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Egg Marketing Losses in South Dakota

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**egg
marketing
losses**

**IN
SOUTH
DAKOTA**

AGRICULTURAL ECONOMICS DEPARTMENT
AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE COLLEGE
BROOKINGS

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EGG MARKETING LOSSES IN SOUTH DAKOTA

By ERNEST FEDER and WILLIAM KOHLMAYER¹

South Dakota is an important egg exporting state, but its farm prices for eggs are low. In fact, South Dakota has the largest per capita production of eggs in the United States.² About 1880 eggs per capita are produced yearly on South Dakota farms, while per capita consumption is about 400. This leaves many eggs to be shipped for consumption elsewhere. Over 41 thousand cases of shell eggs and 2½ million pounds of frozen eggs were shipped to Chicago in 1950. South Dakota ranked sixth and third in this market, respectively.³

Yet South Dakota has also had the lowest farm price, with the exception of North Dakota, for many years. For instance, in 1949 the United States average was 45.1 cents, the South Dakota average, 36.3 cents.

These low farm prices may result from the poor quality of farm eggs or the high cost of marketing in South Dakota, such as the assembling and transportation costs. If quality is poor, South Dakota may be at a disadvantage at central markets in competing with eggs from other states where higher quality eggs are produced.

This bulletin attempts to answer the following questions:

1. What is the quality of farm eggs produced in this state?
2. Do eggs deteriorate in the South Dakota marketing channels?
3. What are the factors affecting quality of eggs and the decline of quality in the marketing channels?

The data used here were obtained from two surveys. The main survey was conducted in 13 North Central states, including South Dakota, with the purpose of obtaining information on egg quality and quality deterioration in the marketing channel between first buyers and wholesale plants.⁴ To that end, buyers and wholesalers were interviewed and their marketing methods analyzed; eggs were candled and graded by a federal-state grader at the buyers' stations and at the wholesale plants. This survey was conducted in 1948. Some data on the operations of the large wholesale plants and the stations refer to 1947.

In 1949 a second survey was made of 36 producers shipping eggs to a South Dakota central plant which operated three weekly truck routes. A federal-state grader inspected the eggs

¹Associate Agricultural Economist and Poultry Husbandman, respectively. Robert Treacy, Research Assistant, assisted in the preparation of this manuscript.

²*Facts and Figures about the Poultry Industry*, Poultry Branch, Production and Marketing Administration, U.S.D.A., Washington, D. C., Oct., 1949.

³*Total Receipts of Eggs and Frozen Eggs at Chicago, by Origin, 1950*, Production and Marketing Administration, Chicago, 1951.

⁴*Changes in Egg Quality During Marketing*, North Central Regional Publication 15, Special Bulletin 361, Michigan State College; Aug. 1949; *Operations of Central Assembling Plants in Relation to Egg Quality* (Mimeo), U.S.D.A., Production and Marketing Administration, Washington, D. C., May 1950; *Operations of Country Buying Stations in Relation to Egg Quality* (Mimeo), U.S.D.A., Production and Marketing Administration, Washington, D. C., May 1950; *Deterioration of Egg Quality During Marketing*, U.S.D.A., Production and Marketing Administration, PA 79, Washington, D. C., Sept. 1949. For more details concerning South Dakota data, see Robert Treacy, *Factors Affecting Loss in Quality of South Dakota Eggs*, Masters Thesis.

at the time of delivery by the trucker. The farmers supplying the plant were interviewed as to holding conditions and flock management practices, with a view to determining the effects on quality.

This research activity centers therefore around two problems only: egg quality and marketing practices affecting quality. Wherever possible, South Dakota data are compared with those of the North Central Re-

gion as a whole, or of other states. The fact that the same survey has been undertaken in 13 states makes such a comparison possible.⁵ Much of what is shown here is not a new story; however, by pointing out the weak links in South Dakota's marketing chain, a way to improvement is cleared.

A brief discussion of some economic aspects of quality improvement is also presented.

Grades of Eggs and Measures of Quality

A brief discussion of the grades used in classifying eggs and a definition of the term "quality" may be helpful.

Federal Grades

In the surveys, eggs were graded according to standards for quality of individual shell eggs established by the U. S. Department of Agriculture. The specifications for these standards refer to interior and exterior quality, and do not take into account the size or weight of eggs.⁶ Grades are established by candling and inspection of the shell.

Grade A eggs, the highest grade, are clean, unbroken and normal AA's and A's. In the following pages these two grades are combined in one category (A grade) except where noted. The minimum requirements for A's are that the air cell must not exceed two-eighths of an inch in depth; that the white is clear and reasonably firm so that the yolk appears fairly well centered and its outline only fairly well defined at candling; and that the yolk

be practically free from apparent defects (Fig. 1).

Grade B eggs are clean, unbroken or slightly abnormal, with an air cell not greater than three-eighths of an inch in depth; with a clear, but slightly weak, white; a yolk off-center and well-defined, and with slight defects in shape.

In grade C eggs the air cell may be larger and free, and the white weak and watery; the yolk becomes plainly visible at candling. Small blood clots or spots are permitted.

If unbroken eggs are soiled, they are classified as stained or dirty eggs. They may be subdivided into stained or dirty eggs of A, B or C interior quality.

If eggs have a checked or cracked shell, they are classified as checks or leakers.

⁵The region includes South Dakota; that is one reason that the comparison is only a rough one.

⁶For further detail, consult: *U. S. Standards for Quality of Individual Shell Eggs*, Order of Promulgation of Standards, U.S.D.A. Office of the Secretary, Sept. 1946 (effective Dec. 1946). These grades should not be confused with federal wholesale grades, federal consumers grades, state grades, or so called company grades. In South Dakota's 1950 Egg Law, purchase grades take into account interior and exterior quality, as well as size and weight; they apply if and when eggs are purchased on a grade basis.

