Poultry Farm Practices and EGG QUALITY

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NORTH CENTRAL POULTRY MARKETING RESEARCH COMMITTEE

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The subproject reported here was carried out in Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Ohio, and Wisconsin, with the cooperation of the Production and Marketing Administration and the Farm Credit Administration, U. S. Department of Agriculture.

The study on which this report is based was conducted in part under authority of the Agricultural Marketing Act of 1946 (RMA, Title II).

PREFACE

This report is the fourth in a series based on regional studies of egg quality and marketing practices in the North Central States. It concerns the extent to which recommended management practices were used by poultrymen, and the relation of such practices to the quality of eggs marketed. The first report, entitled "Changes in Egg Quality During Marketing," was issued as Special Bulletin 361 by the Agricultural Experiment Station of Michigan State College. The second report covered "Operations of Country Buying Stations in Relation to Egg Quality," and the third dealt with "Operations of Central Assembling Plants in Relation to Egg Quality." The last-named two reports were issued by the U. S. Department of Agriculture in May 1950.

The results of the present study should be of value to extension and research workers, as an indication of the extent to which recommended management practices are being followed by poultrymen, members of the egg trade and others interested in improving the quality of eggs delivered by producers, and producers interested in improving their management practices and the quality of eggs they market.

Similar research was conducted in the States of Kansas and Michigan. A bulletin entitled "Egg Quality and Poultrymen's Practices in Kansas" was published by the Kansas Agricultural Experiment Station. Several articles on this subject have appeared in various issues of the "Michigan Agricultural Experiment Station Quarterly."

CONTENTS

SUMMARY

1. This report concerns the poultry flock management and egg-handling practices followed by 730 midwestern farmers during July, August, and September of 1949 and August and September 1950 and the effect of these practices on the quality of eggs marketed. All 1950 records were taken in one State. The quality of eggs marketed was measured in terms of: (*a*) Percentage of Grade A eggs marketed; and (*b*) percentage of stained and dirty eggs marketed. Stained and dirty eggs were not reported for Indiana and Ohio.

2. Poultry flock and egg-marketing practices varied widely. In general, producers with the largest flocks followed more closely the production and marketing practices recommended for marketing high-quality eggs than did those with smaller-sized flocks.

3. The most important practices that were related to a high percentage of eggs marketed as Grade A quality were as follows:

(*a*) Confinement of laying flock.
(*b*) Frequency of gathering eggs.
(*c*) Container used for gathering eggs.
(*d*) Temperature in egg room.
(*e*) Humidity in egg room.
(*f*) Condition of nesting material.
(*g*) Condition of floor litter.

4. The important practices that were related to a low percentage of eggs marketed as stained and dirty were as follows:

(*a*) Condition of floor litter.
(*b*) Condition of nesting material.
(*c*) Frequency of gathering eggs.

Practices of lesser importance were:

(*a*) Confinement of laying flock.
(*b*) Number of layers per nest.

5. In the production and marketing of eggs containing a high proportion of eggs of Grade A quality and a low proportion of stained and dirty eggs, it is essential that producers follow most or all recommended management and marketing practices. Results improve as additional recommended practices are followed.

This report shows that the farmers who followed seven recommended practices sold eggs that averaged 90 percent Grade A and only 4 percent stained and dirty. As the number of recommended practices that were followed decreased the percentage of eggs marketed that were Grade A decreased and the percentage of eggs that were stained and dirty increased. Thus, the producers following only one recommended practice marketed eggs that averaged 61 percent Grade A and 23 percent stained and dirty, whereas those following no recommended practice marketed eggs that averaged only 55 percent Grade A and 23 percent stained and dirty. (These results are presented in more detail in figure 1, p. 1.)

POULTRY FARM PRACTICES AND EGG QUALITY

By A. William Jasper, *Marketing Specialist, Poultry Branch, Production and Marketing Administration*[1]

INTRODUCTION

An extremely wide range exists in the quality of eggs marketed by producers. A study made in 1948[2] indicated a range from 0 to almost 100 percent in the proportion of Grade A eggs marketed by midwestern producers; the average was 67 percent Grade A eggs.

Several studies have been made of marketing practices and of egg quality after the eggs have left the farm, but few studies have attempted to relate production practices to the quality of eggs marketed. Since a very high percentage of eggs are of Grade A or higher quality when laid, the average quality of eggs marketed and the variability in quality of eggs marketed raise many important questions about flock management and egg handling on the farm. These questions can be answered through studies which go beyond a laboratory type of study and relate production and marketing practices to egg quality.

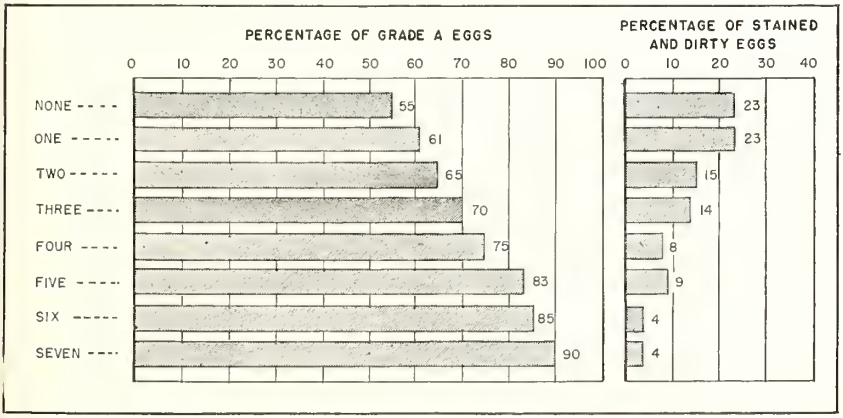

FIGURE 1.—Number of recommended management and handling practices followed by midwestern egg producers and percentage of eggs marketed that were (1) Grade A (from 648 farms) and (2) Stained and Dirty (from 611 farms). Source: Tables 11 and 14.

[1] Acknowledgment is made to Wesley Hansen, formerly a marketing specialist with the Poultry Branch, who was responsible for planning and coordinating the research; to R. S. Sowell, marketing specialist, for the tabulation and summary of statistical data; and to L. B. Darrah, formerly an agricultural economist with the Poultry Branch, who participated in planning the analysis and its presentation.

[2] CHANGES IN EGG QUALITY DURING MARKETING. North Central Regional Publication No. 15. Mich. State Col. Agr. Expt. Sta. Special Bulletin 361. 39 pp. 1949.

OUTLINE OF STUDY

OBJECTIVES

The objectives of the study on which this report is based were:

1. To determine the quality of eggs marketed by producers and the production and marketing practices followed by the producers.
2. To measure the effect of the practices followed upon the quality of eggs marketed.

PROCEDURE

Briefly, the recommended procedure, established by the committee for use in this study, which in some instances was not followed precisely, was as follows:

1. Each of the nine States cooperating in this study selected at least one central assembling plant, their selections being based on the willingness of the plants to provide the type of information needed and on knowledge obtained from previous studies with respect to conditions in such plants.
2. From each of the central assembling plants a list of the regular country buying stations was obtained. Two country buying stations were selected at random from each list.
3. A list of the regular truck routes was obtained for each country buying station. These routes were grouped according to the driver and the day of the week when the route was run. Two routes were chosen at random for each country buying station.
4. For each of the truck routes selected, a list of shippers was obtained. Those shipping less than one case of eggs per pickup were eliminated. The remaining shippers were classified according to the quality of eggs they marketed during the preceding two pickups, the 10 producers shipping the highest quality eggs and the 10 shipping the lowest quality eggs being selected for the study. One State, however, used a random sample of all producers on each of the truck routes.

Several States obtained considerably more than the minimum number of records required by the committee; one State obtained less than the minimum number. The records obtained by each State follow:

State	*Number*	*State*	*Number*
Indiana	76	Nebraska	60
Iowa	135	North Dakota	2
Kansas	154	Ohio	95
Minnesota	87	Wisconsin	80
Missouri	41	Total	730

Most of the records were obtained during July, August, and September of 1949, but records were also obtained in July and August of 1950 in Wisconsin.

Each of the producers selected for study was visited, and records of production practices followed were obtained. A sample of the eggs marketed by each producer was selected at the country buying station and used to determine the quality rating for each producer. The sample was selected from the first shipment made after the farm record was obtained.

LIMITATIONS OF THE DATA

When selecting the producers to be interviewed, those shipping less than one case of eggs per pickup were eliminated. Only producers shipping eggs by truck were included in the sample.

