Egg Marketing (handwritten)

Costs of Candling and Cartoning Eggs

FACTORS AFFECTING THE COST OF
CUSTOM GRADING AND CARTONING EGGS
AT FOUR PENNSYLVANIA COOPERATIVES,
1948—1949

CONTENTS

COST OF CANDLING AND CARTONING EGGS[*]

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Introduction

A recent development in the marketing of eggs in Pennsylvania has been the marked increase in the volume of eggs graded and packed in one-dozen cartons by country-point dealers for direct sale to city retailing outlets. Although this method was in use prior to World War II, it has developed to its present volume primarily during and following the war. This development represents in part some shift of the grading and cartoning operation from the city wholesalers, jobbers and retailers to the country-point dealers and in part the increase that has occurred in the proportion of eggs graded and retailed in cartons.

The trend toward cartoning by country-point dealers is not, of course, limited to Pennsylvania. However, it probably has been most pronounced in the deficit producing areas such as in the northeastern states. In this area a major competitive advantage in producing eggs is the premium paid in nearby markets for "fresh" or high quality eggs. Through grading and cartoning immediately upon receipt from producers and through direct movement to retail outlets or distribution points, this operation tends to reduce the number of handlings and the period of time eggs are in the marketing channel. This and the candling and size grading, if properly done, tend to retain and provide the quality necessary for premium prices.

The quality factor and the convenience of obtaining cartoned "nearby" eggs from a known source and of the specific size and quality desired for their trade make cartoning a service that is desired by many retail outlets. Since labor represents a major cost in grading and cartoning eggs, lower wage rates at country-points as compared to large cities probably has encouraged the shift of the cartoning operation from wholesalers and jobbers in large cities to country-points.

Viewed from the standpoint of economies attainable through large volume operations, the channeling of the higher qualities direct to retail stores and the reduction in shipping and handling charges by the removal of the lower grades, country-point candling and cartoning possibly could develop to include a large proportion of eggs marketed.

However, its development will depend partly on the cost of performing the service. Because of the amount of hand labor used and the price loss on undergrades, in addition to the costs for supplies and equipment, the total cost of grading and cartoning represents a large item in the cost of marketing cartoned eggs. The cost is subject to considerable variation depending on price differentials existing between various qualities of eggs, the yield of cartoned eggs, the speed of candling and other factors. High costs, since they have the effect of raising prices to consumers, tend to limit the use of this method of marketing while variations in costs create difficulties in reflecting equitable prices to both producers and consumers for the different color, size, and quality grades of eggs. Thus the accurate determination of costs, their control, and methods of reducing them are problems that merit considerable attention.

Purpose and Scope

The major cost items common to all candling and cartoning operations are labor, package expense, and replacement cost, sometimes called candling loss by the trade (see page 6). This study was undertaken to provide information on these direct major costs and to determine the effect of factors causing variations in them. Information was also obtained relative to other costs but because of the small number of operations studied and the fact that many of these other costs were joint costs with other phases of the business of these plants, the results have limited application and were not included in this report.

The study was limited to a determination of costs and variations in costs for operations using comparable wholesale and retail grades. Two of the important cost items, replacement cost and labor expense, are materially affected by the yield of cartoned eggs obtained. Since yield is dependent upon the grade of eggs used and cartoned, the costs for operations using different grade standards can vary considerably. In addition the replacement cost is affected by the spread in prices between wholesale grades used and undergrades removed. The spread in prices tends to fluctuate seasonally and from year to year depending on supply and demand conditions. The money costs shown, therefore, are representative only of the costs for plants using comparable grade standards and work methods and for the price situation prevailing during the period studied. However, the data on the physical quantities involved, the effect of various factors on total costs and the scale of costs computed on the basis of actual operating data should be useful as a source of information to those currently engaged in a cartoning program or those considering starting such a program.

Collection of Data

Data were obtained on the candling and cartoning operations of four Pennsylvania cooperative egg marketing associations for the 12-month period, July 1948 to June 1949, inclusive. These cooperatives were selected because all used the same wholesale and retail grades for the eggs handled. Prior to collecting the data, records currently kept by the cooperatives were reviewed and arrangements made for recording additional information required for computing the costs. Subsequently regular visits were made to obtain the current information.

