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THE ECONOMIC
IMPORTANCE OF

Egg Quality

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The Economic Importance of

Egg Quality

Frederick R. Taylor and O. B. Jesness¹

MANY of us wonder why there is so much difference between the egg prices paid to farmers in the Midwest and those paid by consumers in distant markets. A rather common conclusion is that the wide margin means that the handlers in between are making handsome profits and that the remedy lies in reducing such gains.

A point generally overlooked is that the eggs to which the farm prices apply are not identical with those bought by consumers. Only about a third of the eggs produced on the farm reach the consumer as Grade A eggs. Approximately 33 per cent of the eggs laid drop out of the A grade before they reach the buyer; another third break or otherwise lose quality between the time they are sold by the farmer and the time they are bought by the consumer. An important share of the spread between egg prices paid to farmers and those paid by consumers goes to cover this loss in quality.

Because of the growing importance of poultry to Minnesota farmers, this study was undertaken to learn more about the loss of egg quality in marketing. The objectives of the study were: (1) to determine the loss in egg quality during the marketing process; (2) to learn the relationship of flock management and marketing practices to this loss; (3) to analyze the effects of quality loss on costs and returns; and (4) to obtain information useful in reducing this loss.

First, a survey was made of the facilities and operating practices of 31 central assembly plants and 109 buying stations which were regular suppliers of these plants. This information served as background as to reasons for quality change and recommendations for improvement in the marketing channels. Sample lots of 100 eggs of 10 producers at each of these 109 buying stations were selected and graded by the Federal-State Grading Service according to United States Standards for individual Shell Eggs. In all, sample lots of 1,337 different producers were graded to determine the quality of eggs when delivered. These same lots of 100 eggs were graded again upon arrival at the central assembly plants to determine quality changes during this stage of the marketing process. Questionnaires were mailed to these 1,337 producers and the responses of 540 supplied information about their management and marketing practices. These practices then were compared with the grading results to determine the effects of management and marketing practices on quality. Questionnaires also were mailed to a sample of 4,400 farmers whose names were drawn from tax assessor's lists. These questionnaires were designed to obtain information regarding the marketing practices and

¹The authors acknowledge with appreciation the suggestions and criticisms of colleagues, especially Rex W. Cox, Selmer A. Engene, Frank T. Hady, Hubert J. Sloan, and the late Warren C. Waite. The project on which this bulletin is based was under the leadership of Dr. Waite.



FIG. 1. Consumers benefit as well as producers when egg quality is maintained.

outlets for Minnesota eggs. An additional phase of the study included grade records of 70 carlots of eggs graded at the time they were shipped from 13 Minnesota central assembly

plants and again upon their arrival at 14 distant markets. The records were analyzed to obtain information on quality change during this stage of the marketing process.

Importance of Industry

The cash income to Minnesota farmers in 1950 from the sale of eggs was more than 99 million dollars and from the sale of chickens, 18.7 million dollars. The total represented 10 per cent of the farm income from sales. Minnesota egg production has more than doubled since 1939. This has resulted from an increase in the number of chickens on farms and from a marked increase in production per hen. Minnesota is second only to Iowa in volume of production. Any development which improves the returns from the poultry enterprise consequently is of importance to Minnesota farmers.

Poultry constitutes a sideline rather than a major enterprise on most Minnesota farms. That is, eggs and chickens are produced by farms flocks as part of a diversified farm program. This

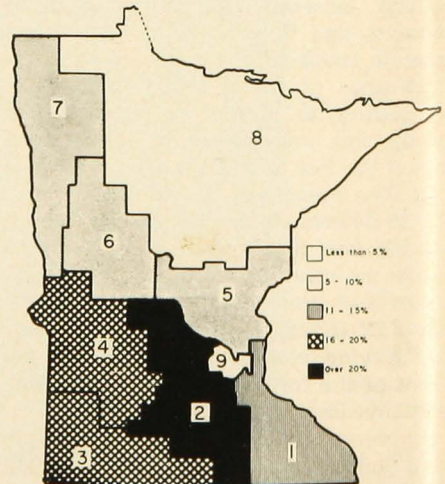


FIG. 2. The proportion of the Minnesota total egg production by type-of-farming area, 1948. (Areas identified by numbers.)

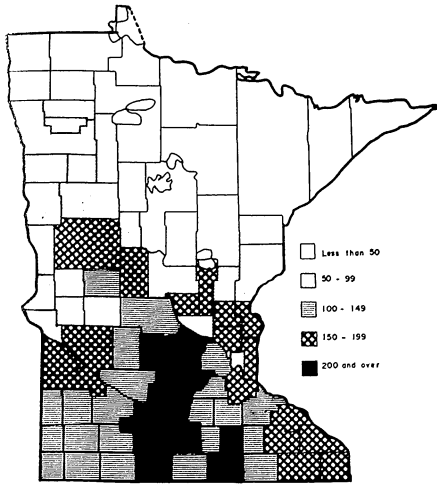


FIG 3. Number of eggs per acre by counties, 1948.

is a significant factor in quality improvement.

While chickens are found on nine out of ten Minnesota farms, the enterprise varies in importance in the different type-of-farming areas of the state (figure 2).

Areas 1, 2, and 3 in southern Minnesota show the heaviest concentration with 62, 92, and 75 hens for each 100 acres in farms, respectively. Areas 7 and 8 in the northwestern and north-eastern sections have only 22 and 17

Table 1. Production and Consumption of Eggs by Areas, 1948

Type-of-farming area	Eggs Produced	Proportion of total production	Eggs consumed	Proportion of total consumption
	thousand	per cent	thousand	per cent
1	493,031	12.67	110,723	10.25
2	1,109,636	28.49	148,713	13.74
3	725,450	18.63	73,260	6.73
4	660,037	16.96	74,260	6.84
5	216,490	5.56	57,905	5.35
6	321,186	8.25	57,574	5.31
7	227,745	5.84	53,427	4.89
8	100,149	2.58	166,530	15.41
9	39,651	1.02	340,988	31.47
State	3,893,375	100.00	1,083,380	100.00

hens per 100 acres, respectively. An indication of the distribution of egg production in the state is provided by figure 3 which shows the production of eggs per acre by counties in 1948. Counties in Area 2 lead with more than 200 eggs per acre, compared with less than 50 in Area 8.