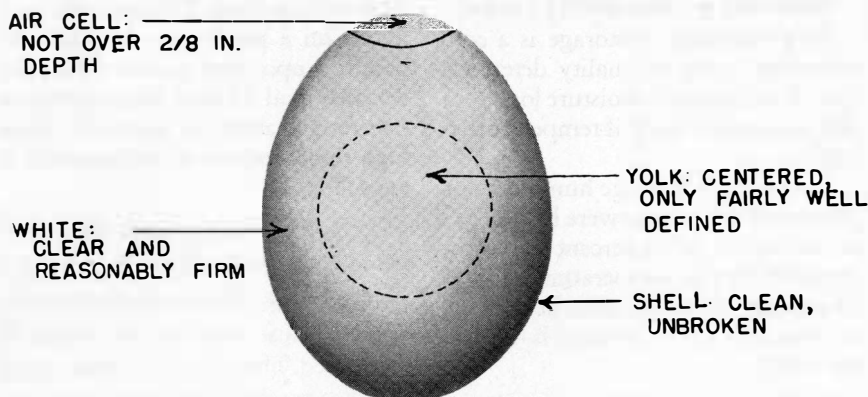


Fig. 1. Minimum requirements for a grade A egg

Measures of Quality

In the following pages the average proportion of A's (including AA's), determined by the grading is used to indicate the quality of the eggs in the various lots. In this study eggs were graded by selecting at random, from a producer's shipment, a sample lot of 100 eggs. The number of A's, B's, C's,

are therefore expressed as percentage figures. The higher the proportion of A's the higher is the quality of the egg shipments. The reduction in the percent of A's during marketing is an indication of the decline in quality. If interior quality or quality deterioration is referred to, the A's may include stained or dirty eggs of A grade, if so stated.

How Do Egg Handling Methods Affect Quality? (Truck Route Case Study)

In the 1949 survey of 36 producers, the method of purchase for the central plants was on the basis of grades. The survey was made in November, when outside temperatures were relatively low.

Effect of Farm Storage Temperature on Quality

Temperature at which eggs were held had a decisive influence on the egg quality. Producers holding eggs at temperatures above 55° had a substantially lower average percentage of A's (Table 1). The average holding tem-

perature on these farms was 65°. When eggs were held at temperatures below 55°, the average temperature was 45°.

Table 1. Effect of Farm Storage Temperature on Quality of Eggs, Nov. 1949

Eggs Kept on Farm at	Percent of A's	
	Including Stains & Dirties	Excluding Stains & Dirties
55° or less	76	63
Over 55°	46	37

On the whole, 60 percent were A's (including stains and dirties, or 49 percent not including stains and dirties).

Humidity a Contributing Factor

Low humidity at storage is a contributing factor to quality deterioration; it causes rapid moisture loss from the eggs, particularly if temperature is high.

In this study, average humidity was 39 percent when eggs were held at 55° or above (65 to 80 percent is recommended for that temperature). It was 49 percent when eggs were held at 55° or less, (60 to 70 percent is recommended).

Are Basements and Porches Good Storage Places for Eggs?

Fourteen out of the 36 farmers kept their eggs in the basement, the others on the porch, on the first floor, in the kitchen or pantry, the living room, or stairs leading to the cellar.

The temperature was more important than the place of storage. All basements were not cool. In some, the temperature was 57° to 67°, in others 49° to 55°. Nor were porches always cool; some were 60° to 70° (usually in the afternoon) the others 40° to 52° at the

time of inspection. Temperature variations on a porch may be wide, depending upon the weather. November 1949 had 13 days when temperature ranged about 55° up to 72°. Such high temperatures are detrimental to eggs (Fig. 2).

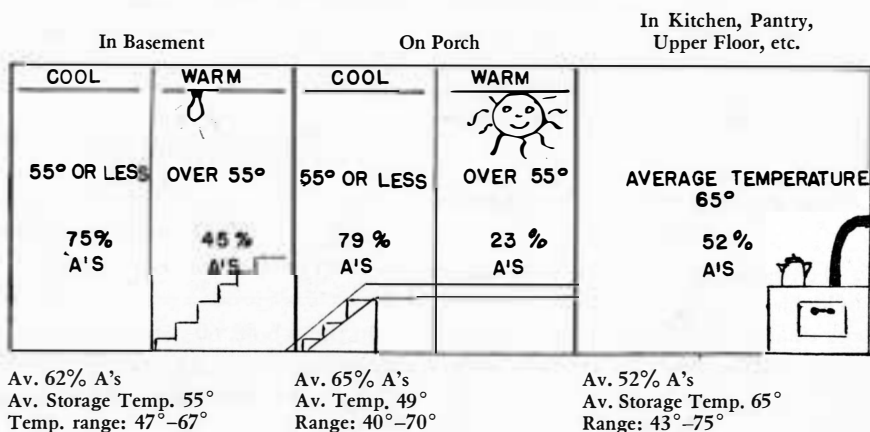
Eggs deteriorate even in the "cool" basement or on the "cool" porch, since these storage places are often inadequate because temperature cannot be controlled. This may account for some of the loss which had taken place up to grading time even when eggs were found kept at a relatively low temperature when inspected.

Wire Baskets vs. Solid Pails

Eight out of ten farmers put eggs immediately into the final storage room. Seven out of ten farmers used solid-wall pails instead of wire baskets. Even in cool basements, eggs cool slowly in solid buckets.

⁷South Dakota Climate Data, November 1949, U. S. Department of Commerce, Vol. LIV, No. 11, Data for community in which study was made.

Fig. 2. Effect of farm storage on quality of eggs



Effect of Pen Management on Quality

Temperature in farm storage seemed to be a more important factor influencing interior quality than the way chicken houses were kept and the number of times eggs were gathered per day, but it should be recalled that the survey was made when outside temperature was relatively low.

If both management and storage are good, that is, if pens are kept dry and clean, if eggs are gathered three times a day and kept cool until day of shipment, then eggs will have high average quality. The few farmers who followed all these recommended practices shipped 91 percent A's. If all practices were poor, that is, when chicken houses were damp and dirty, when eggs were gathered once or twice a day and kept at a temperature above 55°, only 39 percent of the eggs shipped were A's.

Frequency of Delivery

If holding conditions on the farm are poor, quality will decline rapidly the longer the eggs are held. The truck route eggs graded in this study were held on the farm from one to seven days.

More frequent delivery will reduce deterioration on the farm. This may be shown by the example of four farmers whose eggs were graded at the time of this survey, and who delivered their eggs every one to four days at the door of the same buyer. Their eggs averaged 95 percent A's including stains and dirties (or 50 percent AA's and 45 percent A's). The interview revealed that these eggs had been held at an average temperature of 59° and at low humidity in basement, kitchen, or porch (range: 46° to 67°), but they did not have time to deteriorate greatly, despite somewhat unfavorable storage conditions.