The records kept by each of the cooperatives and the summaries they made according to their respective operating periods provided information on the costs for labor, replacement cost, supplies, equipment rental, and inspection for the over-all candling and cartoning operations. Two of the associations operated and kept records in such a manner that information was available currently for calculating the replacement cost and labor cost for each of the different grades used and cartoned. The other two worked different grades simultaneously and did not keep records providing this detail by grades for their entire operation. To obtain this information each week a different candler was given record sheets on which the candler recorded the wholesale grade, the time required to work the 30 dozens and the count of cartoned eggs and of the various types of undergrades for each case worked. Thus for two associations labor and yield for the different grades were determined from a sample rather than the over-all operation.

Method of Plant Operation

The four cooperative egg marketing associations which provided the data on cartoning costs are located in southeastern Pennsylvania, an area which produces a large volume of eggs. All started operating in the early 1930's and sold eggs of their producer members in case lots by the auction method. Selling by auction continued until during World War II when price ceilings and the lack of buyers at sales made this method impracticable. At that time the method of selling was changed to one of negotiation between the cooperatives and the buyers. The latter method was used by all the cooperatives during the period studied.

Since starting operations each of the cooperatives has graded the eggs of producers by inspection according to the Pennsylvania Wholesale Grades as to quality and weight and has further classified them according to size by indicating the net weight of each case. Brown and white shelled eggs were packed separately. These color, quality, and weight classes served as the basis for selling and for payments to producers. Thus the varying returns for quality and size have provided an incentive for producers to deliver packs of high quality, uniformly sized eggs.

The custom candling and cartoning operation was initiated by one of the cooperatives in 1941. Starting from a small scale each of the four cooperatives now provides this service as part of its merchandising program for the sale of high quality eggs. However, the extent to which this method was used varied considerably among the four cooperatives. In the 12-month period studied, the proportion of the total volume of eggs used in the cartoning operation ranged from a low of 2.6 per cent for one cooperative to a high of 25.9 per cent for another, table 1. Within each cooperative the cartoning operation was set up as a separate department. The cooperative with the small cartoning volume carried on its cartoning operation with the part-time work of the employees of the regular wholesale handling operation. The other three cooperatives maintained a corps of employees in a cartoning department.

Eggs used to fill orders of buyers of cartoned eggs were purchased or transferred from the wholesale department and candled and cartoned according to the specifications of the buyers. Buyers of the cartoned eggs paid the wholesale price plus a charge to cover the cost of the candling and cartoning service and of delivery service if the latter was provided. The operations of all four cooperatives generally were comparable in respect to grades used and cartoned. Each utilized principally Fancy and Extras eggs graded according to the Pennsylvania Wholesale Grades for putting up the cartoned product. The four cooperatives graded and cartoned under Federal-State supervision and the cartoned product met the minimum requirements of the U. S. Consumer Grades AA and A. Many of the cartoned eggs were for the same buyers. The specifications of some buyers were above the minimum requirements of the U. S. Consumer Grades for which they were labeled.

Three of the four cooperatives were equipped with carton set-up machines for automatically assembling cartons, conveyor belts for moving the filled cartons from the candling benches to the closing machines, and packing tables and automatic closing and sealing machines. In the fourth, which cartoned a relatively small volume, the candling and cartoning was entirely a bench operation. The cooperative with the largest facilities for candling and cartoning had a candling room for 20 candlers, ten on either side of the conveyor belt. All used roller conveyors, skids or pallets and hand trucks in various manners as aids in handling the 30 and 15 dozen packed cases.

Volume and Seasonality of the Cartoning Operations

During the 12-month period, the four cooperatives marketed a total of 602,433 30-dozen cases of eggs for their members. Of this total 119,365 cases, or 19.5 per cent, were used in the cartoning program. Both the total volume marketed and the volume used for cartoning showed considerable seasonal variation. While the total volume marketed averaged approximately 50,000 cases per month it ranged from a low of about 40,000 cases in September to a high of nearly 55,000 cases in March. In general, the volume used for cartoning showed a similar seasonal trend, ranging from a low of less than 8,000 cases in August to a high of nearly 11,000 cases in March, table 1 and figure 1.