Table 1 provides additional information on the distribution of egg production among type-of-farming areas. Area 2 is well in the lead. Columns 4 and 5 are based on estimates of egg consumption in the state and by areas. These indicate that the annual production exceeds the consumption in all areas except 8 and 9.

Outlets for Minnesota Eggs

MINNESOTA FARMS have provided approximately 7.5 per cent of the nation's egg supplies in recent years. A considerable share of Minnesota's egg sales compete in eastern markets with eggs from other parts of the nation. Quality factors are important in this competition, particularly because of the importance in

eastern markets of nearby eggs which require less time and handling in the marketing process. Quality improvement assumes special importance in the areas of the state which lead in shipments to outside markets.

The channels through which Minnesota eggs move from farm to the consumer vary considerably. The more im-

Table 2. Proportion of Farmers Reporting Selling to Various Types of Buyers and Sales to Each, April and August, 1948

Type of buyer	Proportion of farmers*		Proportion of sales*	
	April	August	April	August
Locally owned plant or produce dealer	43.7	45.6	42.8	47.3
Trucker or plant of outside buyer	11.0	11.9	10.6	13.3
Cooperative association	16.1	14.3	14.1	14.7
Retail store—cash	10.7	7.1	7.8	7.2
Retail store—trade	17.8	19.4	9.1	12.2
Hatchery	7.6	0.3	11.2	0.6
Hotels, restaurants, bakeries	0.3	0.8	0.1	0.7
Consumers	8.7	8.0	3.9	3.9
Other buyers	2.0	0.3	0.4	0.1

* Totals exceed 100 because some farmers reported more than one outlet.

portant combinations include:

1. Producer to consumer
2. Producer to retailer to consumer²
3. Producer to first handler³ to retailer to consumer
4. Producer to first handler to central plant to retailer to consumer
5. Producer to country store to buying station to central plant to retailer to consumer
6. Producer to first handler to central plant to wholesale receiver⁴ to retailer to consumer

There are many variations from the routes listed above but number 6 is typical under Minnesota conditions.

Table 2 summarizing the responses of farmers indicates outlets to which they sold and the proportion of sales to each for the months of April and August 1948.

Locally owned plants and produce dealers were far in the lead as outlets reported by farmers and in the proportion of eggs purchased. Retail stores (cash sales and trade combined) were the second in importance and cooperative associations, third. Seasonal differences, as is to be expected, were most marked in case of hatcheries.

² Consumer includes households, hotels, restaurants, and hospitals.

³ First handler may be trucker, buying station, or huckster.

⁴ Wholesale receivers include commission men, wholesalers, jobbers, and brokers.

METHODS OF ASSEMBLY

Eggs are delivered by the producer to the place of business of the first buyer or are picked up by the buyer. Most Minnesota eggs are delivered by the producer. About 72 per cent of the reporting farmers indicated that they delivered their eggs during April 1948 and that about 66 per cent of the total eggs sold were so delivered. This suggests that larger producers make somewhat greater use of pick-up service. For August the percentages were 68 and 63, respectively. The moderate increase in pick-up by buyers in August may be due to expansion of truck routes in an endeavor to maintain volume during the season of low production.

SALES ON BASIS OF GRADE

Eggs may be bought from producers on the basis of grade or ungraded. The percentages of eggs which farmers reported sold graded by size and interior quality in April and August 1948, were 46 and 49 per cent, respectively. The percentages graded by size only were 26 and 21, while 28 and 30 per cent were sold ungraded. Cooperative associations showed the largest proportion of eggs handled on a grade basis, and retail stores the smallest.

Quality Loss at the Producer Level ⁵

THE FIRST main area of loss of quality in eggs is on the farm between the time eggs are laid and delivery to the first buyer.⁶ Of the eggs in the 1,337 lots which were graded, 67 per cent were Grade A, indicating a loss of one or more grades in quality for 33 per cent of the eggs included. Lots of 100 eggs from each of the 1,337 producers at 109 local markets in seven different type-of-farming areas of the state were graded in April, July, and November 1948. The results summarized in table 3 indicate considerable variation in quality for different areas.

The highest proportion of Grade A eggs was delivered in Area 2 in south central Minnesota. Area 1 in the southeast and Area 3 in the southwest ranked second and third. This suggests some relationships between the importance of the poultry enterprise and quality. As suggested elsewhere, concentrating production in the hands of larger producers may improve quality. The growing importance of poultry on many farms may lead in the same direction.

A seasonal comparison showed that the average of all lots in spring was 66 per cent Grade A eggs, in summer 64 per cent, and in the fall 73 per cent. On the basis of averages for the three periods, 95 to 100 per cent of the eggs delivered by 4 per cent of the farmers graded A; 11 per cent averaged be-

Table 3. Variations in Quality of Eggs Delivered by Producers in Different Type-of-Farming Areas

Area	Proportion of eggs graded as					Total
	Grade A	Grades B and C	A stains and dirties	B and C stains and dirties	Checks, leakers, and loss	
	per cent					
1	71	17	5	2	5	100
2	74	14	5	1	6	100
3	69	11	12	2	6	100
4	55	23	8	7	7	100
6	67	22	4	2	5	100
7	57	31	3	5	4	100
State av.	67	17	7	3	6	100

tween 90 and 94 per cent Grade A; 26 per cent averaged between 80 and 89; 19 per cent between 70 and 79; 13 between 60 and 69; 8 between 50 and 59; while 19 per cent had from 0 to 49 per cent of Grade A. The fact that one-third of the farmers delivered eggs which included 80 per cent or more Grade A suggests that the other two-thirds can improve the quality of the eggs they deliver by the employment of better practices. Here is an opportunity for farmers to improve upon the prices they receive.

