	0	3	4	5	6	7	8	9	10	11	12	Total
Flocks, number	5	1	4	14	28	25	14	6	1	0	20	118
Flocks, percent	4	1	3	12	24	21	12	5	1	0	17	100

	Hours of daylight and electric light per day											
	Day-light only	10	11	12	13	14	15	16	17	18	24	Total
Flocks, number	5	1	0	2	23	50	9	7	0	3	18	118
Flocks, percent	4	1	0	2	19	42	8	6	0	3	15	100

Floor space per hen. Since the size of a flock is reduced during the year because of deaths and culling, fitting the size of the flock to the space available becomes a problem. More space than is needed reduces the potential size of the flock and increases the building cost per hen. On the other hand, crowding leads to difficulties in keeping the litter dry and in controlling disease and cannibalism.

At the time the records were started, there was less than 3 square feet of floor space per hen for two-thirds of the flocks, the average for all flocks being 2.8 square feet. The square feet of floor space for all flocks in the study is given on page 27.

¹Houses and Equipment for Laying Hens. U. S. Dept. Agr. Misc. Pub. 728. 1956.

Square feet of floor space per hen	Based on number of hens at beginning of record period		Based on average number of hens for record period	
	Flocks, number	Percent	Flocks, number	Percent
Less than 2.....	8	7	0	0
2 to 2.4.....	30	25	11	9
2.5 to 2.9.....	42	36	32	27
3 to 3.4.....	25	21	29	25
3.5 to 3.9.....	12	10	24	20
4 to 4.4.....	0	0	12	10
4.5 and over.....	1	1	10	9
Total.....	118	100	118	100

Some flocks, having less than 2 square feet of space per hen, were turned out into a fenced lot or into the barnyard when the weather permitted. Because of the reduction in number, the average floor space based on the average number of hens during the record period increased to 3.4 square feet, or 21 percent.

The 46 flocks that produced hatching eggs had 11 percent more floor space per hen than the average. However, when allowance is made for about 7 males for each 100 hens (males require about 50 percent more space than hens) the use of floor space was similar to the average use. The 8 flocks of heavy breeds, all of which produced hatching eggs, had about 30 percent more floor space per hen than the average of all flocks.

Previous studies have indicated a positive relationship between floor space per hen and rate of lay, and a negative relationship between floor space and culling rate and percent of death loss. In this study, no such relationships were found.

Feeding

Feed handling. Since feed consumption averaged 107 pounds per hen, methods of handling feed obviously had a marked effect on labor requirements.

More than half the laying houses contained feed storage space. In some of the longer houses, a feed room was located in the center of the building; in others, a feed room or bin was provided in a corner or along one wall. For some flocks, however, feed was stored in other farm buildings, sometimes at quite a distance from the laying house.

Twenty-one flock owners had feed grinders in which home-grown

grains were ground before being mixed with protein, vitamins, and mineral concentrates. Five operators had feed mixers and a like number had feed elevators. Six moved feed to the laying house or to overhead bins with blowers. Nine used self-unloading wagons to haul bulk laying mash from a nearby feed mill. These larger pieces of equipment were normally used also for feeding other kinds of livestock, but they illustrate the methods used to reduce labor on some of the largest flocks.

Feeder space presents the same problem of adjustment to size of flock as does housing. When the records were started, only 14 percent of the flocks had the recommended 30 feet of feeder space per 100 hens.¹ The average for all flocks was 22 feet, one-sixth of the flocks having less than 15 feet. The average amount of space for all flocks in the study is shown below.

Linear feet of feeder space per 100 hens ^a	Based on number of hens at beginning of record period		Based on average number of hens for record period	
	Flock, number	Percent	Flock, number	Percent
Less than 15.....	19	16	4	3
15 to 19.....	26	22	18	15
20 to 24.....	34	29	27	23
25 to 29.....	22	19	24	21
30 to 34.....	12	10	19	16
35 to 39.....	3	2	11	9
40 and over.....	2	2	15	13
Total.....	118	100	118	100

^a A linear foot equals one foot of feeding space. For example, a 5-foot feeder open on both sides has 10 linear feet of feeding space.

More feeder space per hen became available as the size of the flock was reduced by death and culling. Based on the average number of hens during the year, feeder space per 100 hens averaged 28 feet.

The type of feeder, except the drum-type or tube self-feeder, had no relationship to the feeder space provided. For 7 flocks, which used only drum-type or tube self-feeders, feeder space was only 12 feet per 100 hens. Heavy breed flocks were provided with 16 percent more feeder space than the average. In flocks fed all mash, feeder space was 10 percent less than the average.

¹ Feeding Forum, American Feed Manufacturers Assoc., Agricultural Service Division, Chicago, Ill. 1956.

Types of feeders. Three types of feeders were used: troughs; round drum-type or tube self-feeders; and mechanical or automatic feeders. Troughs were used exclusively for two-thirds of the flocks; they were 6 to 8 inches wide, 4 to 6 inches deep, and 5 to 8 feet long. They were usually raised about 2 feet above the floor. Most were of metal, though some flock owners built their own of wood. The latter were satisfactory, though more difficult to keep clean.

The larger, round, metal drum-type feeders were set on the floor or a platform, and were filled every 3 or 4 days. The smaller tubes were usually suspended from the ceiling joists by a wire and were filled daily.