By providing an outlet for the sale of larger quantities of eggs when the supply to be marketed was seasonally high and for smaller quantities when the supply decreases seasonally, the cartoning program facilitated the marketing operations of the cooperatives. However, as will be pointed out later in connection with labor costs, the seasonal fluctuation in cartoning volumes entails a problem in maintaining efficient operations in respect to the use of labor in the candling operation. Because of the importance of the efficient use of labor, it raises the question of the feasibility of cartoning and promoting the sale of lower quality cartoned eggs to sell at competitively lower prices during the late summer and fall when labor was least efficiently used.

Table 1. Volume of Eggs Marketed and Used in Cartoning and Per Cent Used in
Cartoning, Four Pennsylvania Cooperatives, 1948 - 49.
(weighted averages)

Approximate period*	Total volume of eggs marketed	Total volume used in cartoning	Per cent of total volume used in cartoning	
	Index**	Index**	Weighted average	Range among cooperatives
July	89	92	20.1	4.7 - 27.1
August	88	86	19.0	4.0 - 23.9
September	85	95	21.6	4.4 - 25.5
October	89	90	19.6	2.9 - 25.3
November	101	88	17.1	1.6 - 23.3
December	105	109	20.2	2.5 - 28.2
January	108	111	20.0	2.1 - 29.2
February	114	108	18.5	1.9 - 25.3
March	117	117	19.6	1.6 - 28.8
April	104	104	19.6	2.7 - 26.2
May	106	102	18.8	1.8 - 27.1
June	95	98	20.2	2.2 - 26.5
	30 dozen cases	30 dozen cases		
Total	602,433	119,365		
Average per period	50,203	9,947	19.5	2.6 - 25.9

*To compute the monthly indexes of volume, data for the two cooperatives
which maintained their records by four week periods were converted
from a 13 to 12 period basis.
**Average of 12 periods equals 100.

Figure 1. Index of Seasonal Variation of Total Volume of Eggs Marketed and
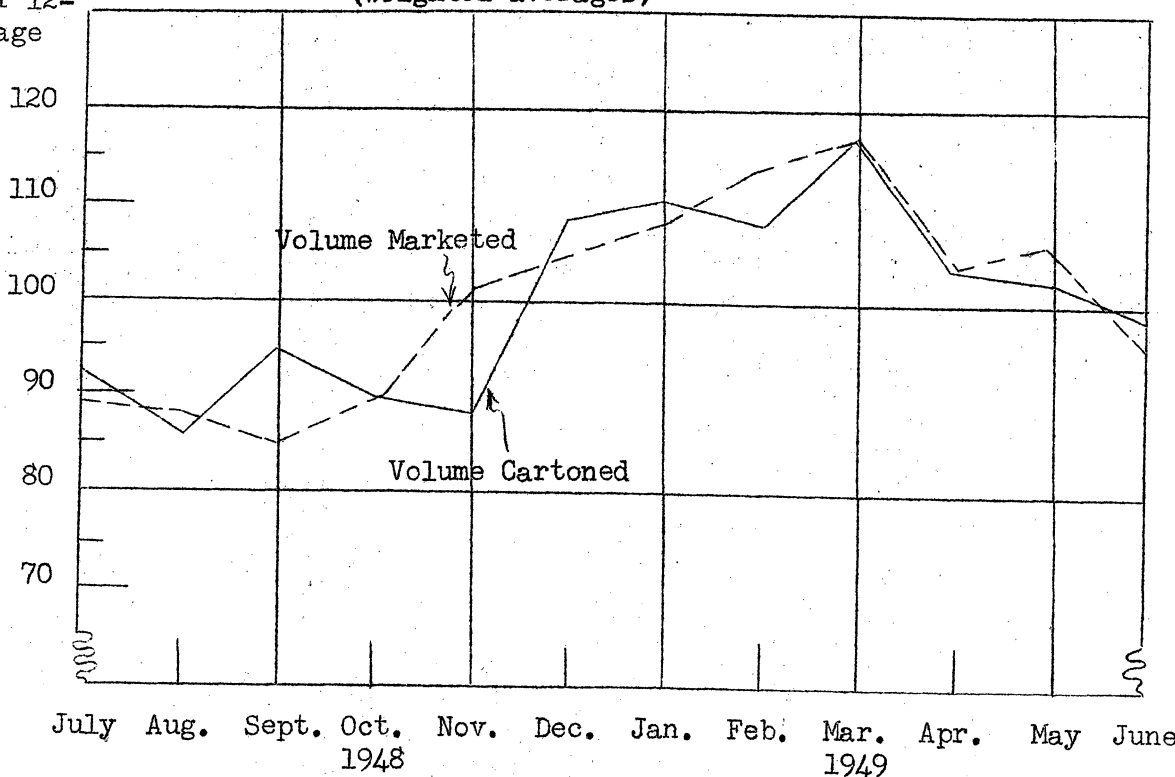Used in Cartoning, Four Pennsylvania Cooperatives, 1948 - 49.
(weighted averages)