Frequency of Gathering Eggs and Proportion of Soiled Eggs

In all samples, one out of five eggs was stained or dirty. The percentage of soiled eggs varied with the frequency of gathering eggs in the pen⁸ (Table 2).

Table 2. Frequency of Gathering Eggs and Percent of Soiled Eggs, Nov. 1948

Number of Times Gathered Per Day	Percent of Stains and Dirties
Three times or more	15
Once	31

Quality of Eggs In Eastern South Dakota

Average Quality of Farm Receipts in South Dakota

In the 1948 survey, 362 sample lots of 100 eggs were graded by a federal grader, in spring, summer and fall on the day they were received by local egg buying stations and large egg buyers. These lots were taken from shipments of 362 farmers and averaged about 30 dozen eggs per shipment.

Mainly eastern South Dakota eggs were graded.

Table 3 shows that 55 eggs out of 100 were clean A's. For purposes of comparison, the data for all the 13 states of the North Central Region are also shown. The latter include the

⁸Under the 1950 South Dakota Egg Regulations (Section 8) checks, stains and dirties are grade C eggs, whether or not they are of interior A or B quality.

South Dakota figures (which have a tendency to lower the regional average).

Table 3. Average Proportion of Clean A Eggs Delivered by Farmers to First Buyers, South Dakota and North Central Region, 1948

Season	In South Dakota	In the Region
Spring	55.3	65.4
Summer	53.5	64.2
Fall	59.6	71.6
Average	55.4	66.7

There were some A's among the stains and dirties which raise the South Dakota average to 65.6 percent A's. But these increase handling costs and, after the cleaning operation, deteriorate rapidly and therefore bring lower prices.

Quality of Eggs in Northeastern United States

How does South Dakota egg quality compare with that produced in the eastern egg markets? A survey to measure the level of egg quality on farms and changes in quality in marketing channels, and to determine factors affecting quality was conducted in August and November 1948, February and May 1949 in six northeastern states from Maine to West Virginia. Eggs ready to be shipped by

farm truck routes were graded at the farms and again in the first and second buyers' plants. These farm eggs graded from a low of 89 percent AA's and A's in May to a high of 93 percent in November and February; in August the average quality was 90 percent. There was thus little difference in quality throughout the year. Only a small decline in AA's, 8 percent in three out of the four months, had taken place when eggs were again graded at the first receiver.⁹

In comparing these data with South Dakota data, it should be kept in mind that the farms studied in that survey appeared to be above average in size of flock.¹⁰

Small Proportion of South Dakota Farmers Selling High Proportion of A's

Few South Dakota farmers deliver eggs of top quality. Only 6 out of 100 farmers selling to country stations or central plants sold eggs averaging between 90 to 100 percent A's. In the fall the proportion was higher, in summer much lower. Half of the farmers sold eggs averaging below 50 percent A's at the first receivers (Table 4). The large proportion of farmers selling many poor eggs accounts for the generally low level of quality.

Table 4. Percent of Farmers Delivering Eggs With Specified Percentages of A's, South Dakota, 1948

Season	100-90% A's	89-80% A's	79-70% A's	69-60% A's	59-50% A's	Below 50% A's
Percent of Farmers						
Spring	4	20	8	12	12	44
Summer	3	18	11	6	8	54
Fall	16	17	16	12		39
Average	6	18	12	8	6	50

Egg Quality in Minnesota

Minnesota, which also sells eggs in relatively distant markets, compares with South Dakota as follows¹¹ (Tables 5 and 6).

Table 5. Average Proportion of Clean A Eggs Delivered by Farmers to First Buyers, Minnesota and South Dakota, 1948

Season	Percent Clean A's	
	Minn.	S. Dak.
Spring	66	55
Summer	64	53
Fall	73	60
Average	67	55

Minnesota is therefore close to the regional average. The proportion of Minnesota farmers selling good eggs is larger than in South Dakota. Apparently as a result, during 1946, '47 and '48, the annual average farm price of eggs per dozen was 3.5 cents higher in Minnesota than in South Dakota.

Cleanliness of Eggs

Stained or dirty eggs increase the costs of handling and thus may reduce the returns to farmers. Can the cleanliness of South Dakota's eggs be im-

proved? According to the survey, there were almost twice as many stains or dirties in a hundred eggs in South Dakota than in the Region as a whole (Table 7). However there were some seasonal differences, the percentage of stained and dirty eggs being highest in the summer.

Table 7. Percent of Stained and Dirty Eggs (Producer Lots) in South Dakota and in the Region, 1948

Area	Percent Stained and Dirty Eggs
South Dakota	20
North Central Region	11

⁹The relatively largest decline in AA's took place between the first and the second buyer. Even after the decline in quality from the farm to the second receiver, from 55 to 65 percent of the eggs were still of AA quality. *Marketing Practices and Egg Quality, 1948-49*, Northeast Regional Publication, No. 3, Cornell University, Exp. Station, Bull. 858, Feb. 1950.

¹⁰*Ibid.* p. 8. According to the 1945 Sample Census of Agriculture, flocks with 100 chickens or more averaged 339 birds in the northeast region, but farm flocks in the survey were larger on the average. In South Dakota, flocks with 100 chickens or more averaged 187 birds in 1945, well below the northeastern average. In the South Dakota survey of 1948, no data were available as to the size of flocks of the producers selling eggs to country buyers. Some producers may have had flocks with less than 100 birds.

¹¹"Minnesota Egg Quality" by Taylor and Waite, in *Farm Business Notes*, Agriculture Extension, University of Minnesota, May 31, 1949.

Table 6. Percent of Farmers Delivering Eggs With Specified Percentages of A's, Minnesota, 1948

Season	100-90% A's	89-80% A's	79-70% A's	69-60% A's	59-0% A's
	Percent of Farmers				
Spring	12	22	17	14	35
Summer	10	23	21	14	32
Fall	22	31	19	11	17
Average	15	26	19	13	27

Factors Related to Quality of Farm Eggs

Size of Shipment

In South Dakota the average shipment of eggs sold by producers to first buyers was a case of 30 dozen eggs. Almost half of all shipments (45 percent) were less than a case; 12 percent, two cases or more. The South Dakota farmer selling a shipment consisting of over two cases of eggs sold a slightly better quality (70 percent A's including stains and dirties) than the farmer selling fewer eggs (65 percent A's). But this seems relatively unimportant, and the relationship was not consistent at all times.