Automatic feeders were used for 20 flocks although the owners of only 11 depended entirely on this type. In automatic feeders, the feed is moved mechanically from the bottom of a hopper that holds 400 to 500 pounds into the metal feed trough, the action being controlled by a time clock or other automatic device. The troughs ranged from 40 to 270 feet long depending on the size of the house. The smallest flock that used this type consisted of 700 hens. For some flocks, more than one type of feeder was used.

Feeding systems. Flock owners used three general systems of feeding: mash and limited whole grain; all mash; and free choice. The mash and limited grain system was used with 68 percent of the flocks. Mash containing 18 to 20 percent protein was kept in feeders before the birds at all times, and supplemental grain was fed in limited quantities, usually by scattering the grain in the litter. Three-fifths of the operators using this system fed grain twice a day, the others only once a day. For all flocks for which this system was used, the average protein content of the entire ration was 16.7 percent.

In the all-mash system, which was used with 15 percent of the flocks, the feed ingredients were ground, mixed, and fed in feeders as a single ration. Some flock owners purchased a commercially prepared complete ration, some had the ration prepared at a local feed mill, and some prepared it on the farm. The all-mash rations averaged 17.2 percent protein.

In the free-choice or cafeteria system of feeding, which was used on 17 percent of the flocks, a high-protein mash, generally 26 percent, and whole grain were full fed in separate feeders, the hens selecting their own proportions of feed. Under this system, the protein content of the entire ration averaged 16 percent.

Many variations within these systems of feeding occurred from

flock to flock, as would be expected with many individuals providing the management. The outstanding difference was in the protein content of the ration, which is given below.

Percent protein, total ration ^a	Flocks, number	Percent
Less than 14.....	3	2
14 to 14.9.....	15	13
15 to 15.9.....	27	23
16 to 16.9.....	22	19
17 to 17.9.....	25	21
18 to 18.9.....	15	13
19 to 19.9.....	6	5
20 and over.....	5	4
Total.....	118	100

^a Calculated from stated feed analysis of purchased concentrates and the following protein percentages of other feeds: corn, 8.6; oats, 12.0; wheat, 10.2; barley, 12.7; rye, 12.6; and condensed whey, 8.8.

While many conditions other than the system of feeding influenced the results, a comparison of the three systems is of interest (Table 12). Financially the all-mash system gave the best returns, the reasons being higher prices for eggs and a lower labor requirement. The flocks using the restricted grain system had the highest feed consumption, feed cost per 100 hens, and cost per dozen eggs, with a labor requirement slightly above the general average, and secured the lowest returns in relation to feed cost and the lowest returns above feed costs.

Table 12. — Three Systems of Feeding Laying Flocks

Item	Mash and restricted grain	Mash only	Free choice
Flocks, number.....	80	18	20
Hens, average number.....	789	1,322	658
Eggs per hen, number.....	213	213	212
Death loss, percent.....	12	11	15
Culled, percent.....	36	43	39
Feed per hen, pounds.....	108	104	102
Feed per dozen eggs, pounds.....	6.2	6.1	6.1
Labor per 100 hens, hours.....	136	109	149
Cost per dozen eggs.....	\$.44	\$.42	\$.42
Price per dozen eggs sold, average.....	.351	.388	.350
Returns per \$100 feed fed.....	164	183	181
Returns above feed cost per 100 hens.....	236	303	267
Feed cost per 100 hens.....	389	374	339

Watering

Nearly all the farms had a pressure water system, but not all of them had water piped to the laying house. Twenty-three percent of the operators carried water for an average distance of 83 feet. Within the laying houses a wide variety of watering devices was used. They may be classified roughly into four groups of about equal size. One group used an entirely automatic system, consisting mostly of shallow V-shaped troughs though there were some round dome-shaped waterers and a few cup-type waterers. Another group used various combinations of automatic and hand-filled waterers. A third group used larger troughs much like metal trough feeders that could be filled either automatically or by hand. The fourth group used various types of hand-filled containers.

Many operators used heat tapes, immersion heaters, or heat lamps to prevent freezing during cold weather. To help keep the litter dry a number of operators located waterers over dropping pits so that any water spilled would fall into the pits.

Nest Types and Space and Roosting Space

Most operators used manufactured metal nests although some used home-made nests of wood construction. Four types were used: individual litter, community litter, individual rollaway, and community rollaway. The litter types had a two- or three-inch layer of nesting material and retained the eggs in the nest. The rollaway types used no nesting material and droppings and foreign material fell through wire mesh bottoms and the eggs rolled out of the nesting area into a covered holding tray.

Individual metal or wooden nests were the only types used for 56 percent of the flocks. Each of the other types was used exclusively with a few flocks. In one-fourth of the flocks more than one kind was used. Cooperators reported it was difficult to train hens to use more than one type of nest and hence only one type was used in one pen.

When the records were started, the number of hens per nest for all flocks averaged 7.9, the average of almost half the flocks being above 7.0. The average number of hens per nest at the beginning of the record period and the average number for the record period are given on page 32.