Direct Costs of Candling and Cartoning

Data obtained from the four cooperatives provided information on the direct costs involved in their candling and cartoning operations. These direct costs were classified into the following categories:

1. Replacement cost.
2. Labor cost.
3. Supply cost (including packages).

Replacement Cost

Replacement cost per dozen cartoned represents the cost incurred due to the difference in price between the wholesale grade used and the off-grades removed, and due to the loss in value of eggs dropped and broken in the candling and cartoning operation. Shortages of eggs in the wholesale pack also may contribute to replacement cost. However, price loss on the off-grades removed is the primary item in replacement cost. It varied with the:

1. Yield of cartoned and various off-grades of eggs.

2. Spread between the price of wholesale grades used and the average price of all off-grades removed.

High yields of the cartoned grade and a narrow spread between the prices of the wholesale grades used and of the off-grades removed served to reduce the replacement cost. Low yields and wide price spreads increased the cost.

Yields - The average yield of cartoned eggs for the combined operations amounted to 88.68 per cent for the 12-month period. By periods the yield of cartoned grades varied from a high of 91.73 per cent in the December period to a low of 82.81 per cent in the June period, table 2.

Yields of around 90 per cent were maintained through the January period. The drop in yield of cartoned eggs during the last five periods was due partially to an increased volume of cartoning done by one cooperative. This necessitated the working of lower wholesale grades with correspondingly lower cartoned yields. Also all cooperatives reported the prevalence of New Castle disease in many supplying flocks, to which they attributed the production of weak watery whites and a resultant reduction in the proportion of high quality eggs.

Table 2. Yield of Various Grades Obtained in Candling and Cartoning Operations,
Four Pennsylvania Cooperatives, 1948 - 49.
(weighted averages)

Period	Cartoned eggs	Jumbo	Producers* or Standards	Checks or Cracks	Leakers	Bloods	Loss
				per cent			
July	89.71	.26	2.78	5.25	.37	1.44	.19
August	90.85	.31	1.63	5.42	.35	1.34	.10
September	89.95	.65	1.93	5.89	.25	1.19	.14
October	89.50	.81	2.65	5.37	.22	1.31	.14
November	91.24	.85	1.25	5.32	.21	1.02	.11
December	91.73	.60	.77	5.03	.22	1.42	.23
January	91.32	.40	.83	5.33	.21	1.72	.19
February	88.09	.42	3.01	6.09	.22	1.91	.26
March	87.24	.32	4.07	5.96	.23	1.99	.19
April	85.47	.30	5.73	6.24	.27	1.85	.14
May	84.07	.36	7.38	6.09	.29	1.64	.17
June	82.81	.41	7.93	6.56	.36	1.65	.28
Average	88.68	.48	3.17	5.68	.26	1.55	.18

*Producers - Not an official Pennsylvania grade. Includes eggs not
uniformly packed as to size, shell color and cleanliness of shell.