Other handling practices have probably a more decisive influence on egg quality than size of shipment, though their importance was not tested in this particular study. In the 1948 survey, the size of shipment was recorded at grading time without reference to frequency of farmers' delivery. In the truck route case study, shipments of two cases or more also showed a somewhat higher average quality (62 percent A's, including stains and dirties) than smaller ones (54 percent). Here the age of the eggs was nearly alike for all lots. Analysis shows that temperature at storage affected quality considerably more than size of shipment.

Method of Delivery and Sale

Whether farmers delivered the eggs to the first buyer or whether the eggs were picked up by trucks on regular routes, also affected quality little. There were slightly more checks on truck routes (Table 8).

Table 8. Method of Delivery to First Buyers and Quality of Eggs, South Dakota, 1948

How delivered	Percent A's*	Checks
By truck routes	50	5
At door of buyer	53	4

*Not including stains and dirties

In contrast, buyers who bought by grades obtained better and cleaner eggs than buyers purchasing ungraded eggs. This was particularly true during the summer (Table 9). But the data available from the survey do not give an explanation why this was so. Two possibilities present themselves: (a) the grading of eggs by plants, at the time of purchase, has the effect of educating farmers to take better care of their produce or (b) plants, who buy on grade, do so because of the availability of higher quality eggs in their territory.

Table 9. Method of Purchase of Eggs By First Buyers and Quality of Eggs, South Dakota, 1948

How Purchased	Percent of A's	Percent of Stains & Dirties
Total		
Graded	61	15
Ungraded	49	25
Summer only		
Graded	63	9
Ungraded	45	23

Buying on grade, however, does not always assure higher quality. In the truck route case study producers knowingly sold their eggs by grades, but still quality was low. The reason was, most likely, that the then existing price differential between first and second grade was 3 to 4 cents, and only a little above the then prevailing

support price for eggs. It is generally recognized by members of the trade and marketing men that price supports without reference to grade reduces the incentive to produce a high quality product.

Type of Buyer

"First buyers" were mainly grocery stores, country stations, and central plants. In South Dakota as well as in the Region, the stores bought the highest average quality of eggs (Table 10).

Table 10. Quality of Eggs at South Dakota Country Buying Stations By Type of Business, 1948

Type of Business	Percent A's not Including Stains & Dirties
Stores	70
Stations	42
Buying branches	37
Central plants	54
Combination receiver	54

This is contrary to commonly held opinion. The explanation may be that stores usually receive eggs from farmers who trade for groceries. For this reason, farmers may deliver eggs to these stores more often than if they were selling to other buyers. Also where eggs are largely bought on an ungraded basis the farmers have no incentive to sort out the eggs and take the poorest ones to the store, which, it

is often claimed, they do if they sell on the basis of grades.

Color of Egg Shells

In South Dakota, as well as in the Region, clean brown-shell eggs graded consistently higher than white eggs (Table 11). The number of stains and dirties was smaller with brown eggs.

The color of the shell has not been found to affect interior quality of eggs. The higher percent of A's amongst the brown eggs results partly from the low percent of stained and dirty A's. This may indicate a bias in grading since it is more difficult to detect stains on dark than on white shells. Such a bias may exist throughout the grading process.

But other factors, not tested here, may also be responsible and should be analyzed more fully. For instance, specialization on farms could account for the difference, though in South Dakota this does not seem to be the case. The greatest number of shipments consisted of mixed eggs (52 percent), the rest being about equally divided between white and brown eggs. Shipments of white eggs were larger on the average (35 dozen) than of brown eggs (29 dozen).

Table 11. Average Quality of Eggs, by Color of Shell, South Dakota, 1948

Color of Shell	Percent				
	A's	A Stains	A's Dirties	Total A's	Total Stains & Dirties
Brown	71	3	2	76	8
Cream	59	4	5	68	10
Mixed	50	8	4	62	23
White	52	8	5	65	26

Deterioration At Egg Buying Stations

Measurement of Quality Deterioration

One purpose of the study was to investigate the decline in egg quality after eggs were received by country buyers, and until they reached the central plants. There were two measures for this decline:

1. To compare eggs graded at the receiving stations *on the day* they were *received* from producers—"producer lots"—with eggs graded one or two days after receipt—"other receipts." There were 36,200 eggs in the first, 9,400 eggs in the latter category. Upon arrival at the stations the federal grader did not always find eggs that had been delivered the same day. He graded, then, those on hand that had been brought in one or two days before. The quality of "other receipts" was considerably lower. Part of the difference may be attributed to the fact that holding conditions at the buyers' were unsatisfactory and caused a quality decline. The difference was particularly noticeable in summer in South Dakota. It was also much larger in South Dakota than in the Region (Table 12).

Table 12. Percent of A Eggs on Delivery by Farmers (Producer Lots) and One or Two Days After (Other Receipts), South Dakota and North Central Region Compared, 1948

Type of Egg Sample and Period	Percent of Clean A's	
	South Dakota	Region
Producer Lots		
Average for 1948	55	67
Summer 1948	54	64
Other Receipts		
Average for 1948	34	60
Summer 1948	26	53

2. The other, more accurate, method of measuring interior quality decline was to grade eggs when received at the first buyer and again when received by the central plant. In South Dakota, 13,400 eggs (134 lots) were thus graded twice ("paired gradings") in spring and summer 1948.

Losses in quality in that stage of the marketing channel were severe, so that South Dakota's central plants received an average quality of eggs well inferior to the Region's (Fig. 3).

The spring loss was larger in South Dakota than the summer loss, probably because the number of A's was already low in the summer season at the first grading. The increase in checks was about 1 percent. Note that the loss of A's shown in Fig. 3, though a good measure of quality deterioration, does not show the full decline in quality. Some B eggs may decline to C grade, and the number of checks, leakers or inedible eggs can increase. On the whole, there is a tendency for the total quality loss to be smaller the higher the quality on the first grading.

Effect of Temperature and Holding Time

Temperature and length of time the eggs were kept at the station were again responsible for much of this loss.