Not all records were completed for all questions. As a result, the number of farms given in the various tables frequently does not total 730.

The percentage of eggs marketed that were stained and dirty is reported; however, the percentage of eggs gathered that were stained and dirty is not reported.

For eggs reported as stains or dirties the interior quality grade was not determined. Therefore, stained and dirty eggs were automatically classed in a lower grade, without consideration of their interior quality which actually might have been Grade A.

Because stained and dirty eggs were not reported for Indiana and Ohio, relationships between management factors and the percentage of eggs marketed as stains and dirties are reported for only 77 percent of all farms studied.

Results are not reported relative to certain management and handling practices on which an effort was made to obtain information because the data collected was insufficient or rendered unreliable by other limiting factors.

DESCRIPTION OF LAYING FLOCK

SIZE AND COMPOSITION OF LAYING FLOCK

Sixty-nine percent of the farms studied had flocks with 100 to 399 layers, almost equally divided, percentagewise, between flocks of 100 to 199 layers and flocks of 200 to 399 layers (table 1). Only 15 percent of the farms had flocks with less than 100 layers, and 16 percent had 400 or more layers.

The flocks included in this study as compared with those reported by the Bureau of the Census, were larger, on the average, than those flocks on all farms with chickens in the nine cooperating Midwestern States.[3] This difference resulted largely from the fact that producers shipping less than one case of eggs per pickup were eliminated from the study.

The laying flocks on the farms studied averaged 243 layers (table 1). Of this total, 66 percent were hens and 34 percent pullets. In general, the larger flocks had a higher proportion of pullets than the smaller flocks. For example, those flocks with 600 or more layers had an average of 49 percent pullets, whereas those flocks with less than 100 layers had only 7 percent pullets.

TABLE 1.—*Farms included in study and size and composition of laying flocks, midwestern region, by number of layers per flock, 1949–50*

Layers per flock (number)	Farms		Average number of layers	Composition of laying flock		
				Hens	Pullets	Total
	Number	*Percent*	*Number*	*Percent*	*Percent*	*Percent*
Less than 100	111	15	70	93	7	100
100 to 199	247	34	133	90	10	100
200 to 399	257	35	267	67	33	100
400 to 599	72	10	467	48	52	100
600 or more	43	6	803	51	49	100
Total or average	730	100	243	66	34	100

[3] United States Census of Agriculture, 1945.

BREED

A wide variety of breeds and crosses were kept on the farms studied (table 2). White Leghorns, the most important single breed represented, were found on 37 percent of the farms for which such information was reported. Combinations of two or more breeds were found on 25 percent of the farms, and various crosses were found on 16 percent of the farms.

Commercial hybrids were found on only 4 percent of the farms studied. However, the hybrid flocks had the highest average number of layers, followed in order by Leghorn flocks, flocks of various crosses, and flocks with two or more breeds or crosses. The number of layers in flocks of all other breeds was below the average for all farms studied.

TABLE 2.—*Breeds of chickens kept and average number of layers, 726 midwestern farms, 1949–50*

Breed	Farms		Average number of layers
	Number	*Percent*	*Number*
White Leghorns	273	37	258
Crosses	115	16	247
New Hampshires	53	7	185
White Rocks	50	7	177
Hybrids	29	4	421
Barred Rocks	13	2	94
Other single breeds[1]	14	2	149
Combinations, two or more breeds[2]	179	25	244
Total or average	726	100	243

[1] Wyandotte, Rhode Island Red, Buff Orpington, Australorp, Brown Leghorn, White Minorca, Ancona, and Black Minorca.

[2] Combinations of 16 different breeds and crosses.

MANAGEMENT PRACTICES

LAYING PENS

Flock confinement

Laying flock confinement was practiced on 25 percent of the farms on which this information was reported (table 3). In contrast, 66 percent of the producers did not confine their laying flocks. Another 9 percent confined their laying flocks part of the day, or during inclement weather, or kept only part of their laying flocks confined.

Confinement of the laying flock was more common with the largest flocks (600 or more layers), 42 percent of which were confined, than with the smallest flocks (less than 100 layers) where 21 percent of the flocks were confined. (Fig. 2.)

Layers kept per nest

Individual nests were used on 97 percent of the 707 farms on which this information was reported. Only 1 percent of the flock owners used community nests, and 2 percent used both individual and community nests.

There were from 4 to 6 layers per individual nest on 41 percent of the 683 farms using only individual nests (table 3), and there were fewer than 4 layers per nest on 20 percent of the farms. There were 7 to 9 layers per

FIGURE 2.—To produce high-quality eggs, laying flocks should not be permitted to roam freely (left), especially during wet, muddy weather. Flocks should be confined (right) so they cannot track outside dirt into the laying house, that will result in an increased number of stained and dirty eggs.

individual nest on another 20 percent of the farms and 10 or more layers per nest on the remaining 19 percent.

In general, the farms with the smallest flocks provided an adequate number of nests whereas those with the largest flocks did not provide a sufficient number of nests. It is generally recommended that individual nests be provided on the basis of one nest for five to six layers. Community nests should provide 1 square foot of nest area for every five layers.

Handling of broody hens

Hens become broody most frequently during the spring months. However, even when the records were obtained in this study—during the months of July, August, and September—85 percent of the flock owners from whom information was obtained reported some broody hens (table 3). In each size of flock group, from 80 to 88 percent of the flock owners reported broody hens.

On most of the farms the broody hens were removed from the nest and confined. However, a few flock owners, mostly those with flocks of less than 200 layers, did not take broody hens from the nest.

Nesting material used

The most common nesting material used was straw, its use being reported for 63 percent of the farms studied (table 3). Hay was used on 20 percent of the farms, other materials on 16 percent, and nesting material was not provided on 1 percent of the farms. The same general pattern was true for flocks in all size groups. (Fig. 3.)

Condition of nesting material

Dry nesting material was found on 98 percent of the farms for which this information was reported (table 3). On 63 percent of the farms the nesting material was clean and dry, on 25 percent it was slightly dirty and

dry, and on 10 percent of the farms it was dirty and dry. The nesting material was dirty and damp on 2 percent of the farms.

As the size of flock increased the proportion of farms with clean nesting material increased from 53 percent for the smallest flocks to 91 percent for the largest flocks. This proportion indicated that as the size of flocks increased the producers were more concerned with providing clean nesting material.

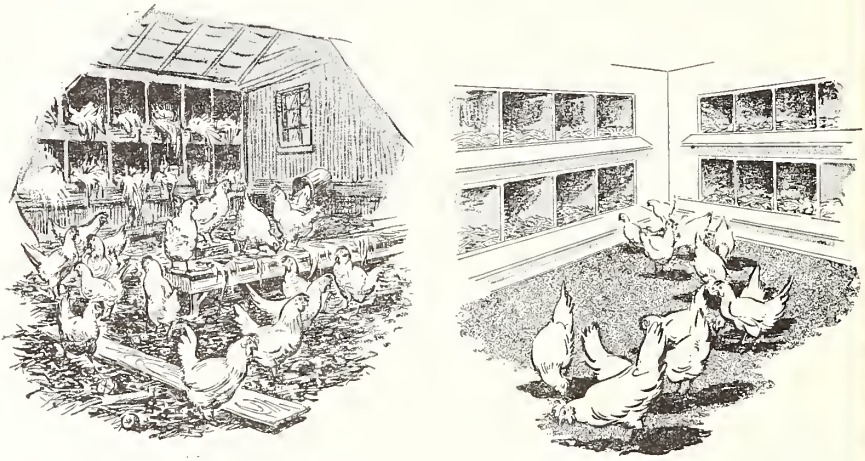

FIGURE 3.—Dirty or damp nesting material and floor litter (left) results in an increased number of stained and dirty eggs. Clean nesting material should be used in nests (right), and new material should be added frequently. New floor litter should be added from time to time, particularly around the water fountains, to maintain the litter in a clean, dry condition (right).

Floor litter used

The most common material used for floor litter was straw, its use being reported for 75 percent of the farms for which this information was reported (table 3). Corncobs or cornstalks were used on 10 percent of the farms and other materials on 15 percent. The same general pattern of floor litter was true for flocks in all size groups.

Condition of floor litter

Dry floor litter was found on 94 percent of the farms for which this information was reported (table 3). Although the floor litter was dry on 94 percent of the farms it was dirty to some degree on more than two-thirds of the farms. The litter was damp and dirty on 6 percent of the farms.