Number of hens per nesting unit ^a	Based on number of hens at beginning of record period		Based on average number of hens for record period	
	Flocks, number	Percent	Flocks, number	Percent
Less than 4	1	1	9	8
4 to 4.9	9	8	35	30
5 to 5.9	22	19	31	26
6 to 6.9	29	24	21	18
7 to 7.9	25	21	10	8
8 to 8.9	15	13	6	5
9 and over	17	14	6	5
Total	118	100	118	100

^a A nesting unit was defined as one individual nest or one square foot of nesting area in a community nest.

As the size of the flock was reduced during the year, the number of hens per nest fell to 5.9. Flocks with rollaway nests had 20 percent less space per hen than the average.

All but two of the operators provided roosts; 89 percent of them used 2 x 2 wooden perches spaced 12 to 18 inches apart and raised 18 to 30 inches above the floor, the dropping pit below being enclosed and covered with 1 x 2-inch welded wire mesh. Such pits were cleaned once or twice a year. In a few cases, roosts were located over dropping boards or against the back wall of the house without an enclosed area.

Culling

Culling consists of removing the low- and non-producing hens from the flock and sending them to market, thus maintaining a high rate of egg production for the remainder of the flock. As long as all birds continue to lay at a relatively high rate, culling is unnecessary. A drop or cessation in production of a hen may arise because of disease, management, nutrition, extreme changes in temperature, or the genetic characteristics of the layer. The removal of such hens reduces the cost of feed and other cash expenses and makes more floor, feeder, and nesting space available for the remaining layers.

A marked variation occurred in the amount and frequency of culling, as the figures below show.

Flock culled, percent	Flocks, number	Per-cent	Flock culled, percent	Flocks, number	Per-cent
0	7	6	41 to 50	16	14
1 to 10	12	10	51 to 60	11	9
11 to 20	14	12	61 to 70	12	10
21 to 30	25	21	Over 70	3	3
31 to 40	18	15	Total	118	100

Seven flocks were not culled at all. More than 40 percent of the original number of birds were culled from 36 percent of the flocks. The 77 flocks composed entirely of pullets had an average culling rate of 24 percent, while the 49 flocks consisting of pullets and year-old hens averaged 49 percent. The average for all flocks was 33 percent. Thirty-six of the flock owners started culling within the first month after the record was started, and by the end of the fourth month, 80 percent of the flocks had been culled at least once.

Frequency of culling was indicated by the number of months during the year that live hens were removed from the flock. The practice of culling varied in a rather even distribution from those who culled but once a year to those who culled every month. The frequency with which 111 flocks were culled is shown here.

Months flocks were culled, number	Flocks reported, number	Per- cent	Months flocks were culled, number	Flocks reported, number	Per- cent
1.....	10	9	7.....	10	9
2.....	8	7	8.....	8	7
3.....	8	7	9.....	11	10
4.....	4	4	10.....	9	8
5.....	12	11	11.....	9	8
6.....	13	12	12.....	9	8
			Total.....	111	100

Litter Management

Of the 206 buildings used as laying houses, 55 percent had concrete floors, 22 percent had earth floors covered with agricultural limestone, 15 percent had earth floors, and 8 percent wooden floors. All flock owners used litter to insulate the floor and to absorb droppings and excess moisture. Exercise was provided for the hens on some farms by scattering whole grain in the litter. Corn cobs, either ground, crushed, or whole were used as litter for two-thirds of the flocks. Other materials used included straw, sawdust, and wood shavings. In most cases, the litter was built up to a depth of several inches. The number and percent of flocks using kinds of litter are shown below.

Litter, kind	Flocks, number	Per- cent	Litter, kind	Flocks, number	Per- cent
Ground corn cobs.....	51	44	Sawdust.....	7	6
Crushed corn cobs.....	18	15	Wood shavings.....	5	4
Whole corn cobs.....	10	8	Corn cobs and straw....	12	10
Straw.....	12	10	Corn cobs and sawdust..	3	3
			Total.....	118	100

Two-thirds of the operators removed the litter once a year, and one-fourth removed it two to four times a year. A few changed litter more frequently. In three instances, the litter was used for more than a year.

Handling Eggs

Egg quality. In food value, flavor, and general appearance eggs are better when first laid than at any other time. Quality with respect to food value and market desirability is measured externally by appearance and internally by means of candling. External appearance includes size, shape, texture, and cleanliness. Candling measures interior quality by the size of the air cell, yolk color, thickness of white, fertility, and shell texture.

Conditions within the control of the producer influence the rate at which egg quality deteriorates. These conditions include cleanliness, temperature, humidity, handling, and age. The importance of temperatures in maintaining quality is shown by the time in which infertile eggs of AA quality will drop to C quality. At 99° F. this change occurs in 3 days; at 75° in about 9 days; at 45° in 65 days; and at 37° in 100 days.¹

To reduce deterioration of quality from high temperatures and low humidity, production specialists recommend gathering eggs frequently, using wire baskets for more rapid cooling, storing in a cool, humid place, and marketing frequently. Since shells are relatively fragile, rough handling increases the number of cracked or broken eggs and may cause interior damage to the yolk and air cell.

For gathering eggs, 91 percent of the operators used wire, plastic-coated wire, or rubber-coated wire baskets of 12 to 16 dozen capacity. The others used metal buckets or wooden baskets.

Frequency of gathering affects the amount of breakage and soiling as well as, in summer, exposure to high temperature. In this study, eggs were gathered from 1 to 4 times a day. Fifty percent of the flock owners gathered eggs 3 times a day and 39 percent twice a day.