HOW MANAGEMENT AFFECTS EGG QUALITY

Information was obtained from producers regarding their use of various recommended management and marketing practices for the purpose of noting their effects on egg quality. These points included frequency of gathering, facilities used in gathering, holding room, sorting and cleaning, delivery, and methods of sale.

⁵The 1948 phase of the Regional RMA Marketing Project NCM-6 is the source of data for this section. The Division of Agricultural Economics, University of Minnesota, and various agencies of the United States Department of Agriculture made a cooperative study of egg quality in Minnesota. The eggs were graded according to the U.S. standards for individual shell eggs by the Federal-State Grading Service. The eggs were classified according to whether they were Grade A, Grade B, Grade C, Grade A Stained, B Stained, C Stained, Grade A Dirty, B Dirty, C Dirty, Checks, Leakers, and Loss. ⁶For measuring losses on the farm and during marketing it has been assumed that all eggs are Grade A when laid. This is not always the case.

Table 4. Frequency of Gathering and Egg Quality

Number of times gathered daily	Proportion of Grade A eggs delivered			Average of three periods
	Spring	Summer	Fall	
		per cent		
Less than three	62	66	75	68
Three or more	67	69	79	72

Frequency of Gathering

The reports of the farmers indicate a relationship between frequency of gathering and egg quality as shown in table 4. Thirty-seven per cent of the producers reported gathering eggs three or more times a day and four per cent more of their eggs graded A than was true for those gathering less frequently. A minority of the producers follow the recommendation of poultry specialists that eggs be gathered at least three times a day, indicating considerable opportunity for improvement. For producers who can employ this and other recommended practices without adding to their outlays, the improvement in quality will be a clear gain.⁷

Collection Facilities

A recommended practice is that wire or reed baskets rather than solid containers be used in gathering eggs in order to expedite cooling. No marked difference in the proportion of A grade eggs was found between producers who reported using the recommended types of containers rather than metal cans or pails. However, producers who reported cooling their eggs before packing in cases, delivered on an average 5 per cent more Grade A eggs than those who indicated that they did not follow this practice.

⁷ The gains from the employment of recommended practices necessarily are shown in terms of averages. The possible gains may be considerably larger for producers who have above average losses from failure to employ these practices.

Holding Room

Eggs should be kept in a cool, humid place awaiting delivery to buyer. The cellar generally is the most suitable place available on the farm. Fifty-three per cent of the producers reported the cellar as the place where eggs were kept after gathering. These producers averaged 4 per cent more Grade A eggs than those who reported holding eggs in other places, (table 5). The effect of the holding place on quality is somewhat greater in summer but the differences in all seasons support the recommendation that the holding place be cool and humid.

Sorting Before Delivery

A recommended practice is to sort out dirty, checked, broken, and odd-sized or misshapen eggs for home use. Fifty-nine per cent of the producers reported sorting before delivery. They averaged 8 per cent more Grade A eggs than those who did not follow this practice. Table 6 indicates the differences by seasons.

Only 18 per cent of the producers who reported sorting their eggs had more than 10 dirty eggs in each 100 de-

Table 5. Location of Holding Room and Preparation of Grade A Eggs

Places eggs are kept	Proportion of Grade A eggs delivered			Average of three periods
	Spring	Summer	Fall	
		per cent		
Cellar	65	69	78	71
All other places	61	64	75	67

Table 6. Influence of Sorting on the Proportion of Grade A Eggs

Item	Proportion of Grade A eggs delivered			Average of three periods
	Spring	Summer	Fall	
		per cent		
Sorted	69	68	79	73
Not sorted	56	65	73	65

Table 7. Influence of Cleaning on the Proportion of Grade A Eggs Delivered

Item	Proportion of Grade A eggs delivered			Average of three periods
	Spring	Summer	Fall	
	per cent			
Those buffing	70	68	78	72
Those washing	66	64	75	68
Not cleaning	56	62	74	65

livered while 39 per cent of those not following this practice had more than this number.

Cleaning

Seventy per cent reported that they cleaned eggs before delivery. Of these, 78 per cent indicated that they washed the eggs, a practice which is not encouraged, while 22 per cent used sandpaper or wire buffers. Table 7 shows the proportion of Grade A eggs delivered by producers following the different practices.

Apparently a large proportion of the producers follow the recommendation that eggs be cleaned, but a considerable share of them employ washing rather than the preferred buffing. This, no doubt, adds to the loss in quality during the marketing process.

HOW MARKETING PRACTICES AFFECT EGG QUALITY

Delivery

A recommended practice is that eggs be delivered to market three or four times a week during hot weather and at least twice a week at other times. An average of 31 per cent of the producers indicated they delivered only once a week, 57 per cent reported two, and 18 per cent three deliveries a week. Producers who delivered three or more times weekly had 4 per cent more Grade A eggs than those delivering less frequently. Table 8 indicates the differences by season.

The percentage figures of Grade A eggs with different practices should be regarded as indicators rather than as exact measurements. Various combinations of practices are employed so it is difficult to measure exactly the effect of any one practice. A producer who gathers eggs three or more times daily, holds them in a cool, humid place, sorts them before delivery, and delivers them three or more times a week will have a larger proportion of Grade A eggs than one who observes only some or none of these practices.