In general, as the size of flock increased the proportion of farms with clean litter increased, although not as markedly as for clean nesting material. This does indicate, however, that as the size of flocks increased the producers paid more attention to keeping clean litter.

Dropping boards or pits

Screening of dropping boards or pits has long been recommended as a desirable management practice. Such screening should result in the production of a higher percentage of clean eggs.

TABLE 3.—*Percentages of producers using specified management practices, by sizes of laying flocks, midwestern region, 1949–50*

Management practice	Farms reporting	Size of laying flock					
		Less than 100	100–199	200–399	400–599	600 or more	All sizes
	Number	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Flock confinement	727						
Total confinement	183	21	17	30	32	42	25
Partial confinement [1]	64	7	11	8	10	5	9
No confinement	480	72	72	62	58	53	66
Layers kept per nest	683						
1 to 3	136	56	25	7		3	20
4 to 6	282	36	56	39	18	14	41
7 to 9	139	3	12	33	29	32	20
10 to 12	78	2	5	15	27	31	12
13 or more	48	3	2	6	26	20	7
Handling of broody hens	693						
None reported	103	20	14	12	16	19	15
Did not take from nest	54	10	10	6	3	5	8
Took from nest, confined	518	68	73	79	79	71	75
Took from nest, not confined	18	2	3	3	2	5	2
Nesting material used	730						
Straw	461	70	59	64	64	63	63
Hay	142	19	28	19	4		20
Other [2]	119	9	12	17	31	32	16
None	8	2	1		1	5	1
Condition of nesting material	566						
Dry:							
Clean	357	53	56	70	79	91	63
Slightly dirty	141	28	29	22	15	9	25
Dirty	55	13	13	7	3		10
Damp, dirty	13	6	2	1	3		2
Floor litter used	655						
Straw	490	73	78	76	73	61	75
Corn cobs or stalks	69	8	8	10	17	19	10
Other [3]	96	19	14	14	10	20	15
Condition of floor litter	555						
Dry:							
Clean	147	26	24	28	28	43	26
Slightly dirty	164	24	30	29	38	33	30
Dirty	209	42	37	40	26	19	38
Damp, dirty	35	8	9	3	8	5	6
Dropping boards or pits	632						
Screened	285	31	32	51	66	82	45
Not screened	347	69	68	49	34	18	55

[1] Confined part of day, at certain times, or part of flock confined.
[2] Includes shavings, sawdust, corncobs, newspapers, and combinations of materials.
[3] Includes grass, sawdust, commercial litter, and combinations of materials.

Dropping boards and pits were completely screened on 45 percent of the farms for which this information was reported (table 3). As the size of flocks increased the proportion of farms with completely screened dropping boards and pits increased from 31 percent for the smallest flocks to 82 percent for the largest flocks. It is clearly evident that producers with larger flocks paid more attention to this particular management factor.

EGG HANDLING METHODS

Frequency of gathering eggs

Eggs were gathered twice daily on 53 percent of all farms studied (table 4). Eggs were gathered once daily on 25 percent of the farms, three times daily on 17 percent, and four times daily on 5 percent of the farms.

In general, producers with larger flocks gathered eggs more frequently than did those with the smallest flocks. Thus, the producers having the

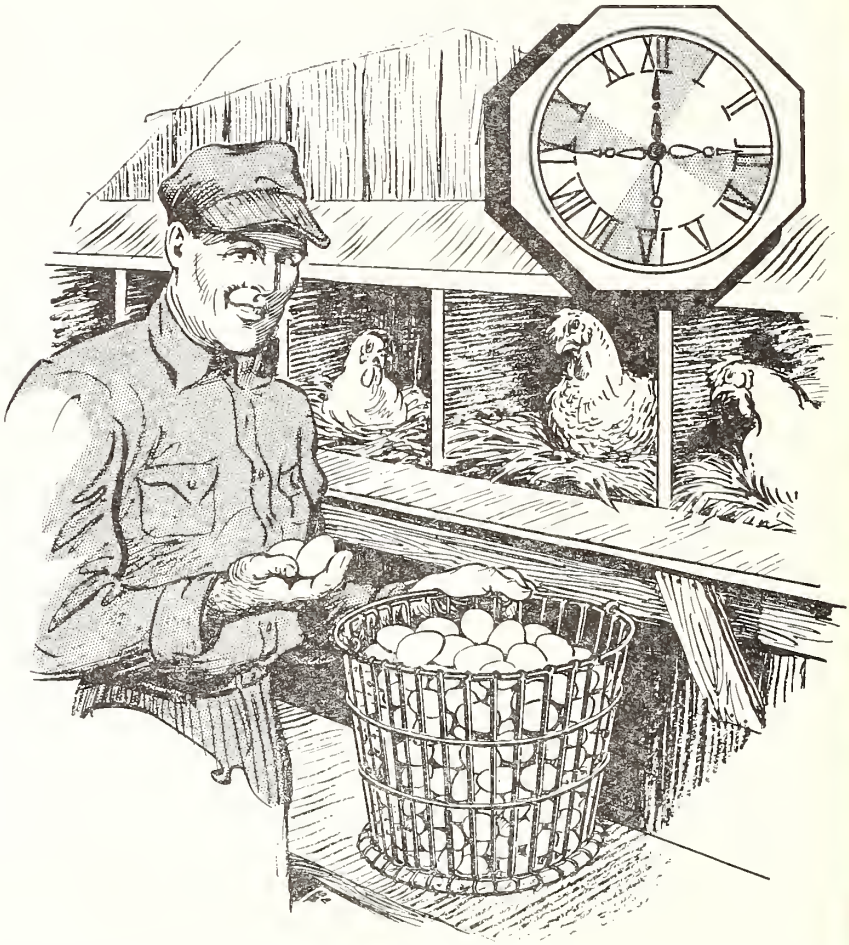

FIGURE 4.—Frequent gathering of eggs is desirable. This is especially important during warm or freezing weather. A wire basket is one of the best containers in which to cool eggs and such a basket can also be used for collecting eggs.

larger flocks followed more closely the recommended practice of gathering eggs at least twice daily and preferably more often. How often it is economically feasible to gather eggs depends on the over-all characteristics of each producer's operation. (Fig. 4.)

Containers used for gathering eggs

On 63 percent of the farms for which this information was reported eggs were gathered in pails or buckets (table 4). Wire baskets, the only other important type of container, were used on 29 percent of the farms. In general, producers with smaller flocks used a pail or bucket, whereas most of those with the largest flocks used wire baskets. About as many of the farms with the smallest flocks gathered eggs in woven baskets as in wire baskets. It is recommended that a container be used for gathering eggs that permits free circulation of air for more rapid cooling.

Methods of cleaning eggs

Dirty eggs were not cleaned on 11 percent of the farms for which this information was reported (table 4). Forty-six percent of the producers used a damp cloth or water alone for cleaning their eggs. Another 18 percent dry-cleaned eggs with a hand buffer, steel wool, or sandpaper. Nine percent used some sort of an abrasive with soap or a detergent and water, and 16 percent of the producers used other methods of cleaning eggs.

Frequency of packing eggs for market

On 82 percent of the farms for which this information was reported eggs were packed for market daily (table 4); on 18 percent of the farms, however, eggs were packed at other intervals, no other frequency of packing being very common.

There was more of a tendency for producers with larger flocks to pack eggs daily than for producers with smaller flocks.

Place where eggs stored

Eggs were held in a cellar or basement prior to being marketed on 63 percent of the farms for which this information was reported (table 4). Next in importance as holding rooms were caves on 16 percent of the farms. Eggs were stored on porches and in various rooms of the farmhouses on 15 percent of the farms, in addition to other places on 6 percent of the farms. In general, as the size of flock increased relatively more producers made use of their cellars or basements and fewer used other places as holding rooms.

Frequency of marketing eggs

The majority of midwestern producers studied marketed their eggs once each week (table 4). This was true for producers on 69 percent of the farms for which this information was reported. Marketing of eggs twice each week was reported for 29 percent of the producers, and three or more times weekly for 2 percent.