Twenty flock owners recorded the number of eggs broken in the nest, but no records were kept of cracked or soiled eggs. Eleven, who gathered eggs 3 times a day, had an average net breakage of 0.35 percent (1.26 eggs per case), while 9, who gathered twice a day, had a net breakage of 0.61 percent (2.20 eggs per case) (Table 13). Eggs broken in the nest are a total loss, and soil nesting material and other eggs:

¹ Card, Leslie E., *Poultry Production*. 8th ed. Lea and Febiger, Philadelphia. 1952.

Table 13.—Effect of Frequency of Gathering on Breakage in Regular Nests; 20 Laying Flocks

Three gatherings per day			Two gatherings per day		
Eggs produced, number	Eggs broken in nest		Eggs produced, number	Eggs broken in nest	
	Number	Percent		Number	Percent
123,139.....	214	.17	123,820.....	258	.21
302,281.....	541	.18	209,512.....	538	.26
52,639.....	104	.20	119,104.....	521	.44
121,323.....	280	.23	84,572.....	373	.44
245,098.....	642	.26	183,375.....	1,285	.70
180,029.....	493	.27	26,026.....	191	.74
103,602.....	328	.32	53,557.....	465	.87
63,609.....	222	.35	83,439.....	728	.87
91,853.....	387	.42	129,748.....	1,261	.97
30,380.....	165	.54	.....	.....	.....
398,241.....	3,481	.87	.....	.....	.....
Average.....	.....	.35	.....	.....	.61

Three-fourths of the operators cooled, processed, and stored eggs in the basement of the farm home. Half the remaining owners had egg rooms, some of which were refrigerated, either in the laying house or in other buildings. In a few instances, old milk houses served as egg rooms.

Cleaning eggs. Clean eggs are not only more attractive to consumers, but, if cleaned properly, spoil less rapidly than dirty eggs. Moreover, soiled eggs rate lower on a graded basis and command a lower price. All but one of the operators in this study cleaned at least a part of the eggs, as the following figures indicate.

Eggs cleaned, percent	Flocks	
	Number	Percent
100.....	24	20
80 to 99.....	7	6
60 to 79.....	5	4
40 to 59.....	15	13
20 to 39.....	24	20
1 to 19.....	42	36
0.....	1	1
Total.....	118	100

Some felt it saved time to wash all eggs rather than to sort out and wash only the soiled eggs. Eighteen percent who followed this practice washed the eggs immediately after gathering by placing the baskets in an immersion-type mechanical washer filled with a detergent-sanitizer solution. Those who cleaned only part of the eggs were

about equally divided between washing and dry cleaning. Those who washed eggs by hand either used a damp cloth or immersed eggs in water. Because some dealers objected to buying washed eggs, some operators cleaned the soiled eggs with a soft-backed emery or sanding block, or with a buffing wheel run with an electric motor. Sanding was sometimes necessary to remove stains left after mechanical washing.

The cleaning methods used were not necessarily related to size of flock, as indicated by the fact that mechanical washing equipment was used by some flock owners having flocks of 450 hens, while a few operators with flocks of over 2,000 hens used hand cleaning methods.

After the eggs were cleaned and cooled, 80 percent of the owners packed the eggs in 30-dozen cases. The other 20 percent sorted the eggs for size, particularly during the early months when pullets were producing smaller eggs. Part of this group also candled the eggs before packing them in dozen cartons. Such additional processing requires more labor and in some cases special equipment. Mechanical graders, gravity flow egg scales, or single-egg type hand scales sorted the eggs. The bar light on mechanical graders or single-egg type candlers candled the eggs.

Marketing eggs. The prices received depended on: (1) the basis of selling — whether graded, farm run or ungraded, or for hatching; (2) the type of outlet; (3) the length of time pullets had been laying; (4) the season of the year; and (5) the area of the state.

In this study, 59 percent of the eggs were sold on a graded basis, 29 percent as ungraded or farm run, 10.5 percent to hatcheries, and 1.5 percent were used by the farm family. Of those sold on a graded basis, nearly three-fourths went through the usual marketing channels, and a little more than one-fourth were sold directly to consumers or to special outlets. These latter sales involved additional services by the flock owner — grading, in many instances candling, packing in dozen cartons, and delivering. These additional services involved extra cost, but the eggs also brought higher prices, as the figures below show.

Method of sale	Area of state		
	Southern	Central	Northern
	<i>cents per dozen</i>		
Graded, to consumers and special outlets.....	40.3	....	43.4
Graded, to grading stations.....	28.4	30.3	33.7
Farm run, ungraded.....	28.6	32.5	33.2
Hatcheries.....	52.6	49.9	59.1
Average, all sales.....	33.5	34.6	40.5
Farm run, average for area ^a	28.6	30.0	30.5

^a Data from Illinois Crop Reporting Service.

In general the prices were highest in the northern area and decreased to the south. Some of the cooperators in the northern area were close enough to Chicago to make use of special market outlets, and a few in the southern area had similar outlets in St. Louis. None of those in the central area used such outlets.

The farm-run or current-receipts basis of selling eggs, as shown in this study, resulted in somewhat higher prices than was generally true in the same areas of the state. Because of their larger volume of eggs and better management practices, the owners of selected flocks command higher prices on a farm run or ungraded basis than is true of farmers generally.