In general, the higher the egg case temperature at the first grading, the greater the subsequent decline in over-all quality. In summer, 1948, almost 75 percent of the egg cases delivered at the stations had a case temperature of 70° and over, at the first

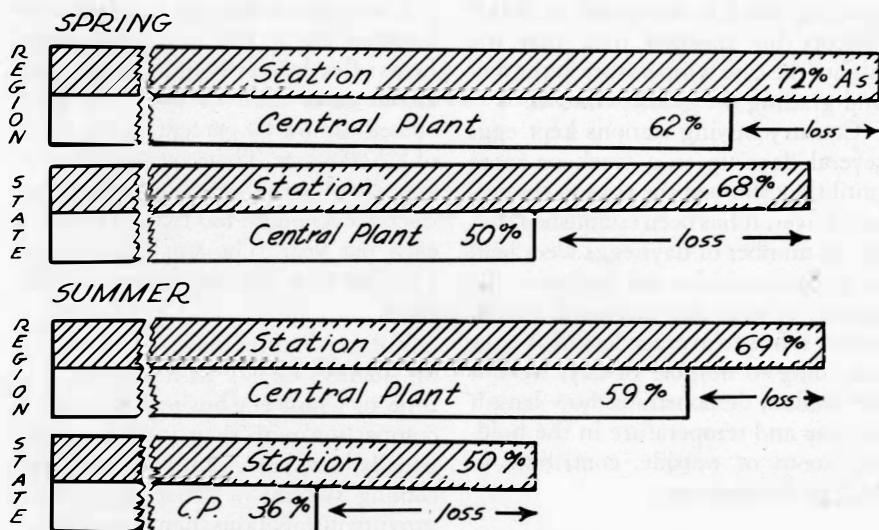
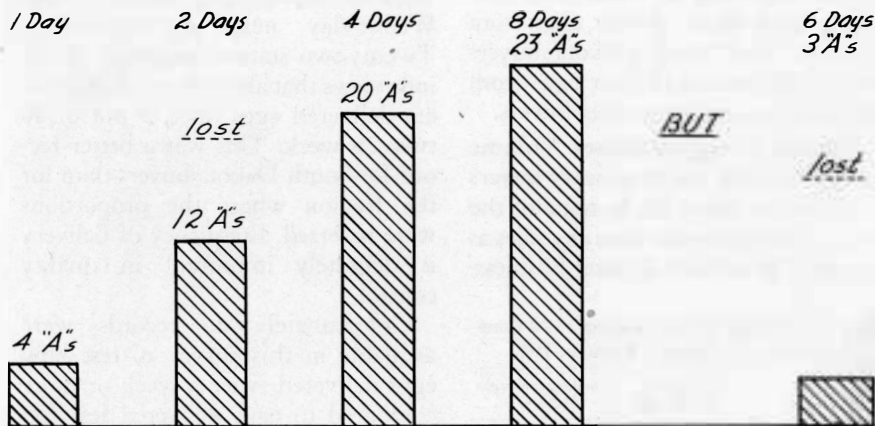


Fig. 3. Percent of A eggs (including stains and dirties) at the station and central plant, spring and summer, for South Dakota and the region, showing how many A eggs were lost between gradings.

100 Eggs Held Without Refrigeration in Summer

Held Under Refrigeration



1 day	.....	Average egg case temperature at first grading 64.7°	outside 83°
2 days	.....	Average egg case temperature at first grading 72.5°	outside 83°
4 days	.....	Average egg case temperature at first grading 78.9°	outside 88°
8 days	.....	Average egg case temperature at first grading 72.4°	outside 94°
6 days	.....	Average egg case temperature at first grading 59.8°	outside 74°

Fig. 4. Samples of 100 eggs held at country buyers with and without refrigeration in the summer, showing loss of A eggs into lower grades, 1948

grading. Also, it was found in South Dakota for summer data that the higher the case temperature at the second grading the greater the loss.

Country buying stations kept eggs several days up to a week or more until they shipped the eggs to the second buyer. It has been established that as the number of days eggs were held at the station increased, the loss in the quality of eggs also increased. Fig. 4, which refers to average loss of A eggs according to number of days held at the station, demonstrates how length of time and temperature in the holding room or outside, contribute to quality deterioration.

Characteristics of Country Buyers and Handling Methods Affecting Quality

Twenty-three country buyers, who handled most of the eggs graded, were interviewed in 1948.¹² Country buyers are defined here as those who buy the greatest share of their eggs from farmers. The South Dakota buyers bought 88 percent of their eggs from farmers, the rest from other buyers.

Volume of egg purchases. Volume of egg business for 20 country buyers is shown in Table 13. In none of the four classes of buyers were egg sales as much as 50 percent of total business.

Table 13. Volume of Egg Business of 20 Country Buyers, by Type of Business, 1947

Type of Buyer	Number Reporting*	Total Eggs Bought (Cases)
Retail stores	4	2,000
Produce stations	7	68,000
Cream stations	3	44,000
Others (creameries and hatcheries)	6	13,000
Total	20	126,000

*No data available for three buyers on volume of business.

The bulk of the egg business was handled by a few relatively large firms: five buyers bought more than 11,000 cases each in 1947 and purchased almost 80 percent of the total of 126,000 cases. Their average volume was 20,000 cases per year. Fifteen of the buyers bought less than 5,000 cases each per year. The smallest volume handled was 250, the largest, 30,000 cases.

Volume figures have this bearing on quality: buyers with a small volume, or whose egg business is small in comparison with their total business, usually have less incentive to invest in cooling systems or other quality-improving installations than those whose egg business is important.

Delivery by farmers and by station routes. Over 80 percent of the eggs were delivered to the station by farmers themselves. The heaviest day in the week for deliveries was Saturday with Wednesday next in importance. Twenty-two stations reported in the interviews that about 4 out of 10 farmers delivered eggs once, 5 out of 10 twice, a week. This was a better record for South Dakota buyers than for the Region where the proportions were reversed. Frequency of delivery is definitely important in quality control.

Unfortunately no records were available in this survey to test how eggs delivered twice a week or more compared to eggs delivered less frequently.¹³ Since South Dakota shows low average quality, it is likely that (a) either holding conditions on farms

¹²A few of the stations did not have any eggs at the time of the federal grader's visit, but they are included in following data.

¹³See however, p. 7.

are more responsible for poor quality than frequency of delivery; or (b) that the eggs actually graded were not delivered to the stations in the manner indicated in the interviews.

About 4 out of 10 South Dakota buyers had one, or several, truck-routes. Their average mileage was considerably greater than that in the region (87 miles for South Dakota and 50 miles for the Region), reflecting the scattering of South Dakota suppliers over a wide area.