Eggs were marketed most frequently on the farms with the largest flocks. Ninety-two percent of the producers with the smallest flocks reported marketing eggs once each week and 8 percent twice each week. Of those producers with the largest flocks 55 percent marketed eggs once

TABLE 4.—*Percentages of producers using specified egg-handling methods, by sizes of laying flocks, midwestern region, 1949–50*

Egg-handling method	Farms reporting	Size of laying flock					
		Less than 100	100–199	200–399	400–599	600 or more	All sizes
	Number	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Frequency of gathering eggs	729						
Once daily	185	36	29	20	21	14	25
Twice daily	385	44	53	53	63	58	53
Three times daily	123	18	14	20	8	26	17
Four or more times daily	36	2	4	7	8	2	5
Containers used for gathering eggs	721						
Pail or bucket	450	75	65	61	56	35	63
Wire basket	209	11	27	30	40	65	29
Woven basket	45	12	6	6	1		6
Other[1]	17	2	2	3	3		2
Methods of cleaning eggs	723						
None cleaned	78	14	10	10	10	12	11
Damp cloth	181	27	26	26	15	26	25
Washed in water	151	9	23	21	24	33	21
Hand buffer, steel wool, or sandpaper	127	19	17	16	21	19	18
Abrasive, soap and water	69	12	8	10	15	5	9
Other	117	19	16	17	15	5	16
Frequency of packing eggs for market	718						
Daily	588	77	81	85	81	88	82
Every other day	39	5	6	4	6	7	5
Twice weekly	39	6	3	6	12	2	5
Weekly	32	5	7	3	1	3	5
Other	20	7	3	2			3
Place where eggs stored	728						
Cellar or basement	460	51	56	68	80	84	63
Cave	114	15	20	17	3	2	16
Porch, kitchen, or other room in house	110	21	18	10	17	7	15
Other[2]	44	13	6	5		7	6
Frequency of marketing eggs	717						
Weekly	498	92	81	54	59	55	69
Twice weekly	208	8	18	44	41	40	29
Three or more times weekly	11		1	2		5	2

[1] Includes combinations of containers and aprons.
[2] Includes woodshed, springhouse, grain house, and refrigerator.

each week, 40 percent twice a week, and 5 percent three or more times a week.

For those producers marketing eggs once each week, Thursday was the most frequent market day, it being used by 28 percent of the 498 producers reporting. Saturday was used least often. Of the 208 producers marketing eggs twice each week, 40 percent used Monday as the first market day, and 38 and 33 percent used Thursday and Saturday, respectively, as the second market day.

Temperature and relative humidity of egg-holding rooms

The average temperature outside the egg-holding rooms was 75° F., while the average inside temperature was 70° F. on the farms on which this information was reported (table 5). The outside and inside egg-holding room temperatures were lower on the farms with larger flocks than on those with smaller flocks, there being only a few degrees of difference between outside and inside holding-room temperatures for all flock-size groups. Thus, on the average, producers were not cooling their eggs to the recommended holding temperatures below 60° F., preferably to about 55° F. (Fig. 5.)

The relative humidity inside the holding rooms averaged 73 percent on the farms for which this information was reported (table 5). This was 15 percent higher than the average relative humidity outside the holding rooms.

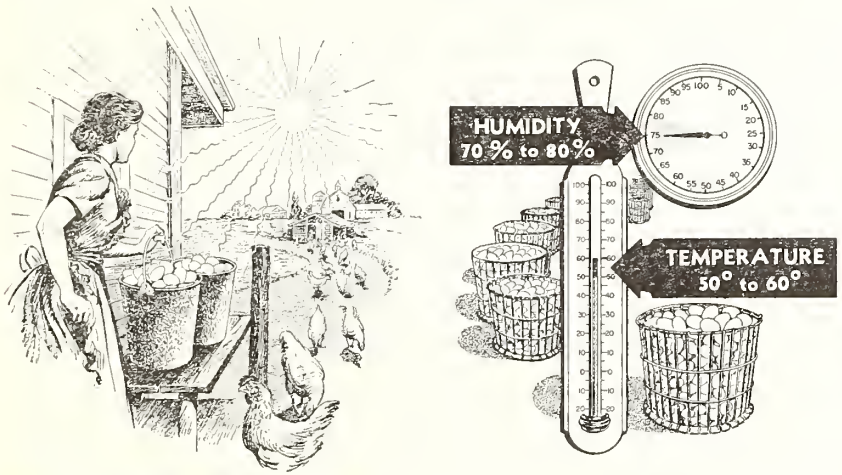

FIGURE 5.—Eggs should not be stored in a warm, dry place because their initial high quality will decline rapidly (left). A reliable thermometer should be kept in your basement or egg-storage room in order to maintain a temperature as near 50° to 60° F. as possible. It is also essential to maintain a relative humidity of 70 to 80 percent in the egg room if the interior quality of the eggs is to be maintained.

For temperatures from 60° to 70° F., as was the case in this study, the recommended relative humidity is about 80 percent. With decreasing temperatures lower relative humidity percentages are recommended.[4] The egg-holding rooms on farms with the largest flocks had more nearly optimum relative humidity readings, 77 percent, than the holding rooms on the farms with the smallest flocks, 71 percent.

[4] Benjamin, E. W., Pierce, H. C., and Termohlen, W. D.: Marketing Poultry Products. Pp. 35–36. John Wiley & Sons, Inc. 1949.

TABLE 5.—*Temperature and relative humidity outside and inside egg-holding rooms on 599 midwestern farms, by size of laying flocks, 1949–50*

Size of laying flock (number)	Farms	Temperature		Relative humidity	
		Outside holding room	Inside holding room	Outside holding room	Inside holding room
	Number	*°F.*	*°F.*	*Percent*	*Percent*
Less than 100	86	75	71	60	71
100 to 199	211	78	72	56	71
200 to 399	203	76	70	59	75
400 to 599	64	69	67	60	71
600 or more	35	67	64	62	77
Total or average	599	75	70	58	73

QUALITY OF EGGS MARKETED

The quality of eggs marketed was determined by official graders of the U. S. Department of Agriculture for the first shipment of eggs made after the farm was visited. Quality determinations were based on the following measures: (1) Percentage of Grade A eggs marketed; and (2) percentage of stained and dirty eggs marketed. Exceptions to this procedure were credited to Indiana and Ohio where the percentage of stained and dirty eggs was not obtained because such eggs were classed as Grade C or undergrades.

GRADE A EGGS

The percentage of Grade A eggs marketed was obtained on 648 farms (table 6). For these farms, it was calculated from table 6 that an average of 70 percent of the eggs marketed were Grade A. The percentage of eggs marketed that were of Grade A quality ranged from 0 to 99 percent. From 43 percent of the farms 80 percent or more of the eggs marketed were of Grade A quality, and from 29 percent of the farms 60 to 79 percent of the eggs marketed were of Grade A quality. Thus, 28 percent of the producers had fewer than 60 percent of their eggs marketed as Grade A.

TABLE 6.—*Distribution of farms marketing Grade A and stained and dirty eggs, by percentage range in quality of eggs marketed, midwestern farms, 1949–50*

Range in quality (percent)	Farms marketing eggs that were—			
	Grade A		Stained and dirty	
	Number	*Percent*	*Number*	*Percent*
0	2	(1)	112	22
1 to 19	19	3	252	49
20 to 39	52	8	103	20
40 to 59	110	17	34	7
60 to 79	185	29	6	1
80 to 99	280	43	4	1
Total	648	100	511	100

[1] Less than ½ of 1 percent.

STAINED AND DIRTY EGGS

The percentage of stained and dirty eggs marketed was obtained on 511 farms (table 6). For these farms, it was calculated from table 6 that an average of 14 percent of the eggs marketed were stained and dirty. The percentage of eggs marketed that were stained and dirty ranged from 0 on 22 percent of the farms to more than 80 percent for 4 farms. It was calculated from table 6 that 49 percent of the producers marketed from 1 to 19 percent, with an average of 8 percent of stained and dirty eggs, and 20 percent of the producers marketed from 20 to 39 percent, with an average of 28 percent of stained and dirty eggs.

INFLUENCE OF PRODUCTION AND MARKETING PRACTICES ON EGG QUALITY

As shown previously, egg quality as measured by the percentage of eggs marketed that were Grade A eggs and stained and dirty eggs varied widely among the farms studied. It has also been noted that many of the management practices analyzed also varied from farm to farm. Questions are often raised concerning the reasons why practices vary, and why farmers have not concerned themselves more with the production of high-quality eggs. The purpose of this section is to indicate the practices that were found to be most closely associated with the quality of eggs marketed and the importance of following all recommended management practices in the production and marketing of high-quality eggs.