Five types of market outlets were used: grading stations; truckers; produce houses; hatcheries; and direct sales to consumers or to special outlets, such as restaurants and hospitals. More than three-fourths of the flock owners used two or more of these outlets, and only 22 percent disposed of their eggs through a single outlet. One-third used truckers as a major outlet, and 30 percent sold most of their eggs to grading stations. The number and percent of flocks and kinds of outlets used are shown below.

Outlet	Flocks, number	Percent
Grading stations.....	35	30
Truckers.....	39	33
Produce houses.....	18	15
Hatcheries.....	13	11
Direct to consumers or special outlets.....	13	11
Total.....	118	100

Forty percent of the flock owners sold some eggs to hatcheries, but hatcheries were the major outlet for only 11 percent of the owners. The quantity of eggs sold to hatcheries was generally limited by the length of the hatching season. While a few owners used the hatchery outlet for longer periods, for 62 percent of the owners the season lasted less than 20 weeks and for 82 percent less than 30 weeks. The proportion of eggs sold to hatcheries varied greatly, but only 22 percent of the owners disposed of more than 50 percent of the eggs to hatcheries.

All hatcheries paid premiums above the market price. Premiums based on prices of Grade A large eggs ranged from 10 to 20 cents a dozen and averaged 14 cents. Those based on the current-receipts price ranged from 14 to 30 cents a dozen and averaged 20 cents. Hatcheries using the Grade A base paid 1.7 cents a dozen more than those using the current-receipts base. Some owners received an additional bonus

at the end of the hatching season based on the hatchability of their eggs.

Males for hatching flocks were obtained by raising day-old male chicks which in most cases were provided without charge by the hatcheries from which the pullet chicks were purchased.

The length of time pullets have been in production affects average egg price because of the size of the eggs. For the month ended October 5, an 8-year average of the distribution of size of eggs bought from all Illinois farmers on a graded basis was: large, 47 percent; medium, 27 percent; small, 21 percent; undergrade, 3 percent; and broken, inedible, and rejects, 2 percent.¹ The corresponding percentages for the month ending March 23 were: large, 77 percent; medium, 16; small, 1; undergrade, 4; and broken, inedible, and rejects, 2 percent. Thus average prices tend to be lower during the fall months when pullets are coming into production.

Finally, egg prices vary from month to month because of changes in supply and demand. This pattern varies from year to year, but the seasonal variation appears to be flattening out (Fig. 2). In the 16-month period covered by this study, however, average prices received by Illinois farmers were below 30 cents a dozen in 10 of the 16 months, and in only one month exceeded 35 cents a dozen. Egg prices have shown much more favorable relationships to feed prices in some recent years.

Delivering eggs. Thirty-five percent of the owners had all the eggs picked up at the farm by the buyer; 19 percent delivered all the eggs to market; and the other 46 percent delivered part of the eggs. For one-half those who delivered eggs, the distance to market one way was over 9 miles, and for one-seventh, the distance was 20 miles or more. When delivering eggs was combined with other business or a pleasure trip, only part of the mileage was charged to egg marketing.

COMPARISON OF FLOCKS BY AREAS AND BREEDS

The southern area had the smallest average size of flocks, a rate of lay slightly below average, cost of feed per 100 pounds somewhat above average, labor input per 100 hens much higher than average, cost of eggs per dozen higher, and egg prices lower than average (Table 14). As a result returns as measured in terms of \$100 of feed

¹The Evolution of Graded Egg Marketing in Illinois. Ill. Agr. Exp. Sta. Bul. 619. 1957.

Table 14. — Comparison of Laying Flocks by Areas

Item	Area			All flocks
	Southern	Central	Northern	
Records, number.....	36	54	28	118
Hens, average number.....	565	930	1,055	848
Rate of lay.....	210	214	214	213
Feed per hen, pounds.....	107	102	115	107
Feed cost per 100 pounds, dollars...	3.73	3.44	3.44	3.55
Labor, hours per 100 hens.....	158	114	142	130
Total cost per dozen eggs, cents....	.47	.41	.45	.433
Price per dozen eggs sold, average, cents.....	.335	.346	.405	.357
Returns per \$100 feed fed, dollars..	154	174	183	170
Net management returns per 100 hens, dollars.....	-212	- 87	- 60	-116
Returns above feed cost per 100 hens, dollars.....	195	259	310	252
Hens at beginning of record period, number.....	725	1,224	1,321	1,095
Pullets, percent.....	96	88	80	89
Death loss, percent.....	12	12	12	12
Culled, percent.....	36	38	40	38
Square feet of floor space per 100 hens at beginning of record period....	290	266	272	280
Feet of feeder space per 100 hens at beginning of record period.....	21.8	22.1	22.1	22.0

fed, net management return per 100 hens, or returns above feed cost, fell considerably below the average for all records.

The northern area was closer to the average for all flocks. Size of flock was larger than the average as were feed consumption per hen and hours of labor per 100 hens. Both cost of production and average price per dozen eggs were above average. Returns were highest in this area.

Feed consumption per hen, hours of labor per 100 hens, and cost per dozen eggs were lowest in the central area. In other respects, the central area occupied an intermediate position between the northern and southern areas.