Purchasing methods. Of the 23 buyers interviewed, only one reported that he bought all his eggs from farmers on a grade basis, although three purchased part of their eggs on a grade basis. Nineteen stations handled all eggs ungraded, i.e. current receipt, or "loss-off" (inedible eggs for which the buyer does not pay). As becomes apparent from Table 14, not all buyers candled all their eggs, since only 13 stations reported candling all eggs the year round and one station reported no candling whatever. Only two of the stations cleaned the soiled eggs they purchased.

Holding conditions and frequency of shipping to next buyer. Eight stations held all or part of their eggs in a refrigerated cooler. Others held eggs in the general storeroom, on the main floor or in the basement, where temperatures were not controlled. Of the

five buyers handling the largest volume of eggs (from 11,000 to 30,000 cases) three had refrigerated coolers, one used the basement, one the general storeroom. The last two buyers resold half or most of their eggs to egg breakers or driers directly, whereas the first three sold none to these outlets. This may indicate that the choice of outlets may be influenced by the quality of the product sold or in turn may affect the handling methods used. The other five, which were smaller receiving stations with refrigerators, were either creameries or produce houses having retail outlets. On the day of the survey, 15 stations were holding their eggs at a temperature ranging from 65 to 70°.

According to data obtained in the interviews, the movement of eggs from receiving stations to larger wholesale buyers was relatively frequent. Three of 23 stations reported shipping four or more times weekly, 9 three times, 7 twice, and 2 shipped once a week. This gave a somewhat more favorable picture than for the Region. Since the holding-time is an important factor affecting interior quality of the eggs at country receiving stations, these data do not explain why the decline in the quality of South Dakota eggs in this phase of the marketing channel is greater than in the Region.

Table 14. Candling Practices of 23 Egg Buyers, by Method of Purchase from Farmers, 1948

Method of Purchase from Farmers	Number of Stations Candling All Eggs	Number of Stations Not Candling All Eggs
Purchasing all or some eggs on graded basis	3	1*
Purchasing all eggs on loss-off method	6	7
Purchasing all eggs on current receipt basis	4	2

*This station reported grading some eggs, but also reported no candling.

A possible explanation may be that (a) eggs did not move so often as the stations reported in the interview (which took place in spring when volume was high); or (b) that the stations reporting frequent shipments were not amongst those whose eggs were graded by the federal grader. It must be remembered that the interview of buyers did not take place at the same time that eggs were graded by the federal grader.

At the time of grading, several stations volunteered further information

on frequency of shipment; at that time, only one reported three deliveries per week. All others reported either bi-weekly or weekly delivery to other buyers. This leaves some doubt as to the accuracy of the available information concerning the movement of eggs to wholesalers and indicates the need for further study.

Outlets. The 23 South Dakota country buying stations sold 19 percent of their eggs to egg breaking and drying plants. The largest share, 71 percent, went to central assembling plants.

Central Assembling Plants

Characteristics of Central Assembling Plants

Central assembling plants were defined as larger enterprises obtaining a considerable part of their egg supply from other egg buyers. In South Dakota, the central plants were selected with an emphasis on *volume* rather than on whether they obtained most of their eggs from other buyers. The sample of 11 plants is believed to be representative of the large egg dealing firms in the state (Table 15).

Table 15. Origin of Purchase of Eggs by Central Assembling Plants, South Dakota, 1947

Area	Proportion Bought	
	From Farmers Percent	From Other Buyers Percent
South Dakota	30	70
North Central Region	26	74

None of the 11 plants interviewed specialized in egg business to the exclusion of other lines of business, as in some other states of the North Central Region. Nine of 11 plants had a poul-

try, or poultry and creamery, business in addition to eggs. Two had an egg drying or breaking business. This reflected a substantial amount of diversification in each plant.

Volume of Eggs Handled

The 10 plants that reported egg volume data purchased 619,000 cases of eggs in 1947,¹⁴ ranging from 16,000 to over 200,000 cases. Six of these handled less than 40,000 cases of eggs per year and accounted for one-fourth of the purchases of the 10 plants. Only one plant sold over 100,000 cases, and it handled 45 percent of all egg purchases. South Dakota plants, with less than 40,000 cases, handled a larger proportion of all eggs bought than did the Region.

Source of Egg Supply

The 10 South Dakota plants reporting on volume bought, on the average, a somewhat larger share of their eggs from farmers (about 30 percent) than

¹⁴The total number of cases of eggs sold by farmers to all egg buyers in South Dakota in 1947 was estimated at 2,731,000.

the average plant in the Region (Table 15). The reason for that appears to be that central plants, shipping to large central markets outside of the state of South Dakota, relied more heavily on farm truck routes or farmers' door-deliveries to supplement their supply of higher grade eggs.

Producers' eggs received by central plants were of a higher average quality (58 percent A's excluding stains and dirties) than those received by stations (50 percent). Eggs received by the plants from other buyers were of considerably lower quality because of the quality deterioration occurring at the stations (Table 16).

Table 16. Average Quality of Eggs Received By Central Assembling Plants, By Source of Supply and By Season, South Dakota, 1948

Season	Percent of A Eggs Received by Central Plants*	
	From Farmers	From Other Buyers
Spring	68	51
Summer	59	36
Fall	70	—

*Including stains and dirties.

In fact it was observed that the larger the proportion of eggs purchased by central plants from farmers, the larger was the proportion of eggs resold by these plants to other wholesalers or retailers; and that plants selling heavily to egg driers or breakers

(or those having their own drying or breaking facilities) leaned the heaviest on other buyers for their source of supply.

A slightly larger proportion of South Dakota firms operated farm truck routes to assure themselves of a steady supply of eggs than in the Region. Six plants had, on the average, four farm routes averaging 62 miles per round trip and picked up the eggs on the farm once or twice a week (usually twice in summer). Six of the eleven plants had dealer routes: three of them had twice-weekly routes; one (the largest plant) thrice-weekly; the other two varied from one to three times per week.

Also, in 1947, most of South Dakota plants purchased their eggs from farmers on the basis of grades—both when door delivered or collected on truck routes (Table 17).

The two South Dakota central plants which operated an egg drying or breaking business purchased *all* their eggs from other buyers on a current receipt basis and did not operate any farm truck routes at the time of the survey.