SIZE OF DELIVERY AND QUALITY

Differences in quality between eggs delivered by producers and those picked up by truck did not appear to be significant. However, quality tended to improve as the size of the delivery increased. Averages for all areas and the three periods showed that 69 per cent of the eggs in deliveries consisting of 30 dozen or less were A grade, while 75 per cent of those in deliveries between 30 and 60 dozen met the requirements of this grade. Size of delivery by itself should not influence quality. In fact, if larger lots are the result of less frequent delivery, the effect will be to lower quality. Other things being the same, the larger deliveries come from producers with larger flocks. The higher quality of large deliveries probably results from the better care and handling which owners of larger flocks provide. This supports the view

Table 8. Influence of the Frequency of Delivery on the Proportion of Grade A Eggs Delivered

Frequency of delivery	Proportion of Grade A eggs delivered			Average of three periods
	Spring	Summer	Fall	
	per cent			
Once a week	63	64	75	68
Twice a week	63	66	76	70
Three times	66	69	84	72

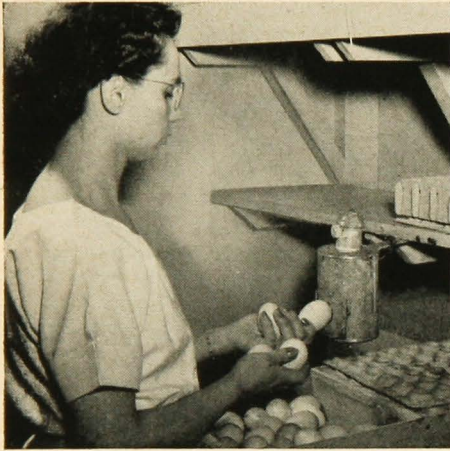


FIG. 4. Candling is an important step in buying eggs on a grade basis.

that there may be quality gains from increasing the size of the poultry enterprise and from concentrating production on the farms where larger flocks are kept and better care provided.

Methods of Sale

Of the 1,337 lots, 91 per cent were bought from producers on the basis of grade and 9 per cent as current receipts, or ungraded. Those sold on the basis of grade contained 69 per cent Grade A clean eggs and 75 per cent Grade A quality eggs.⁸ Those sold on current receipts basis were 50 per cent Grade A clean eggs and 70 per cent Grade A quality eggs.

This difference was about the same for spring, summer, and fall (figures 5 and 6). The proportion of stained and dirty eggs was somewhat higher in those sold ungraded.

Sale on grade basis is recommended because it provides an incentive to improve quality in order to obtain a better price and discourages delivery of low quality eggs. Handlers who buy from farmers should note this.

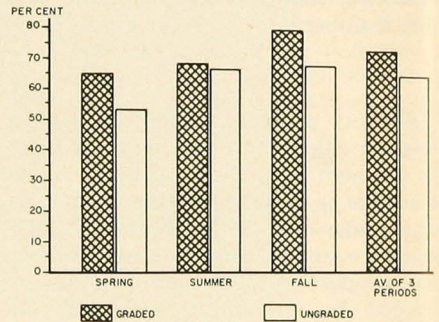


FIG. 5. Differences in proportion of Grade A eggs by seasons between sales on a graded and ungraded basis.

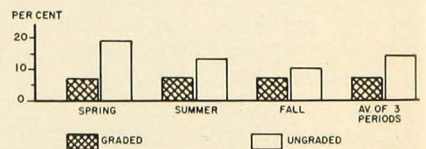


FIG. 6. Differences in proportion of stained and dirty eggs by seasons between sales on a graded and ungraded basis.

Quality Changes Between Buying Station and Central Plant

THE SECOND important area of quality loss is between the time of

⁸Grade A quality eggs includes Grade A clean plus stained and dirty eggs of Grade A interior quality.

delivery at the buying station and arrival at the central plant. The quality loss here was measured by grading the same lots at the buying stations and upon arrival at central plants (table 9).

The grading at the country buying station averaged 66, 64, and 73 per cent Grade A clean eggs for the spring, summer, and fall, respectively, or an average for the three periods of 67 per cent. The same lots graded at the central assembly plant averaged 57, 56, and 67 per cent Grade A eggs for the three seasons, or an average for all of 59 per cent. The proportions of A quality eggs at the central plant were 9, 8, and 6 per cent below those at the country buying stations for the three seasons, or an average of 8 per cent reduction for the three combined.

When stained and dirty eggs of A grade interior quality are included, the proportion of eggs of A quality is increased. The averages shown in table 3 presented earlier are on this basis in order to obtain an indication of loss from shell damage.

The data shown in table 9 indicate changes of approximately 12, 10, and 8 per cent for the three periods and an over-all average change of 10 per cent when shell damage as well as decrease in per cent of A grade is included.

Table 9. Changes in the Percentage of A Quality and Shell Damage Between Country Buying Stations and Central Assembly Plants, Spring, Summer and Fall, 1948

Period	A Quality		Decrease in per cent of A Grade	Shell damage		Increase in shell damage
	Station	Plant		Station	Plant	
Spring	72.9	62.2	10.7	5.2	6.3	1.1
Summer	70.1	61.1	9.0	5.8	6.9	1.1
Fall	80.0	72.9	7.1	4.5	5.5	1.0
Average three periods	73.8	64.6	9.2	5.2	6.3	1.1

Changes in grade varied in different parts of the state. Areas in the southern part of the state showed higher quality of eggs delivered by producers and also the largest reduction in the proportion of Grade A eggs. Those picked up on truck routes showed somewhat greater deterioration than those delivered by the producers.

Quality changes also were measured by a *point system*.⁹ For the purpose of this comparison, grade was established solely on the basis of the interior quality, the condition of the shell being disregarded. Points were assigned to each grade as follows: 0 for A, 1 for B, 2 for C, and 3 for checks (table 10). These points were multiplied by the number of eggs falling within the appropriate classification. Table 11 illustrates the results obtained by type-of-farming areas when this method was applied to measuring quality changes in hands of first buyer and at the central plant. As this table shows,

⁹ A *point* represents a decline in quality of one grade for one egg in a lot of 100. Thus, 12 points may be a decline of one grade for 12 eggs or of two grades for 6 eggs, or other combinations. The range covered by different grades is not the same. Price differentials among grades fluctuate with the result that exact monetary values of quality declines cannot be determined. The point system is indicative rather than being any exact measure.