GRADE A EGGS

Size of flock

Hens in small flocks should lay eggs of a quality equal to that of hens in large flocks if the composition, feeding, care, and genetic background of the flocks are the same. It was noted previously, however, that farmers with large flocks operate differently, in general, than do farmers with small flocks. Thus, size of flock reflects some management practices that are believed to be associated with the quality of eggs marketed.

A summary comparison of various management practices on farms with the largest and with the smallest flocks is given in table 7. It can be

TABLE 7.—*Comparison of management and handling practices on midwestern farms with largest and with the smallest flocks, 1949–50*

Management and handling practices	On farms with—	
	Largest flocks (600 or more layers)	Smallest flocks (less than 100 layers)
Composition of flock	49 percent pullets	7 percent pullets.
Confinement of flock	42 percent confined	21 percent confined.
More than 6 layers per nest	83 percent	8 percent.
Handling of broody hens	71 percent confined	68 percent confined.
Condition of nesting material	91 percent clean and dry	53 percent clean and dry.
Condition of floor litter	43 percent clean and dry	26 percent clean and dry.
Screened dropping pits	82 percent screened	31 percent screened.
Frequency of gathering eggs	86 percent two or more times daily.	64 percent 2 or more times daily.
Container for gathering eggs	65 percent wire basket	11 percent wire basket.
Cleaning of eggs	88 percent cleaned eggs	86 percent cleaned eggs.
Place for storing eggs	85 percent basement	52 percent basement.
Times eggs marketed weekly	45 percent two or more times.	8 percent 2 or more times.
Temperature in egg-holding room	64° F.	71° F.
Humidity in egg-holding room	77 percent	71 percent.

readily observed that producers with the largest flocks, with one exception (layers kept per nest), followed recommended management practices more closely, on the average, than did producers with the smallest flocks.

As the number of layers in the flock increased, the average percentage of eggs marketed that were Grade A also increased (table 8). The producers with less than 100 layers marketed eggs that averaged 65 percent Grade A quality. The producers with 600 or more layers marketed eggs that averaged 83 percent Grade A quality. Although producers with the smallest flocks marketed a lower percentage of Grade A eggs, some individual producers with small flocks marketed a high percentage of Grade A eggs, and some individual producers with large flocks marketed a relatively low percentage of Grade A eggs.

Some of the difference in the percentage of eggs marketed as Grade A from the largest flocks as compared with that from the smallest flocks might be accounted for by the difference in the proportion of pullets in the largest and smallest flocks. The largest flocks had a higher percentage of pullets, and eggs produced by pullets during their first few months of lay usually grade higher than eggs produced by hens.[5]

TABLE 8.—*Percentages of Grade A eggs marketed from 648 midwestern farms, by size of laying flocks, 1949–50*

Layers per flock (number)	Farms	Layers per farm	Percentage of eggs marketed that were Grade A	Percentage of farms marketing—		
				Less than 50 percent Grade A eggs	50 to 79 percent Grade A eggs	80 percent Grade A eggs or more
	Number	*Number*	*Percent*	*Percent*	*Percent*	*Percent*
Less than 100	87	69	65	25	48	27
100 to 199	211	134	66	24	38	38
200 to 399	237	269	72	15	37	48
400 to 599	71	467	74	10	44	46
600 or more	42	808	83	2	22	76
Total or average	648	255	70	18	39	43

Of the producers with the smallest flocks, one-fourth marketed eggs that graded less than 50 percent of A quality, and slightly more than one-fourth marketed eggs that were at least 80 percent Grade A. Of the producers with the largest flocks only 2 percent marketed eggs that were less than 50 percent Grade A, and slightly more than three-fourths marketed eggs that were 80 percent or higher of A quality.

Management practices and holding conditions

The apparent relationship of the different management practices and holding conditions to the quality of eggs marketed varied widely (table 9). Some practices or conditions had no apparent relationship to the interior quality [6] of eggs marketed. The reasons for this are not obvious; however, it is possible that such practices had little or no effect on quality, or any actual effect may have been offset by some other factor or factors.

[5] Hunter, J. A., VanWagenen, A., and Hall, G. O.: Seasonal Changes in Interior Egg Quality of Single Comb White Leghorn Hens. Poultry Science. 15: 115–118. 1936.

[6] Candled grade.

The number of layers kept per individual nest did not appear to have any effect on the percentage of Grade A eggs marketed (table 9). This might be explained by the fact that although producers with the larger flocks, on an average, provided fewer nests for a given number of layers than producers with smaller flocks, they gathered their eggs more often, on an average, than producers with smaller flocks.

Also, the practice of screening dropping pits or boards did not appear to have any effect on the percentage of Grade A eggs marketed (table 9). The effect of not screening dropping pits or boards may be indirect in that it is a cause of dirty eggs which are generally dropped into a lower grade if not cleaned, irrespective of the interior quality of the eggs, or the dirty eggs might have been cleaned before they were marketed.

The way in which broody hens were handled, the number of times eggs were marketed each week, and the method of cleaning eggs seemed to have only a slight effect on the percentage of Grade A eggs marketed (table 9). Those producers who dry cleaned eggs or used only a damp cloth to clean eggs marketed a slightly higher percentage of Grade A eggs than those who washed eggs in water.

The frequency of packing eggs for market had little effect on the percentage of Grade A eggs marketed.

Several management and handling practices appeared to have a definite effect on the percentage of eggs marketed as Grade A (table 9). The factors associated with a considerably higher percentage of Grade A eggs marketed were as follows:

(*a*) Laying flock confined.
(*b*) Frequent egg collections.
(*c*) The use of wire baskets for gathering eggs.
(*d*) Storage of eggs in a cool basement or cave.
(*e*) Dry and clean nesting material.
(*f*) Dry and clean floor litter.

It was determined that the majority of producers marketed less than 10 percent of stained and dirty eggs, and this group of producers marketed a higher percentage of Grade A eggs, regardless of what other management practices were followed. This clearly indicates the importance of marketing clean eggs. Producers who market eggs of high interior quality and fail to clean the stains and dirties generally receive a lower price for such eggs.

Results of this study tend to indicate that temperature and humidity were both important, but that temperature had more effect than relative humidity in maintaining interior egg quality.

The temperature and humidity of the rooms in which the eggs were held before marketing had a definite effect on the percentage of Grade A eggs marketed (table 9). A higher percentage of Grade A eggs were marketed when the eggs were held below 70° F. than when held at higher temperatures. There was a direct correlation between higher humidity readings in egg-holding rooms and an increase in the percentage of eggs marketed as Grade A.

The effect of temperature on the keeping quality of eggs may be readily observed in figure 6. This figure shows the effect of egg-room temperatures when the relative humidity was low (average 58 percent), medium (average 74 percent), and high (average 86 percent).

Within each humidity group, a lower percentage of Grade A eggs was marketed with each increase in the temperature of the egg-holding rooms.

TABLE 9.—*Selected management and handling practices and average percentages of eggs marketed that were Grade A, midwestern farms, 1949–50*

Practice	Management group	Farms reporting	Average percentage of Grade A eggs	Apparent importance of factor in relation to quality of eggs marketed[1]
		Number	*Percent*	
Laying flock confined	Yes	174	78	Important.
	Partly	61	74	
	No	411	66	
Layers kept per individual nest	1 to 3	115	68	None.[2]
	4 to 6	247	68	
	7 to 9	131	74	
	10 or more	115	71	
Handling of broody hens	Confined	458	70	Slight.
	Not confined	66	65	
Condition of nesting material	Dry	482	70	Important.
	Damp	13	50	
	Clean	314	75	Important.
	Slightly dirty	126	63	
	Dirty	55	52	
Condition of floor litter	Dry	465	70	Important.
	Damp	33	57	
	Clean	127	78	Important.
	Slightly dirty	156	70	
	Dirty	205	63	
Dropping pits or boards screened	Yes	269	71	None.
	No	285	70	
Number of times eggs gathered daily	1	153	60	Important.
	2	346	70	
	3	113	79	
	4 or more	35	84	
Container used for gathering eggs	Pail, bucket	399	67	Important.
	Woven basket	32	70	
	Wire basket	193	76	
Method of cleaning eggs	None cleaned	62	57	Slight.[3]
	Damp cloth	158	73	
	In water	202	69	
	Without water	112	74	
	Other	108	72	
Place where eggs stored	Basement or cave	520	72	Important.
	Porch, kitchen, or other room in house, and other	126	63	
Times eggs marketed weekly	Once	432	69	Slight.
	2 or more	204	72	
Temperature in holding room	50° to 69° F.	296	72	Important.
	70° to 79° F.	266	66	
	80° F. or more	52	55	

See footnotes at end of table.