Comparison by breeds shows little difference between egg-laying breeds. Of the 118 flocks, 75 were White Leghorns, 23 hybrid, 12 mixed, and 8 heavy-breed (Table 15). The White Leghorn and hybrid flocks were quite similar in results, the hybrid flocks having a slight advantage in cost per dozen eggs and in flock returns. The mixed flocks were those in which two or more flocks of Leghorns and hybrids were housed separately, but only one combined record was kept. These flocks consumed more feed per hen than either the Leghorn or hybrid

Table 15. — Comparison of Laying Flocks by Breeds

Item	Leghorn	Hybrid	Mixed	Heavy
Records, number.....	75	23	12	8
Hens, average number.....	793	677	1,867	336
Rate of lay.....	217	214	225	154
Feed per hen, pounds.....	105	105	120	108
Feed cost per 100 pounds, dollars.....	3.57	3.39	3.42	4.04
Labor per 100 hens, hours.....	133	134	131	152
Total cost per dozen eggs, cents.....	.42	.41	.42	.65
Returns per \$100 feed fed, dollars.....	.342	.345	.367	.507
Net management returns per 100 hens, dollars.....	168	179	172	152
Returns above feed cost per 100 hens, dollars.....	-125	- 97	- 88	-161
Hens at beginning of record period, number.....	248	260	288	205
Pullets, percent.....	1,033	832	2,426	431
Death loss, percent.....	89	90	78	96
Culled, percent.....	12	13	11	14
	37	29	52	45

groups, had a higher rate of lay, and a higher return above feed cost. These were mostly large flocks, the operators of which had greater access to special markets. They had a smaller proportion of pullets and as a result had a much heavier rate of culling.

The 8 heavy-breed flocks were mostly small flocks. Only 3 were kept for the entire year, the average for the group being 320 days. This accounts in part for the relatively low production of 154 eggs per hen. The labor input was also high. The operators of these flocks sold hatching eggs which returned premium prices; yet because of high costs and low production, the returns for these flocks were lower than the returns for any of the other groups.

SIGNIFICANCE OF THE STUDY

The records of 118 Illinois poultry flocks as summarized here should prove helpful not only to those who cooperated in the study, but also to others who have established or are contemplating establishing flocks of similar sizes. Inasmuch as the price situation was unfavorable to flock owners during the period of the study, the profits and losses incurred should not be considered as typical of the laying flock enterprise. Farm management studies normally show wide differences among producers in any farm enterprise, regardless of price level. The present study is no exception, and it is assumed that the differences between the high-income and low-income flocks as illus-

trated here would be equally true under more favorable relationships.

For most Illinois flocks, this enterprise is a part of a larger farm business which includes numerous other enterprises. Under these conditions, each enterprise should carry a share of the general farm overhead expenses such as taxes, insurance, and interest on the investment, even though such items may not seem to be directly related to an enterprise. The operator who builds a new laying house and invests in the needed equipment recognizes that he has a sizable investment that naturally depreciates with the passage of time. The operator who makes use of existing buildings and equipment with a minimum outlay of cash or effort is less likely to recognize building and equipment items as direct costs. This latter position is most applicable to the tenant operator who absorbs these items of cost in a very indirect way if at all.

Much the same situation holds with regard to the labor used on the laying flock. For 84 percent of the flocks, all the labor was performed by members of the farm family with no cash outlay. On the other farms, part of the labor was done by hired men who in most cases were kept the year round for the entire farm business and were not hired specifically to work with the poultry enterprise. While all labor used in the laying flock enterprise was charged at 90 cents an hour, the question could well be raised with each flock of whether this labor could have been used to better advantage in other ways.

Inasmuch as many of these items of cost do not involve an immediate cash outlay, the profitableness of the enterprise is often measured by the amount by which cash receipts exceed direct cash outlays, or by the returns above feed costs. These current measures are readily obtained and serve a useful purpose, but obviously they fall short of including all the costs which must be recognized over a long period of time. It is this longer viewpoint that this study has tried to express. Since many conditions enter into the degree of success that an operator attains with a laying flock, it follows that there are numerous alternatives from which he must select. The variety of conditions and practices enumerated in this study indicate the many decisions made by these cooperators. There is no one set of conditions that would fit all situations; how well each producer selects those conditions of production and marketing that best fit his particular situation determines his management ability.

SUMMARY

This study included 118 Illinois laying flocks of which 28 were in the northern, 54 in the central, and 36 in the southern part of the state. For purposes of analysis, the flocks were classified into five groups: under 400 hens; 400-649; 650-899; 900-1,149; and 1,150 and over. The flocks averaged 848 hens. The records were started in the fall of 1954 and kept for a year unless the flock was sold earlier.

The difference in net management earnings between the highest 20 percent and the lowest 20 percent of the flocks amounted to \$367.60 per 100 hens. Of 11 efficiency factors studied, 95.8 percent of the difference was accounted for by five factors. Cost per dozen eggs accounted for 25 percent; average price of eggs sold, 20.6 percent; number of eggs produced per hen, 17.1 percent; feed cost per 100 hens, 16.6 percent; and hours of labor per 100 hens, 16.5 percent.

Feed consumption per hen averaged 107 pounds; labor requirements per 100 hens averaged 130 hours, of which 62 hours was used in feeding, watering, and gathering eggs, 46 hours in cleaning and packing eggs, and 22 hours in occasional work.