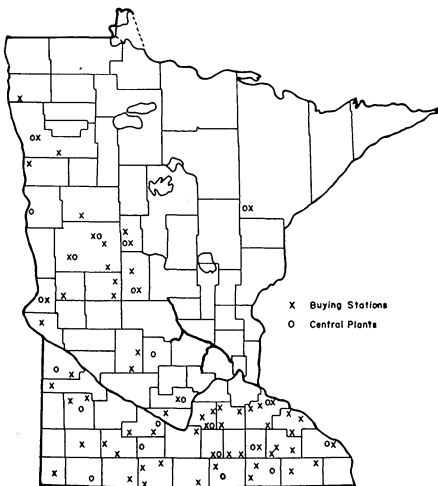


FIG. 7. Locations of buying stations and central plants at which lots of 100 eggs from 1,337 producers were graded.

Table 10. Point Deterioration of Egg Quality

Classification	Deterioration weight	No. of eggs at station	1st line deterioration	No. of eggs at plant	2nd line deterioration
A	0	65	0	45	0
B	1	25	25	40	40
C	2	7	14	10	20
Checks	3	3	9	5	15
Total			48		75
Difference in point deterioration			75-48=27		

* Equal weight differences between grades have been assumed to simplify these illustrative comparisons.

Table 11. The Average Point Value of Interior Quality Change Between First Buyer and Central Plant by Areas, 1948

Area	Average point value of		
	First grading	Additional change	Total change
1	31.5	11.4	42.9
2	34.9	14.8	49.7
3	31.3	12.0	43.3
4	57.7	13.1	70.8
6	39.3	10.7	50.0
7	59.3	11.5	70.8
State	39.3	12.3	51.6

quality changes were smaller in areas 1, 2, and 3 in southern Minnesota than in areas 4, 6, and 7 in west central and northwestern Minnesota.

The greatest quality change occurred in summer and spring, with considerably smaller changes in the fall (table 12). One reason why spring and summer are so close together in this comparison is that the temperatures for the two grading periods used in this study were quite similar. A cool spring and a warm summer could be expected to lead to greater differences between these seasons.

Table 12. The Average Point Value of Interior Quality Change Between the First Buyer and the Central Plant by Periods of the Year, 1948

Periods	First grading	Additional change	Total change
Spring	39.7	13.4	53.1
Summer	43.4	12.9	56.3
Fall	32.1	9.7	41.8
State	39.3	12.3	51.6

Change in Quality Between Central Plant and Terminal Market

SEVENTY CARLOADS of eggs of approximately 500 cases each from 13 central assembly plants in Minnesota destined for 14 markets were sample graded at the time of shipment and at the terminal market.¹⁰ Quality loss was measured by the change in

¹⁰This study was made in cooperation with the Federal-State Grading Service, Production and Marketing Administration, U.S. Department of Agriculture, Washington, D.C., and the Federal-State Grading Service in Minnesota, in the spring, summer, fall, and winter of 1949 and winter and spring of 1950.

proportion of Grade A eggs between these two gradings.

These shipments averaged 81 per cent Grade A eggs when graded at the plants and not quite 64 per cent at the terminal market, or a difference of 17 points, (table 13). The quality loss in the shipments varied considerably among markets, being much higher in shipments to southern and western markets than to eastern and midwestern outlets.

Table 13. Change in the Proportion of Grade A Eggs in Shipments from Minnesota to Specified Areas, 1949-50

	Number of shipments	Proportion origin	Proportion destination	Difference in proportions
Eastern markets	39	80.4	69.8	-10.6
Southern markets	15	82.2	42.3	-39.9
Midwestern markets	11	83.6	73.0	-10.6
Western markets	5	83.0	63.4	-19.6
Total	70			
Average		81.4	63.9	-17.5

Additional details on quality changes in this stage of marketing are supplied by table 14 which summarizes the results of 14 carlot shipments made by seven firms in the spring of 1950. These shipments showed a drop from 83 per cent to below 68 per cent in the proportion of eggs grading A and an increase from 12 per cent to 25 per cent in eggs grading B. C grade, stains, and

checks, were minor in both gradings, but the increases in these grades were proportionately large. Considerable differences among shipments and firms may be noted. Distances, time, refrigeration, temperature, and humidity probably explain some of the differences. The management and marketing practices employed prior to shipment, no doubt, account for some of the differences in quality loss. Variations among shippers and shipments suggest that there may be opportunities for improvement through employing better practices.

A comparison of grade changes for shipments by seasons showed the greatest drop in percentage of A grades in the fall, about 21 points. Summer came next with 16, winter with 14, and spring with approximately 10, in comparison with the average of 17.5 points for the 70 carlots. One explanation for the high figure in the fall may be that this is a period of low production and shipments may be made at longer intervals. Spring is the period of high production, requiring less time to assemble carload lots.

Table 14. Changes in Grades in 14 Cars Shipped by Seven Minnesota Firms, 1950

Firm	Cases	Quality at first grading					Quality at second grading				
		A	B	C	Stains	Checks and losses	A	B	C	Stains	Checks and losses
1	550	82.1	10.9	.4	3.5	3.3	77.7	17.7	.3	2.3	2.0
2	478	84.2	12.5	.8	.5	2.0	72.8	22.4	1.2	.7	2.9
	480	83.9	11.3	1.4	.5	2.9	72.0	21.3	.6	1.9	4.2
3	500	83.1	13.1	.4	.6	2.8	64.9	27.1	.5	4.1	3.1
	500	84.5	11.6	.....	.4	3.6	74.3	14.8	.5	6.9	3.5
4	480	84.0	10.6	.7	3.3	1.5	73.1	20.8	.2	1.7	4.2
	480	85.9	7.9	.4	4.3	1.4	82.5	11.3	.5	1.0	4.7
5	530	80.1	14.2	1.2	1.1	3.4	46.7	46.5	4.0	.....	2.8
	530	87.3	11.2	.....	.4	1.1	44.7	50.5	2.5	.....	2.3
	320	74.6	22.4	.....	.6	2.4	32.8	54.6	2.6	6.6	2.2
6	480	83.9	10.5	1.3	1.5	2.8	80.1	13.3	.1	1.9	4.6
	504	80.5	14.6	.8	1.5	2.5	69.1	23.0	.9	2.2	4.8
7	500	83.6	14.0	.7	.3	1.5	81.7	12.6	.3	1.3	4.2
	480	83.7	10.6	.6	2.7	2.5	74.3	21.2	.3	.9	3.3
Average		83.0	12.5	.6	1.5	2.4	67.6	25.5	1.1	2.3	3.5