Holding Time and Conditions

Eggs were held in the plants for periods ranging from two days to two weeks. Several plants reported shipping eggs more often in spring

Table 17. Proportion of Central Assembling Plants Buying Eggs on Grade or Ungraded, From Farmers or Other Buyers, South Dakota and Region, 1947

Area	From Farmers		From Other Buyers	
	On Grades	Ungraded	On Grades	Ungraded
South Dakota	82	18	36	64
North Central Region*	53	36	19	70

*Some firms bought both on grades and ungraded; they are not included here. In South Dakota the firms bought either on grades or ungraded.

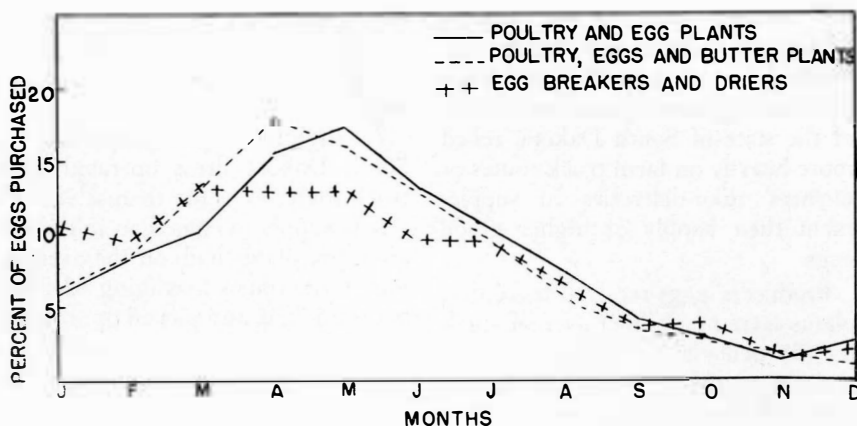


Fig. 5. Monthly egg purchases by 10 South Dakota central assembling plants, 1947

(April) than in summer or fall. Therefore volume was a factor in holding time within some individual firms, since the largest volume of eggs is received in April (Fig. 5). However, the small South Dakota plants did not hold eggs any longer than the larger ones. Plants selling heavily to breakers and driers held eggs somewhat longer than plants selling to other outlets. Except for one firm, all had satisfactory temperature controlled storage facilities.

Outlets

In South Dakota, close to 50 percent of the eggs handled by the large buyers went into an egg breaking or dry-

ing business in 1947, whereas for the Region as a whole, wholesale receivers were the most important outlet for central assembling plants (Table 18).

Under rules and regulations of the USDA Production and Marketing Administration—an important buyer in 1947 and 1948 of dried and frozen eggs—clean or stained edible eggs as well as eggs “with loose adhering dirt on the shells,” after being washed could be used in the production of dried or frozen eggs for sale with official identification, regardless of interior or exterior quality. These buying and processing methods furnished no incentive for the improvement of quality by farmers or first receivers.

Table 18. Proportion of Eggs From Assembling Plants Going to Various Market Outlets, South Dakota and North Central Region, 1947

Area	Percent of Eggs Sold to				
	Local	Wholesale Receivers	Company Branch	Hucksters, Chains, and Dairies	Breakers & Driers
South Dakota	2	27	23	*	47
Region	8	41	12		29

*Less than 1 percent.

Economic Aspects of Quality

The quality of South Dakota eggs and the *physical* factors affecting the loss in A eggs as they move from the producers to the central assembling plants have been described. The information may prove helpful in directing farmers, country buyers and assembling plants in their efforts to better the quality of this important agricultural product.

Deterioration of Quality Results in Economic Losses

The production of top quality agricultural products and the prevention of losses in marketing channels are often advocated as an *ideal* to be reached by all producers, and handlers:¹⁵ by producing and marketing a product of uniform and high quality, marketing costs can be reduced, and further, high quality will result in higher returns to farmers because of higher prices paid by the consumers for quality products.¹⁶ This assumes, rightly or wrongly, that the price differential obtained for higher grades will remain the same after greater quantities of top quality products reach the market.

Quality deterioration represents an economic loss which can be estimated with prevailing price-relationships. For instance, for the North Central Region as a whole, in terms of 1948 prices, there was a loss of \$28.30 for each 100 cases of eggs because of the over-all decline in quality between country buyers and the large wholesale receivers.¹⁷

Such direct losses are also serious in South Dakota. They may be small for

the individual farmer, but in the aggregate, they may be painful. In addition to direct losses, *indirect* losses should be taken into account, though it may be difficult to assess them in terms of dollars and cents. The production of poor quality and ununiform produce may decrease the bargaining power of the farmer or the firm; it may be a factor which increases business risks and reduces long run net profits. In addition, if eggs become inedible by the time they reach the consumers, the loss of a market may result.

Attainment of High Quality Not Always Economically Feasible or Desirable

Though arguments in favor of reaching the ideal of a 100 percent top-grade production of eggs are numerous, this goal cannot be advocated without qualifications. Especially in South Dakota, the question arises whether the quality aspect is not over-emphasized. Perhaps the South Dakota industry operates most efficiently at its present level. Investments on farms and in plants (such as refrigeration) or added marketing costs, necessary to maintain quality may not result in sufficiently higher returns. Before the production of 100 percent A eggs is advocated for South Dakota,

¹⁵See regional publication, *Changes in Egg Quality During Marketing*, North Central Regional Publication 15, Special Bulletin 361, Michigan State College, Aug. 1949.

¹⁶For an analysis of how a decrease in deterioration may result in reduced marketing costs, see: *Marketing Eggs in the Lake States*, University of Wisconsin, Res. Bull. 168, July 1950, pp. 12 ff.

¹⁷*Changes in Egg Quality During Marketing*, Op. Cit., pp. 15 and 23.

further studies should reveal first the economic reasons why South Dakota farmers do not produce higher quality eggs.

In answering this question, the following points should not be overlooked:

1. Quality is an important, but not the only, factor influencing the price of eggs in large markets. Condition of packages, size and uniformity of shipments, availability, may be other factors determining sale price in markets.

2. There usually exists a demand for a lower priced product where quality is not so essential. Eggs can be frozen or dried, instead of being consumed fresh, and can be used in that form by industrial users. In 1947-48, egg driers or breakers were important buyers in South Dakota for both egg receiving stations and central assembling plants. They are lower price outlets, but they may offer sufficient returns to South Dakota farmers who consider the sale of eggs an incidental farm enterprise.