For all flocks, the cost per dozen eggs was 43.3 cents: feed 22.2 cents; flock depreciation, 8.8 cents; labor, 6.7 cents; buildings and equipment, 3.9 cents; and other expense, 1.7 cents.

Investment per 100 hens averaged \$923, of which buildings represented \$567; equipment, \$133; and laying flock, \$223. Building costs per 100 hens were \$41, equipment \$27, and laying flock \$151.

Egg production averaged 213 or 17.75 dozen per hen; eggs returned an average of 35.7 cents per dozen, although the prices received varied widely depending on the type of outlet. While returns above feed cost averaged \$203 per 100 hens, only 21 percent of the flocks produced incomes large enough to pay all costs, both cash and noncash, because egg prices were abnormally low during the period of the study. By size of flock, the losses ranged from \$31 to \$200 per 100 hens.

The results reflect a wide variety of management practices as well as many types of housing and equipment, but the results can seldom be traced to specific practices.

Housing varied from remodeled barns to modern prefabricated buildings, and provided an average of 2.8 square feet of floor space when the records were started and 3.4 square feet as an average for the period. Lights were generally used to provide a day of 14 hours or more.

Trough feeders were used for two-thirds of the flocks; drum-type or tube self-feeders or automatic feeders for the rest of the flocks. Feeder space per 100 hens averaged 22 feet at the beginning of the record-keeping period and 28 feet for the entire period.

The mash and limited grain feeding system was used for four-fifths of the flocks. Feed costs were higher and returns less for this system than for either the all-mash or free-choice systems.

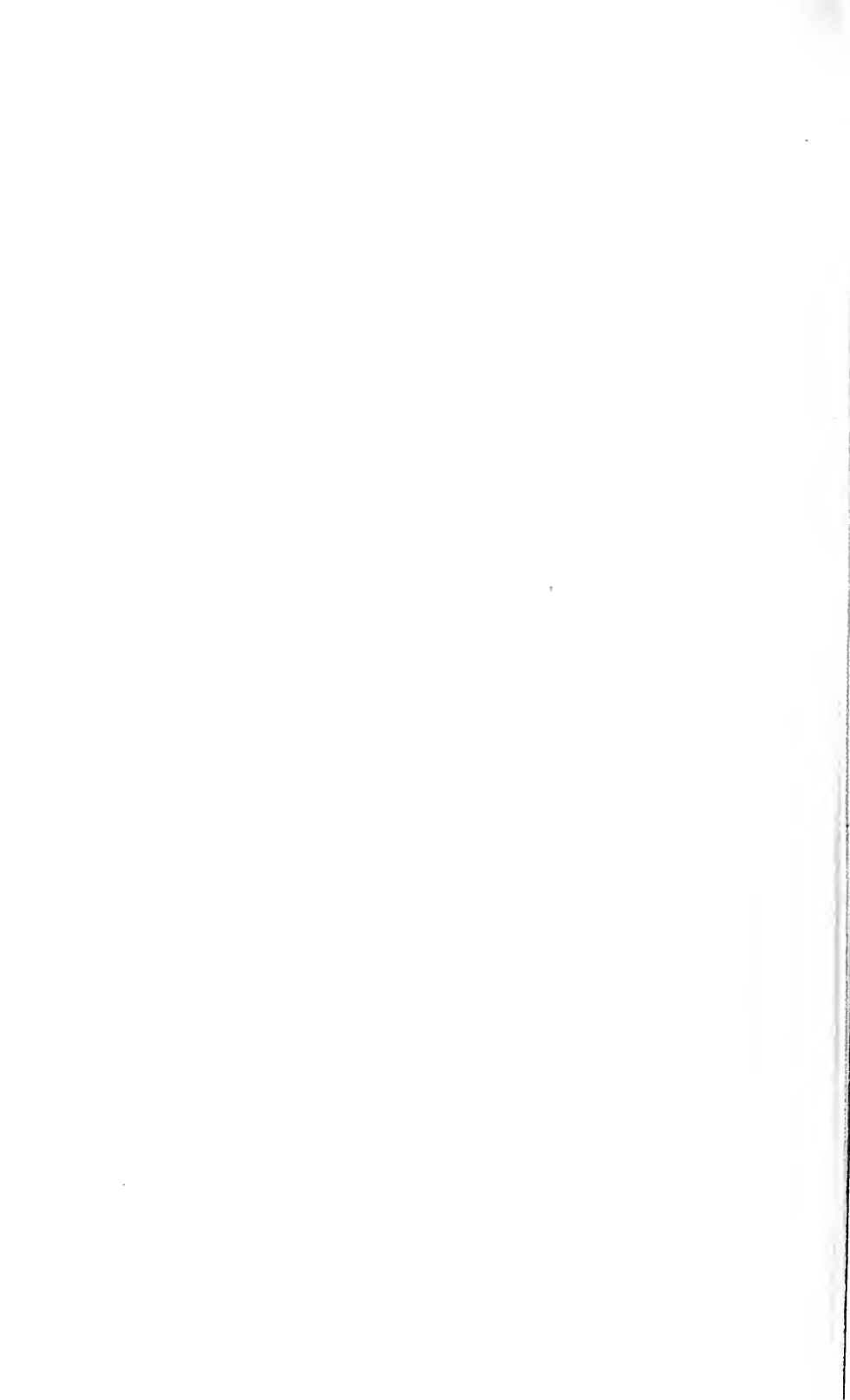
An average of one-third of the beginning flock was culled during the year, the proportion varying greatly among flocks.