Quality Loss from Hen to Terminal Market

QUALITY LOSSES indicated by this study are that 33 per cent of the eggs dropped out of the A grade before they reached the first buyer; another 8 per cent did so between that buyer and the central assembler; and 21 per cent more fell short of A grade requirements between there and the terminal market. Assuming that the eggs are all Grade A when laid, only 38 per cent reach the terminal market as Grade A eggs. This loss in quality plays an important role in bringing

about the difference between the prices paid the farmers and those paid in the terminal markets and by consumers. The common assumption is that the spread is accounted for by handling costs and profits. This overlooks the effects of quality loss. An important share of the spread goes to cover the loss in quality, and hence value, between the time the eggs leave the farmer and reach the consumer. Reduction in quality loss can be very significant in narrowing the spread.

Prices of Minnesota Eggs

A COMPARISON of prices received for eggs by Minnesota farmers with those in other states is of interest in connection with a consideration of the economic aspects of quality. Minnesota ranked forty-second among the states in 1949 in average farm prices of eggs. Minnesota's average for that year was 40 cents, compared with an average of 45 cents for the United States and 63 cents for Massachusetts. Farmers in eastern states average better prices for eggs than Minnesota producers. There are several reasons for this. One is the longer distance from Minnesota to important consuming centers involving greater transportation and handling charges. Another is that Minnesota is a surplus producer and has fewer urban centers to provide nearby markets for eggs. An important part of the disadvantage, however, lies in the failure of quality to measure up to the standards required to bring top prices.

The fact that egg production is a sideline on Minnesota farms affects quality and also adds to costs because of the larger areas from which eggs are assembled. Minnesota farmers cannot do anything about distance from consuming centers or lack of local markets. They, together with handlers, can improve quality by the employment of better practices in production and marketing. Figure 8 compares average farm

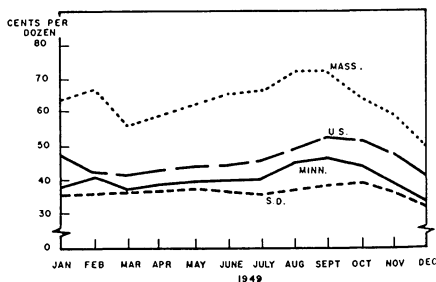


FIG. 8. Average monthly farm prices of eggs for Minnesota, Massachusetts, South Dakota, and the United States, 1949.

Table 15. Prices of Grade A Large and Medium Eggs Paid Farmers in Minnesota and Prices for Same Grades at Five Eastern Chain Stores, March 1948-January 1949*

Prices	Cents per dozen											
	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Av.
	Grade A large											
Minnesota farm†	40.6	41.8	40.2	42.5	44.8	49.5	51.6	58.9	58.7	46.4	41.2	46.9
Eastern retail‡	62.1	60.9	62.6	67.1	71.6	75.0	78.4	86.6	87.5	74.8	69.0	72.3
Difference	21.5	19.1	22.4	24.6	26.8	25.5	26.8	27.7	28.8	28.4	27.8	25.4
	Grade A medium											
Minnesota farm†	36.5	37.1	35.7	36.7	37.8	40.9	39.8	42.1	43.6	38.3	35.6	38.6
Eastern retail‡	59.9	58.1	59.1	61.2	63.2	67.2	70.1	75.4	73.3	65.6	61.2	64.9
Difference	23.4	21.0	23.4	24.5	25.4	26.3	30.3	33.3	29.7	27.3	25.6	26.3

* Data collected by a cooperative study with the B.A.E. and the Agricultural Experiment Stations of Minnesota, Wisconsin, and Michigan in 1948-49.

† Average price of Grade A eggs paid by four central assembly plants in Minnesota, 1948-49.

‡ Average price of Grade A eggs as sold by five retail chain outlets in an eastern market, 1948-49.

egg prices in Minnesota with those in the leading state of Massachusetts, the United States' averages, and those for South Dakota, which are lower. This figure also illustrates seasonal variations in prices for the states included and the United States.

A comparison of prices paid Minnesota farmers for Grade A eggs and retail prices for the same grade of eggs by five eastern chain stores is given in table 15. This provides an indication of the spread between prices received by Minnesota producers and those paid by eastern consumers for eggs of the same quality. The spread appears to be slightly greater for the medium eggs and tends to widen as prices rise.

Data obtained for the same period gave additional information on price

spreads. These data concerned eggs handled by one central assembler who purchased from farmers and shipped to an eastern wholesaler, who in turn sold directly to a retailer. The results are summarized in table 16. The average price to farmers was 47.1 cents; to the assembler, 55.3 cents; to the eastern wholesaler, 65.7 cents; and to the retailer, 72.3 cents. The average margins for the 11 months were 8.2 cents to the assembler, 10.4 cents to the wholesaler and 6.6 cents to the retailer. The monthly averages of margins of the assembler varied from 5.8 cents in July to 10.8 cents in October. Those of the wholesaler ranged from 7.9 cents in October to 14 cents in January. For the retailer the range was from 3.2 cents in April to 9.5 cents in September.