TABLE 9.—*Selected management and handling practices and average percentages of eggs marketed that were Grade A, midwestern farms, 1949–50*—Continued

Practice	Management group	Farms reporting	Average percentage of Grade A eggs	Apparent importance of factor in relation to quality of eggs marketed [1]
		Number	*Percent*	
Relative humidity in holding room	49 percent and under	21	59	Important.
	50 to 59 percent	68	65	
	60 to 69 percent	107	69	
	70 to 79 percent	174	71	
	80 to 89 percent	145	72	
	90 to 99 percent	39	75	

[1] The degree of importance was determined on the following arbitrary basis: When the difference between the average percent of Grade A eggs for a good practice compared to a poor practice was 0 to 1 percent it was considered to be unimportant; when the difference was 2 to 6 percent it was considered to be slightly important; when the difference was more than 6 percent it was considered to be important. The import of those factors designated as important is verified in table 10.

[2] Any effect of this factor was apparently offset by one or more good management practices.

[3] Comparison only of those eggs cleaned.

Within each humidity group shown in figure 6 there are three temperature breakdowns—low average, medium average, and high average. By comparing the percentages of Grade A eggs marketed between humidity

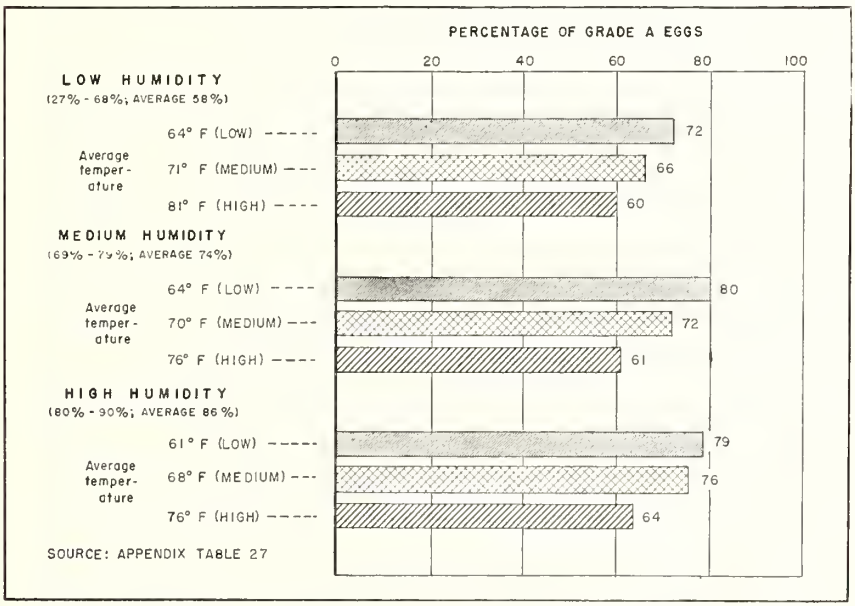

FIGURE 6.—Influence of egg-holding room temperature on egg quality when relative humidity was low, medium, and high, midwestern farms, 1949–50.

groups by temperature breakdown, it will be observed that there were increases in the percentages of Grade A eggs marketed when increases occurred in relative humidity readings, except as follows: There was no additional benefit derived when relative humidity readings were increased above 79 percent with low average temperatures.

Combination of factors

A totally accurate determination of the effects of different practices or factors on the percentage of eggs marketed that were Grade A was not possible in this study because the interior quality of dirty and stained eggs was not determined. Thus, the percentage of Grade A eggs marketed might have resulted directly from the factor or indirectly through a factor which affected the relative importance of stained and dirty eggs. Whether or not eggs were cleaned had a pronounced effect on the percentage of eggs marketed as Grade A (table 9); however, this factor was not considered in the detailed analysis.

Based on the information in table 10, it appears that the most important practices resulting in a higher percentage of Grade A eggs marketed were as follows:

(*a*) Confinement of laying flock.
(*b*) Gathering of eggs two or more times each day.
(*c*) Use of wire baskets for gathering eggs.
(*d*) Cooling of egg rooms to reasonably low temperatures.
(*e*) Maintenance of reasonably high relative humidity readings in egg rooms.
(*f*) Maintenance of dry and clean nesting material.
(*g*) Maintenance of dry and clean floor litter.

It should be noted that the condition of the nesting material and floor litter, although of real importance, might have achieved this importance through its effect on the relative number of dirty and stained eggs as well as through other management practices.

An analysis also indicates that:

1. Keeping the laying flock confined gave better results when eggs were gathered three times daily rather than once or twice.
2. There was a higher amount of quality retention when eggs were gathered twice each day, rather than once, than when they were gathered three or more times, rather than twice.
3. Temperature and relative humidity were both important; however, temperature was more important than relative humidity in maintaining interior egg quality.

It is not sufficient that a producer employ one or two recommended management practices when attempting to produce high-quality eggs. Any one management practice that is undesirable may limit the quality of eggs marketed even though all other practices are good.

Producers who marketed the highest quality eggs (average 90 percent Grade A) followed seven recommended practices (table 11). These producers followed the seven practices listed above.

Producers who followed six recommended practices marketed 85 percent Grade A eggs, those who followed five recommended practices marketed 83 percent Grade A eggs, and those who followed four recommended practices marketed 75 percent Grade A eggs. Producers who followed two recommended practices marketed 65 percent Grade A eggs, those who followed only one recommended practice marketed only 61 percent Grade A eggs, and those who followed no recommended practice marketed only 55 percent Grade A eggs.

TABLE 10.—*Relative influence of various management practices on the percentages of eggs marketed as Grade A, midwestern farms, 1949–50*

Practice	Management group	Average increase in percentage points of eggs marketed that were Grade A[1]	Practices for which farms were matched
		Percent	
1. When laying flock confined rather than not confined[2]	Eggs gathered 1 time each day	−2	Temperature in egg room. Humidity in egg room.
	Eggs gathered 2 times each day	11	
	Eggs gathered 3 or more times each day	[3]6	
2. Condition of nesting material[4]	When dry rather than damp	17	Temperature in egg room. Confinement of flock.
	When clean rather than dirty	12	
3. Condition of floor litter[5]	When dry rather than damp	10	Temperature in egg room. Confinement of flock.
	When clean rather than dirty	7	
4. Frequency of gathering eggs[2]	Eggs gathered 2 or more times daily, rather than once	10	Temperature in egg room. Confinement of flock.
	Eggs gathered 3 or more times daily, rather than twice	[3]8	
5. Container used for gathering eggs[6]	When wire basket rather than other container	5	Temperature in egg room. Confinement of flock.
6. Temperature[2]	When low (average 63° F.) rather than high (average 74° F.)	10	Humidity in egg room. Confinement of flock.
7. Relative humidity in egg room[2]	When high (average 82 percent) rather than low (average 62 percent)	3	Temperature in egg room. Confinement of flock.

[1] Weighted averages were computed on the basis of the lowest number of observations within each category multiplied by the difference between average quality in each category (plus or minus). The sum of those products was then divided by the total number of least observations.

[2] Computed from Appendix table 15.

[3] Cumulative increase.

[4] Computed from Appendix tables 16 and 17.

[5] Computed from Appendix tables 18 and 19.

[6] Computed from Appendix table 20.

TABLE 11.—*Recommended practices followed by 648 midwestern egg producers and percentages of eggs marketed that were Grade A* [1]

Recommended practices followed	Farms	Percentage of eggs marketed that were Grade A
	Number	*Percent*
None	36	55
One	97	61
Two	133	65
Three	170	70
Four	111	75
Five	49	83
Six	34	85
Seven	18	90

[1] For recommended practices followed see page 18.

STAINED AND DIRTY EGGS

The best measure of the effect of various management practices on the exterior condition of eggs would have been the percentage of eggs gathered that were dirty. It is the proportion of dirty eggs that affects the appearance of eggs and determines the relative size of the egg-cleaning job. However, the percentage of eggs gathered that were dirty is not reported in this study because of the difficulty in obtaining accurate information. Information so obtained from farmers may be biased because producers probably consider dirty eggs as a reflection on their ability as poultrymen. Also, there is the likelihood that to some producers a small speck of dirt would make an egg dirty, whereas to others such eggs would not be dirty.