3. High quality and improvement may or may not be necessary to maintain an industry's relative position. The available data show that South Dakota's egg industry appears to have maintained a relatively stable share of total United States production: that is, about 2 percent over the past 25 years. Cash income from eggs as a proportion of total cash farm income in South Dakota has not varied greatly in the long run. On the average, between 1925 and 1948, cash income from eggs was 5.1 percent of total cash farm income in South Dakota. However, the spread between average

South Dakota farm prices and average United States farm prices for eggs has increased from 2 to 3 cents in the 1930's to 8 cents in 1945 to 1948. During the past decade, two factors, a strong war and post-war demand for eggs and by-products and the price-support program, have encouraged egg production but reduced the incentive to supply a quality product.

4. The added returns from improved quality to South Dakota farmers, many of whom sold not more than one case of eggs to egg stations in 1948, should be greater, or equal to, the increased costs incurred to improve egg quality, or the improvement is not economically justified. Increased profits from improved quality can usually arise only if eggs are purchased by the buyers on the basis of grades. The producer of good quality eggs is penalized if he sells his product ungraded.

A simple illustration should demonstrate the dollar and cents advantages of selling good quality eggs on grade. Assume that:

a. Farmer X follows all good practices in the chicken house and in storing eggs at low temperature. He ships a case of eggs which grades out as follows (ignoring size and weight of eggs): 80 percent A's, 10 percent B's and 10 percent C's, dirties and stains.

b. Farmer Z follows poor practices, keeps eggs in warm storage. His eggs grade out as follows: 40 percent A's, 30 percent B's, and 30 percent C's, dirties and stains.

Since the price differential between grade A and grade B varies within seasons, let us assume first a small (3 cents), and then a larger (10 cents)

Table 19. Total Gross Returns With a Small Price Differential (3 Cents Between Grades A and B)

Grade	Price per Dozen	Farmer X		Farmer Z	
		Number of Dozen	Gross Receipts	Number of Dozen	Gross Receipts
A	\$0.38	24	\$ 9.12	12	\$ 4.56
B	.35	3	1.05	9	3.15
C, stains and dirties	.26	3	.78	9	2.34
Total gross receipts			\$10.95		\$10.05

Table 20. Total Gross Returns With a Large Price Differential (10 cents)

Grade	Price per Dozen	Farmer X		Farmer Z	
		Number of Dozen	Gross Receipts	Number of Dozen	Gross Receipts
A	\$0.42	24	\$10.08	12	\$ 5.04
B	0.32	3	.96	9	2.88
C, stains & dirties	0.26	3	.78	9	2.34
Total gross receipts			\$11.82		\$10.26

differential. The gross returns of the producers will then be as shown in Tables 19 and 20.

With the small differential, the added gross returns would be 90 cents per case; with the larger differential \$1.56 per case. On a yearly basis the total added income in this illustration would lie between \$50 and \$80, if the two farmers should continue to produce the same quality all year and market one case of eggs per week.

5. It is more difficult to compute the *costs* of improving quality. They include *direct* costs such as alterations in chicken houses, or bettering egg storage facilities, or costs resulting from more frequent deliveries; or *indirect* costs such as those resulting from failure to invest *time, money* and *effort* in other more profitable enterprises. These costs vary from farm to farm. Though difficult to estimate, they are real costs, and are taken into consideration by South Dakota farmers. The competition of other, more profitable enterprises may be one of the impor-

tant reasons why farmers market low quality eggs, and why there are not more large-scale chicken enterprises on South Dakota farms.¹⁸

With larger laying flocks, and larger egg shipments, the added returns from improved quality are likely to increase faster than the extra cost. If and when a flock of 500 or more chickens becomes more common in South Dakota, egg quality is likely to improve. As the chicken enterprise becomes a more important source of income on the farm, management and marketing methods tend to become better. For instance in Minnesota, farms with flocks of over 200 birds tended to produce better eggs than farms with smaller flocks.¹⁹

6. Similar reasoning applies to egg buying stations and central plants which can prevent part of the quality

¹⁸In 1945, 1475 farms reported flocks with over 400 birds. Ag. Census 1945, Special Report, Sample Census of Agriculture.

¹⁹See "Management Practices Affect Egg Quality" by Taylor and Waite in *Farm Business Notes*, Minnesota University, Agricultural Extension, Oct. 28, 1949.

decline by using better methods of handling and storing, or by collecting eggs more frequently. A relatively small volume of egg purchases and long mileage of truck routes may make such improvements too costly.

7. The absence of large consumer markets in the state may be a factor

in making farmers less alert to differences in quality. Even with sufficient economic incentives, an educational program is probably necessary to make farmers aware of the economic advantages of production of high quality eggs.²⁰

Summary and Conclusions

The main results of the two surveys, can be summarized as follows:

1. A truck route case study showed that adequate temperature of the farm storage room was the main factor in keeping egg quality high. Holding temperature is not always adequate in places of storage such as basements, though often believed to be satisfactory. The number of stained and dirty eggs is considerably larger if eggs are gathered only once a day, than if they are gathered three or more times a day.

2. The largest decline in egg quality took place before eggs reached the first buyer. Only slightly more than one-half of the eggs marketed by South Dakota's farmers were of clean A quality. South Dakota's eggs were considerably lower in quality than eggs produced in other parts of the country.

3. After arriving at the country buying stations, eggs suffered a further substantial decline in quality due to lack of refrigeration and infrequent

shipments. By the time eggs arrived at the central assembling plants, they averaged 36 percent A's, including stains and dirties, in the summer of 1948.

4. A large percentage of South Dakota eggs was sold to egg breaking or drying plants in 1948 where quality was not an essential factor.

5. The low egg prices that South Dakota farmers have received for the past few years are partly a reflection of poor quality. Improvement in the quality of South Dakota egg production is often advocated because it would result in greater returns for farmers. However, each farmer and buyer must investigate thoroughly whether the additional costs spent in the process of improving quality will be at least offset by additional returns. The goal of higher egg quality is not in all cases economically desirable; it is so only under favorable price, cost and market conditions.

²⁰The South Dakota Extension Service has a circular for practical, inexpensive equipment that can be put together on the farm. *Egg Coolers*, South Dakota State College, Agr. Ext. Service, Circ. 425, June 1949.