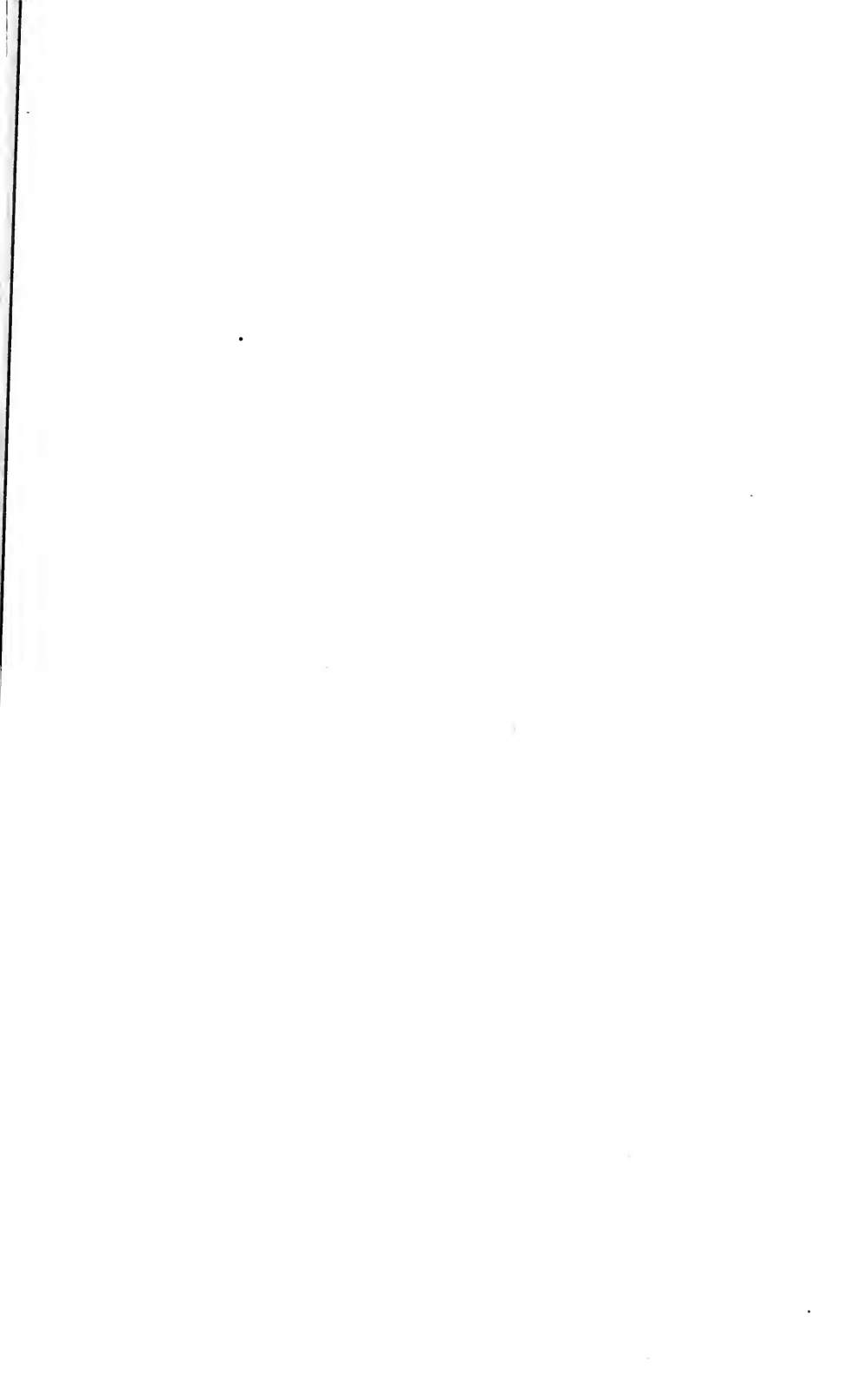
Individual nests of wood or metal were the most commonly used types, though community and rollaway types were also used. Eggs were gathered from one to four times a day. When eggs were gathered three times a day, there were slightly more than half as many broken eggs as when they were gathered twice a day. Eggs were generally cleaned and cooled before they were packed.

Fifty-nine percent of the eggs were sold on a graded basis; 29 percent were sold as farm-run; 10.5 percent went to hatcheries; and 1.5 percent were used by the farm family. Market outlets were: grading stations; truckers; produce houses; hatcheries; and direct sales to customers or special outlets. Premium prices were received for direct sales and for hatching eggs, the latter usually for limited periods.

Considerable variation occurred among the three areas of the state in size of flock, proportion of pullets in the flock, pounds of feed per hen, unit cost of feed, hours of labor per 100 hens, cost and price per dozen eggs, and returns above feed costs.

White Leghorns and hybrids gave similar results. Mixed flocks of egg breeds had somewhat higher egg production and feed consumption. By contrast, the 8 heavy-breed flocks — all producing hatching eggs — were of smaller size, produced fewer eggs, and required more labor.





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