The percentage of stained and dirty eggs marketed has the advantage of being determined by an impartial grader. However, the results are limited to the eggs marketed—not all eggs—and may reflect to some degree the cleaning job done rather than practices followed.

It must be recognized that the seasonal effect of some management practices on the number of dirty eggs produced is very significant. Results reported in this section pertain to eggs produced in the months of July, August, and September, a relatively dry season.

Management practices

Two management practices—whether or not dropping pits or boards were screened, and the method of cleaning eggs—seemed to have no relationship to the percentage of eggs marketed that were stained and dirty (table 12). The important factor with regard to the cleaning of eggs was whether or not they *were* cleaned, not *how* they were cleaned.

Whether or not laying flocks were confined and the kind of nesting material and floor litter used appeared to have a slight effect on the percentage of stained and dirty eggs marketed (table 12). Producers who totally confined their laying flocks marketed a slightly smaller percentage of stained and dirty eggs than those who did not practice laying-flock confinement. Producers who used hay for nesting material and corn cobs or stalks for floor litter marketed a slightly higher percentage of stained and dirty eggs than did those producers who used straw or other materials for nesting material and floor litter.

Three management factors appeared to have a definite effect on the percentage of eggs marketed as stains and dirties (table 12). These factors, associated with a considerably lower percentage of stains and dirties marketed, were as follows:

(*a*) Dry and clean nesting material.
(*b*) Dry and clean floor litter.
(*c*) Frequent egg collections.

TABLE 12.—*Selected management and handling practices and average percentages of eggs marketed that were stained and dirty, midwestern farms, 1949–50*

Practice	Management group	Farms reporting	Average percentage of stained and dirty eggs	Apparent importance of factor in relation to quality of eggs marketed[1]
		Number	*Percent*	
Laying flock confined	Yes	119	11	Slight.
	Partly	48	10	
	No	344	16	
Layers kept per individual nest	1 to 3	87	12	Slight.
	4 to 6	190	14	
	7 to 9	105	14	
	10 or more	96	17	
Nesting material used	Hay	118	16	Slight.
	Straw	310	13	
	Other[2]	54	13	
	None	4	11	
Floor litter used	Corncobs or stalks	48	16	Slight.
	Straw	364	14	
	Other[2]	39	10	
Condition of nesting material	Dry	353	12	Important.
	Damp	13	21	
	Clean	231	9	Important.
	Slightly dirty	87	18	
	Dirty	48	19	
Condition of floor litter	Dry	332	12	Important.
	Damp	26	22	
	Clean	95	6	Important.
	Slightly dirty	120	13	
	Dirty	143	16	
Dropping pits or boards screened	Yes	213	14	None.[3]
	No	210	13	
Number of times eggs gathered daily	1	136	21	Important.
	2	276	13	
	3	74	6	
	4 or more	24	7	
Method of cleaning eggs	None cleaned	62	31	None.[4]
	With water	17	12	
	Without water	44	11	
	Other	83	11	

[1] The degree of importance was determined on the following arbitrary basis: When the difference between the average percent stained and dirty eggs for a good practice compared to a poor practice was 0 to 1 percent it was considered to be unimportant; when the difference was 2 to 6 percent it was considered to be slightly important; when the difference was more than 6 percent it was considered to be important. The import of those factors designated as important is verified in table 14.

[2] See table 3.

[3] Any effect of this factor was apparently offset by the washing of eggs before they were marketed.

[4] Comparison only of those eggs cleaned.

Combination of factors

Based on the information in table 13, it appears that the most important practices resulting in a lower percentage of eggs marketed that were stained and dirty were as follows:

(*a*) Maintenance of dry and clean nesting material.
(*b*) Maintenance of dry and clean floor litter.
(*c*) Gathering of eggs two or more times each day.

TABLE 13.—*Influence of various management practices on the percentage of stained and dirty eggs marketed, midwestern farms, 1949-50*

Factor	Condition	Average decrease in percentage points of eggs marketed that were stained and dirty[1]	Factors for which farms were matched
1. Laying flock confinement[2]	When confined rather than not confined	3	Whether eggs cleaned. Times eggs gathered daily.
2. Layers per nest[3]	When 6 or fewer	3	Whether eggs cleaned. Times eggs gathered daily.
3. Condition of nesting material[4]	When dry rather than damp	4	Whether eggs cleaned. Times eggs gathered daily.
	When clean rather than dirty	6	
4. Condition of floor litter[5]	When dry rather than damp	10	Whether eggs cleaned. Times eggs gathered daily.
	When clean rather than dirty	5	
5. Frequency of gathering of eggs[2]	Eggs gathered 2 or more times daily, rather than once	6	Whether eggs cleaned. Laying flock confinement.

[1] Weighted averages were computed on the basis of the lowest number of observations within each category multiplied by the difference between average quality in each category (plus or minus). The sum of these products was then divided by the total number of least observations.

[2] Computed from Appendix table 21.
[3] Computed from Appendix table 22.
[4] Computed from Appendix tables 23 and 24.
[5] Computed from Appendix tables 25 and 26.

Factors of less importance resulting in a lower percentage of eggs marketed (during the months of July, August, and September) that were stained and dirty (table 14) were as follows:

(*a*) Confinement of laying flock.
(*b*) Number of layers per nest.

Producers who marketed the lowest percentage of stained and dirty eggs followed six or seven recommended practices (table 14). Only 4 percent of the eggs marketed by these producers were classified as stained and dirty. As the number of recommended practices followed decreased, the percentage of eggs marketed that were stained and dirty increased. Thus, the producers who followed only one or no recommended practice marketed eggs that were 23 percent stained and dirty.

TABLE 14.—*Recommended practices followed by 511 midwestern egg producers and percentage of eggs marketed that were stained and dirty* [1]

Recommended practices followed	Farms	Percentage of eggs marketed that were stained and dirty
	Number	*Percent*
None	32	23
One	84	23
Two	114	15
Three	129	14
Four	68	8
Five	39	9
Six	27	4
Seven	18	4

[1] For recommended practices followed see page 18.

An important consideration related to the percentage of eggs marketed that were classified as stained and dirty is the nature of the cleaning job performed on the eggs. Obviously, a good job of cleaning might easily offset several poor management practices and cause the effect of some factor as shown in this analysis to be understated; on the other hand, if a poor job were done, it might cause the effect of some factor to be overstated.

APPENDIX A (TABLES)

TABLE 15.—*Temperature in egg room, laying flock confined, humidity in egg room, times eggs gathered, and percentage of eggs marketed that were Grade A*

Temperature in egg room	Low (average 63° F.)											
Flock confined [1]	Yes						No					
Humidity in egg room (percent)	Low, average 61			High, average 80			Low, average 59			High, average 82		
Times eggs gathered daily	1	2	3–5	1	2	3–5	1	2	3–5	1	2	3–5
Number of farms	3	27	14	1	22	35	8	19	6	19	45	7
Percentage of eggs marketed that were Grade A	74	80	84	99	84	90	61	64	65	71	72	78

Temperature in egg room	High (average 74° F.)											
Flock confined [1]	Yes						No					
Humidity in egg room (percent)	Low, average 63			High, average 81			Low, average 63			High, average 84		
Times eggs gathered daily	1	2	3–5	1	2	3–5	1	2	3–5	1	2	3–5
Number of farms	13	38	19	8	19	17	36	61	17	24	72	21
Percentage of eggs marketed that were Grade A	56	70	83	44	73	73	61	59	74	49	67	76

[1] Those partly confined were included with those fully confined.

TABLE 16.—*Temperature in egg room, laying flock confined, condition of nesting material (dry or damp), and percentage of eggs marketed that were Grade A*

Temperature in egg room	Low (average 63° F.)				High (average 74° F.)			
Laying flock confined[1]	Yes		No		Yes		No	
Condition of nesting material	Dry	Damp	Dry	Damp	Dry	Damp	Dry	Damp
Number of farms	85	1	59	3	103	1	203	8
Percentage of eggs marketed that were Grade A	85	73	70	62	70	58	63	42

[1] Those partly confined were included with those fully confined.