Table 16. Prices to Minnesota Farmers, Margins of Central Assembler, Wholesaler and Retailer and Retail Prices for Grade A Large Eggs for March 1948-January 1949

	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Av.
Minnesota farm price	40.8	42.0	40.0	42.2	44.8	49.3	51.6	59.8	58.8	46.8	41.8	47.1
Central assembler margin	8.0	7.3	8.4	8.6	5.8	6.2	7.4	10.8	10.3	10.1	7.2	8.2
Wholesaler margin*	8.4	8.4	10.1	8.6	12.4	12.3	9.9	7.9	10.5	11.8	14.0	10.4
Retailer margin	4.9	3.2	4.1	7.7	8.6	7.0	9.5	8.1	7.9	6.0	6.0	6.6
Retail price	62.1	60.9	62.6	67.1	71.6	75.0	78.4	86.6	87.5	74.7	69.0	72.3
Combined monthly margin	21.3	18.9	22.6	24.9	26.8	25.5	26.8	26.8	28.7	27.9	27.2	25.2

Source: Data collected by a cooperative study with the B.A.E. of the U.S. Department of Agriculture and the Agricultural Experiment Stations of Minnesota, Wisconsin, and Michigan in 1948-49.

* The wholesaler margin appears to be greater than it actually is because transportation costs are included here instead of being shown separately. Transportation costs average 1.5 cents a dozen.

Table 17. Prices Paid Minnesota Farmers for Eggs by Type-of-Farming Areas Expressed as Percent of Yearly Average

Area	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Range
1	100	94	93	94	92	93	97	101	104	112	116	103	24
2	97	92	91	98	92	94	96	105	104	115	117	100	26
3	96	94	91	99	93	95	98	106	101	109	117	101	26
4	97	95	93	100	95	96	97	102	100	108	115	102	22
5	93	90	89	96	90	94	94	96	108	119	134	99	45
6	90	92	91	95	91	91	96	105	107	111	128	101	38
7	100	91	93	98	77	83	100	103	110	117	129	103	52
8	87	94	91	89	89	92	102	98	108	117	124	110	37
9	99	89	90	92	88	92	97	108	107	110	121	106	33

Source: Mid-month average prices, State-Federal Crop Reporting Service.

ber. These margins have to cover quality losses as well as handling costs.

SEASONAL AND AREA PRICE VARIATIONS

Egg prices show marked seasonal swings because of variations in production and the importance of quality. Prices paid farmers for eggs usually are lowest in the spring period of high production and highest in the fall when production is low. The seasonal variation differs for various areas (table 17). Areas 1, 2, 3, and 4 produce more eggs throughout the year than needed for local consumption. The seasonal variations in prices consequently are less in these areas than in those having deficits part of the year. Areas 5 and 7 ship eggs part of the year but have in-shipments during periods of low production. Seasonal price changes are particularly marked in these areas.

Variations from area to area also are the result of such factors as (1) differences in availability of local markets, (2) quality differences, (3) methods of sale, and (4) the degree of concentration of production. The seasonal difference has shown some tendency to decrease as production per bird has increased and with the practice of earlier hatched chicks for earlier fall production. The range during the time of this study also was affected by the price support program.

Eggs sold by farmers on a graded basis during the 11-month period averaged about 3 cents more a dozen than those sold ungraded. While the price differential between grades varies by seasons and among the type-of-farming areas, the premium obtained for Grade A eggs should be sufficient to make it worth while to produce higher quality eggs (table 18).

Table 18. Average Prices Received by Farmers in Different Types-of-Farming Areas for Various Grades of Eggs in Different Seasons of 1948*

	Area						
	1	2	3	4	6	7	Av.
Spring							
cents							
Grade A Large	42	41	40	41	41	39	41
Number II†	36	36	36	36	36	34	36
Standards‡	31	33	32	31	32	32	32
Summer							
Grade A Large	45	44	44	43	45	44	44
Number II	37	37	36	36	38	38	37
Standards	32	33	33	31	32	32	32
Fall							
Grade A Large	62	61	60	59	61	58	60
Number II	44	42	43	42	43	41	43
Standards	32	32	32	30	31	30	31

* These are average prices as reported by 65 buying stations in Minnesota as paid to farmers per dozen eggs of various sizes for three periods during the year. These were plants which were included in the grading program during 1948.

† Number II includes Grade A Medium and Grade B Large.

‡ Standards include Grade B Medium, Grade C, Stained and Dirties.

Economic Aspects of Quality Change

SOME PRODUCERS may sell eggs directly to ultimate consumers or large users. Direct sales are most common in areas near centers of population, as in the eastern United States. An important share of the eggs consumed in Minneapolis and St. Paul comes directly from producers. Minnesota farmers generally, however, do not have direct access to urban centers so most of Minnesota's eggs pass through the hands of several agencies and may be in the marketing channels for several weeks before reaching consumers at distant points.

With minor exceptions, eggs are of high quality when laid. Deterioration begins at that time. No marketing process is able to avoid all of the loss in quality, but the preventable loss varies with the methods and practices used by producers and handlers. Because these are under their control, they can reduce losses. Since these losses account for a major share of the spread between the prices received by the farmer and those paid by the consumer, a reduction in them is important.

Quality losses are of two kinds: (1) Reduction in interior quality, including air cell, yolk, and the white; (2) quality loss because of the appearance or condition of the shell as in dirty,

stained, checked, or broken eggs. Table 19 illustrates quality changes which are believed to be reasonably typical of those which occur on the farm and during the marketing process. Individual instances naturally will show wide variations because of differences in practices and conditions. It will be noted that only two-thirds of the eggs were of A grade when sold by the farmer and that less than one-third of the original eggs reached the retailer as Grade A. The proportion of B grade doubled and C grade had increased by one-half during the marketing process.

Representative prices received by various participants in egg marketing at the time of this study are indicated in table 20. The average price to farmers for this period would have been 45 cents a dozen if all eggs had been Grade A. However, as shown in tables 8 to 19 this was not the case. A typical 100 dozen would show the following distribution:

A	grade, 67 dozen at \$.45=	\$30.15
B	grade, 17 dozen at \$.35=	5.95
C	grade, 16 dozen at \$.25=	4.00

Returns for 100 dozen \$40.10

Table 19. Illustrative Changes in Egg Quality*

Grade	Hen lays	Farmer delivers	Buying station delivers or discards	Central plant delivers or discards	Wholesaler delivers or discards	Retailer sells or discards
A	100	67	59	39	36	30
B		17	22	36	37	35
C		10	2	5	1	7
Checks, leakers, and loss		6	1	1	1	1
Remaining	100	100	84	81	75	73

* These comparisons are presented as illustrations of losses resulting from quality deterioration rather than as exact measurements.