TABLE 17.—*Temperature in egg room, laying flock confined, condition of nesting material (clean or dirty, and percentage of eggs marketed that were clean or dirty), and percentage of eggs marketed that were Grade A*

Temperature in egg room	Low (average 63° F.)				High (average 74° F.)			
Laying flock confined[1]	Yes		No		Yes		No	
Condition of nesting material	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty
Number of farms	70	16	43	19	62	42	114	97
Percentage of eggs marketed that were Grade A	86	80	74	59	75	63	68	55

[1] Those partly confined were included with those fully confined.

TABLE 18.—*Temperature in egg room, laying flock confined, condition of floor litter (dry or damp), and percentage of eggs marketed that were Grade A*

Temperature in egg room	Low (average 63° F.)				High (average 74° F.)			
Laying flock confined[1]	Yes		No		Yes		No	
Condition of floor litter	Dry	Damp	Dry	Damp	Dry	Damp	Dry	Damp
Number of farms	82	1	54	4	100	6	192	20
Percentage of eggs marketed that were Grade A	87	.....	69	63	69	70	63	52

[1] Those partly confined were included with those fully confined.

TABLE 19.—*Temperature in egg room, laying flock confined, condition of floor litter (clean or dirty), and percentage of eggs marketed that were Grade A*

Temperature in egg room	Low (average 63° F.)				High (average 74° F.)			
Laying flock confined[1]	Yes		No		Yes		No	
Condition of floor litter	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty
Number of farms	49	34	12	46	24	82	36	176
Percentage of eggs marketed that were Grade A	89	81	82	65	72	68	66	62

[1] Those partly confined were included with those fully confined.

TABLE 20.—*Temperature in egg room, laying flock confined, container used for gathering eggs, and percentage of eggs marketed that were Grade A*

Temperature in egg room	Low (average 63° F.)				High (average 74° F.)			
Laying flock confined[1]	Yes		No		Yes		No	
Container used for gathering eggs	Wire basket	Other	Wire basket	Other	Wire basket	Other	Wire basket	Other
Number of farms	54	49	31	97	53	65	45	210
Percentage of eggs marketed that were Grade A	85	86	73	70	74	66	73	62

[1] Those partly confined were included with those fully confined.

TABLE 21.—*Times eggs gathered, eggs cleaned or not, laying flock confined, and percentage of eggs marketed that were stained and dirty*

Times eggs gathered daily	Once				Two or more times			
Eggs cleaned or not	Yes		No		Yes		No	
Laying flock confined[1]	Yes	No	Yes	No	Yes	No	Yes	No
Number of farms	20	84	4	27	137	203	5	25
Percentage of eggs marketed that were stained and dirty	22	15	38	36	8	12	20	26

[1] Those partly confined were included with those fully confined.

TABLE 22.—*Times eggs gathered, eggs cleaned or not, layers per nest, and percentage of eggs marketed that were stained and dirty*

Times eggs gathered daily	Once				Two or more times			
Eggs cleaned or not	Yes		No		Yes		No	
Six or fewer layers per nest	Yes	No	Yes	No	Yes	No	Yes	No
Number of farms	60	40	25	6	177	135	12	17
Percentage of eggs marketed that were stained and dirty	19	12	32	55	8	14	29	22

TABLE 23.—*Times eggs gathered, eggs cleaned or not, condition of nesting material (clean or dirty), and percentage of eggs marketed that were stained and dirty*

Times eggs gathered daily	Once				Two or more times			
Eggs cleaned or not	Yes		No		Yes		No	
Condition of nesting material	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty
Number of farms	37	34	9	17	176	72	6	11
Percentage of eggs marketed that were stained and dirty	13	20	34	37	7	13	25	25

TABLE 24.—*Times eggs gathered, eggs cleaned or not, condition of nesting material (dry or damp), and percentage of eggs marketed that were stained and dirty*

Times eggs gathered daily	Once				Two or more times			
Eggs cleaned or not	Yes		No		Yes		No	
Condition of nesting material	Dry	Damp	Dry	Damp	Dry	Damp	Dry	Damp
Number of farms	65	6	24	2	244	4	16	1
Percentage of eggs marketed that were stained and dirty	17	10	33	67	8	16	25	22

TABLE 25.—*Times eggs gathered, eggs cleaned or not, condition of floor litter (clean or dirty), and percentage of eggs marketed that were stained and dirty*

Times eggs gathered daily	Once				Two or more times			
Eggs cleaned or not	Yes		No		Yes		No	
Condition of floor litter	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty
Number of farms	10	57	1	22	82	166	1	16
Percentage of eggs marketed that were stained and dirty	10	18	33	36	5	10	11	26

TABLE 26.—*Times eggs gathered, eggs cleaned or not, condition of floor litter (dry or damp), and percentage of eggs marketed that were stained and dirty*

Times eggs gathered daily	Once				Two or more times			
Eggs cleaned or not	Yes		No		Yes		No	
Condition of floor litter	Dry	Damp	Dry	Damp	Dry	Damp	Dry	Damp
Number of farms	59	8	22	1	234	14	15	2
Percentage of eggs marketed that were stained and dirty	16	21	37	13	8	19	20	59

TABLE 27.—*Influence of egg holding room temperatures on egg quality when relative humidity was low, medium and high, midwestern farms, 1949–50*

Temperature	Relative humidity								
	Low (average 58 percent) (range 27–68 percent)			Medium (average 74 percent) (range 69–79 percent)			High (average 86 percent) (range 80–99 percent)		
	Temperature condition		Percent Grade A eggs marketed	Temperature condition		Percent Grade A eggs marketed	Temperature condition		Percent Grade A eggs marketed
	Average ° F.	Range ° F.		Average ° F.	Range ° F.		Average ° F.	Range ° F.	
Low	64	55–67	72	64	57–67	80	61	55–64	79
Medium	71	68–74	66	70	68–72	72	68	65–73	76
High	81	75–96	60	76	73–84	61	76	74–80	64

APPENDIX B (QUESTIONNAIRE)

REGIONAL RESEARCH PROJECT IN EGG MARKETING, AGRICULTURE EXPERIMENT STATIONS, PRODUCTION AND MARKETING ADMINISTRATION, BUREAU OF AGRICULTURAL ECONOMICS, AND FARM CREDIT ADMINISTRATION COOPERATING

Enumerator.....

Date.....

Producer Schedule

Name.....Address.....

County.....State.....

I. Breed..... Number in laying flock now.....

Hens in laying flock..... Pullets in laying flock.....

How many roosters are with the flock?.....

II. Pen Management

Kind of litter.....

Condition of litter (circle) dry, damp, wet, and clean, slightly dirty, dirty.

Was laying flock confined during past week?.....

When were they not confined?.....

Are dropping pits screened?.....

Type of nest (circle) individual, community.....

Type of nesting litter.....

Condition of nests (circle) dry, damp, wet, and clean, slightly dirty, dirty.

Adequacy of litter (circle) scanty, moderate, abundant.

Number of nests.....

Amount of nesting space.....X.....feet.

III. Egg Collection

What time of day were eggs usually gathered during the past week?.....

..... Second time..... Third time.....

When were broody hens taken from the nests?.....

Where were they confined?.....

Type of container eggs are gathered in.....

After gathering the first collection, what do you do with the eggs?.....

.....

Where are eggs stored until sold?.....

Total eggs gathered yesterday.....

Total dirty eggs gathered yesterday.....

Total eggs laid on floor yesterday.....

Total broken or damaged eggs gathered yesterday.....

IV. Temperature and Humidity

(*a*) Outside:

	1st [1] reading	2d [1] reading	Percent humidity
Dry bulb			
Wet bulb			

(*b*) In egg-room—if place to keep eggs is porch—or other unprotected area, do not take another temperature and humidity reading:

	1st [1] reading	2d [1] reading	Percent humidity
Dry bulb			
Wet bulb			

[1] Readings should be taken until last two agree.

Time of reading.....

Where do you store empty egg cases, flats, and fillers?.....

Do you take empty cases direct from storage when you are ready to case eggs?

.....

How soon do you pack previous week's eggs after they are gathered?.....

.....

How do you clean dirty eggs?.....

Number dirty eggs gathered last week.....

How long did it take to clean them?.....minutes for a week.

V. Egg Temperature

On what day or days did you market eggs last week?.....and.....

What time of day do you generally market your eggs?.....

If you deliver, how long does it take you to drive to the market?.....

The road from this farm to market has.....miles of rough road, and.....miles of good road.

What type of vehicle do you use to take your eggs to market?.....

Distance the eggs travel from farm to market.....

What type of ration is fed?.....

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