Table 20. Prices Received by Grades

Grade	Farmer	Buying station	Central plant	Whole-saler	Retailer
A	\$.45	\$.47	\$.55	\$.65	\$.72
B	.35	.37	.45	.55	.62
C	.25	.27	.35	.45	.52

In short, at these prices and with this loss in quality, farmers averaged 40 cents instead of 45 cents a dozen, or a loss of 5 cents a dozen from quality deterioration. Applied to a total sale of 296 million dozen eggs sold by Minnesota farmers during 1949, the result is 14.8 million dollars which represents 12 per cent of the total sales of 130 million dollars.

If there had been no quality loss at the country buying station, the eggs in the preceding illustration should have brought 42 cents a dozen. However, using the grades and prices shown in the preceding tables gives the following results:

A grade, 59 dozen at \$.47=	\$27.73
B grade, 22 dozen at \$.37=	8.14
C grade, 19 dozen at \$.27=	5.13

Received for 100 dozen \$41.00

In other words, the quality loss during this stage of the marketing process at these price levels averaged 1 cent a dozen. If this rate is applied to 80 per cent of the total sales of Minnesota eggs, the result indicates that about 2.4 million dollars may be involved in quality deterioration while eggs are going through buying stations.

Quality losses cannot be established for all eggs for each step of the marketing process because they do not all go through the various steps. Thus, the central assembly plant may ship the eggs of higher grade and sell others locally or for drying or breaking. If there were no loss in quality between receipt and sale by central assembly plants, the following returns at the prices during the time of the study

would have been expected:

A grade, 59 dozen at \$.55=	\$32.45
B grade, 22 dozen at \$.45=	9.90
C grade, 19 dozen at \$.27=	5.13

Returns for 100 dozen \$47.48

With average deterioration, however, the following returns would be more representative:

A grade, 39 dozen at \$.55=	\$21.45
B grade, ¹¹ 6 dozen at \$.55=	3.30
B grade, ¹² 30 dozen at \$.45=	13.50
C grade, ¹² 25 dozen at \$.27=	6.75

Total 100 dozen \$45.00

This indicates an average quality loss of \$2.48 per 100 dozen, or 2.48 cents per dozen, in this stage of marketing. Not all eggs are shipped but when this rate is applied to 50 per cent of total sales it indicates a quality loss of about 3.7 million dollars to Minnesota eggs in this phase of marketing.

The disposal of a 100-dozen lot by the wholesaler could yield results about as follows:

A grade, large, 80 dozen at \$.65=	\$52.00
B grade, large, 16 dozen at \$.55=	8.80
C grade or lower, 4 doz. at \$.40=	1.60

Total \$62.40

If all of the eggs had been Grade A Large when sold by the wholesaler, they should have brought 65 cents a dozen, the quality loss at this stage representing 2.6 cents a dozen. This amount together with the amount in other stages of the marketing process indicates the very significant place occupied by quality deterioration in the spread between prices paid to farmers for eggs and the prices paid by consumers. Reduction in quality losses offers the most promising way of narrowing that spread.

¹¹ This is based on the assumption that the grading tolerance of 20 per cent allowed assembly plants to include some of the top quality B grades with the A's.

¹² The assumption is that 30 dozen of B grade and 25 dozen of C grade are sold locally or for drying or breaking.

Suggestions for Quality Improvement

EGGs are a perishable commodity. Some loss in quality would take place in eggs even though every step in handling from the time eggs are laid until they are consumed could be kept ideal. While all of the quality loss cannot be eliminated, the amount of loss can be reduced materially.

As this study shows, practices followed by producers in gathering, storing, and delivering eggs have an important effect on quality. Producers, however, cannot be expected to devote the time and effort required to reduce these losses unless an incentive is provided in the form of better returns. That incentive can come from more general use of grades in buying and from reductions in losses during the marketing processes which will permit higher returns to producers for quality eggs.

If eggs are to reach the consumer with a minimum of loss in quality it is essential that:

1. Good production, management, and marketing practices be employed by producers
2. Proper facilities be available and careful handling be provided during marketing
3. There be speed in getting eggs from hen to the consumer.

For Producers—

A number of the practices needed to maintain quality while eggs are in the hands of producers can be employed with little or no added cash outlay. These include:

1. Gathering eggs three or more times daily

2. Prompt cooling before packing
3. Keeping in a cool, moist place
4. Sorting before delivery
5. Cleaning stained eggs by buffing and keeping dirties for home use
6. Delivering to market two or three times a week
7. Selling to outlets which buy on grade basis and have adequate facilities for proper handling.

Other factors which may help quality and returns include:

1. Use of earlier hatched chicks to obtain more production in periods of higher prices
2. Expansion of volume by increased flock size and production
3. Adoption of uniform strains and breeds in an area
4. Payment of premiums for quality eggs
5. Educational programs to emphasize quality and how to obtain it.

For Buying Stations—

Factors affecting buying station operations which may improve quality are:

1. Payments of premiums for quality
2. More general use of buying on grade with improved standardization and enforcement of grades
3. More adequate facilities for receiving, handling, and storing eggs
4. Rapid cooling
5. Frequent delivery to assembler.

For Central Assembly Plants—

Central assembly plants can pay more nearly what eggs are actually worth if they are well graded and standardized when delivered. Central plants can help reduce quality losses by providing:

1. Rapid, well-refrigerated transportation
2. More direct routing of shipments

3. Proper packing, loading, and shipping

4. More rigid grading.

For Wholesalers and Retailers—

Wholesalers and retailers likewise can contribute to quality improvement by careful attention to grade and by providing facilities and methods which will hold losses to a minimum.