Exclusive of the over-sized Jumbo eggs, off-grades and loss
accounted for 10.84 per cent of all eggs candled during the 12-month
period. Of this 10.84 per cent, more than one half (5.94 per cent) were
eggs with defective shells, namely checks, cracks and leakers. In addition,
some of the loss recorded may have been eggs broken too badly to salvage.
Eggs with defective shells accounted for the largest share of off-grades
in all months except May and June, when they were exceeded by the yield
of eggs of the Producers or Standards classification. The average yield of
Producers and Standards for the 12-month period was 3.17 per cent. However,
when the yield of cartoned eggs declined in the later months, the yield of
Producers or Standards increased to a high of 7.93 per cent in June. Al-
though loss amounted to only about two tenths of one per cent for the year,
it represented a complete monetary loss. The other types of off-grades did
yield some return, as the eggs containing blood spots were sold for dog
and fox food.

The yield of cartoned eggs was quite variable among cooperatives, depending on the nature of the individual cartoning operation, and the quality of the eggs candled. Among the four cooperatives, the average yield for the 12-month period ranged from a low of 86.42 per cent to a high of 95.07 per cent, Table 3. In each period the same cooperative had

Table 3. Yield of Cartoned Eggs, Four Pennsylvania Cooperatives, 1948-49.

| Period | Yield of cartoned eggs | |
	Range among the four cooperatives	Weighted average
	- - - - - - - -per cent- - - - - - - -	
July	88.31 - 95.58	89.71
August	89.31 - 95.21	90.85
September	88.53 - 94.69	89.95
October	87.68 - 94.57	89.50
November	89.87 - 96.04	91.24
December	91.13 - 95.45	91.73
January	90.33 - 94.60	91.32
February	85.68 - 94.73	88.09
March	84.46 - 95.07	87.24
April	80.92 - 95.31	85.47
May	79.24 - 94.53	84.07
June	77.50 - 94.79	82.81
Average	86.42 - 95.07	88.68

the highest yield of cartoned eggs. At this cooperative the cartoning operation used only a small proportion of all the eggs handled. As a result this operation could exercise more selection as to the quality of eggs used and maintained consistently high yields.

Price Spread - The average price of wholesale grades used in the cartoning operations during the 12-month period was 62.51 cents per dozen. Off-grades were sold for an average of 45.18 cents, or at an average price loss of 17.33 cents per dozen. However, the price of eggs used varied widely from a low of 51 cents per dozen in February to a high of 76 cents per dozen in October. The price of off-grades sold followed the same general price movement, but the changes were of lesser magnitude. As a result the spread between those prices (price loss on off-grades) varied considerably over the year, from 11.75 cents in May to 26.82 cents in August, table 4 and figure 2.

To determine if the variations in price loss on off-grades were typical of the usual changes in price differentials among grades, an analysis was made of the seasonal price spread between two top quality grades and two off-grades most common to the cartoning operation, as sold in 30-dozen cases through the wholesale departments of the four cooperatives during the years 1947 through 1949, tables 5 and 6 and figures 3 and 4.

Table 4. Yield of Cartoned Eggs, Price of Eggs Used, Price of Off-grades
Sold and Replacement Cost per Dozen of Cartoned Eggs, Four Pennsyl-
vania Cooperatives, 1948 - 49.
(weighted averages)

Period	Yield of car- toned eggs	Price of wholesale grades used	Price of off-grades sold	Price loss on off grades	Replacement cost per dozen of cartoned eggs
	per cent	- - - - - cents per dozen - - - - - -			Cents
July	89.71	68.39	42.91	25.48	2.93
August	90.85	72.56	45.74	26.82	2.71
September	89.95	74.18	48.75	25.43	2.85
October	89.50	76.09	52.35	23.74	2.78
November	91.24	71.57	52.28	19.29	1.86
December	91.73	61.48	45.35	16.13	1.45
January	91.32	51.14	37.87	13.27	1.26
February	88.09	50.99	39.07	11.92	1.61
March	87.24	54.46	41.43	13.03	1.91
April	85.47	58.02	44.34	13.68	2.32
May	84.07	58.69	46.94	11.75	2.23
June	82.81	60.79	47.68	13.11	2.72
Average	88.68	62.51	45.18	17.33	2.21

Figure 2. Price per Dozen of Wholesale Grades Used and Off-grades Sold, and
Price Loss per Dozen on Off-grades, Four Pennsylvania Cooperatives,
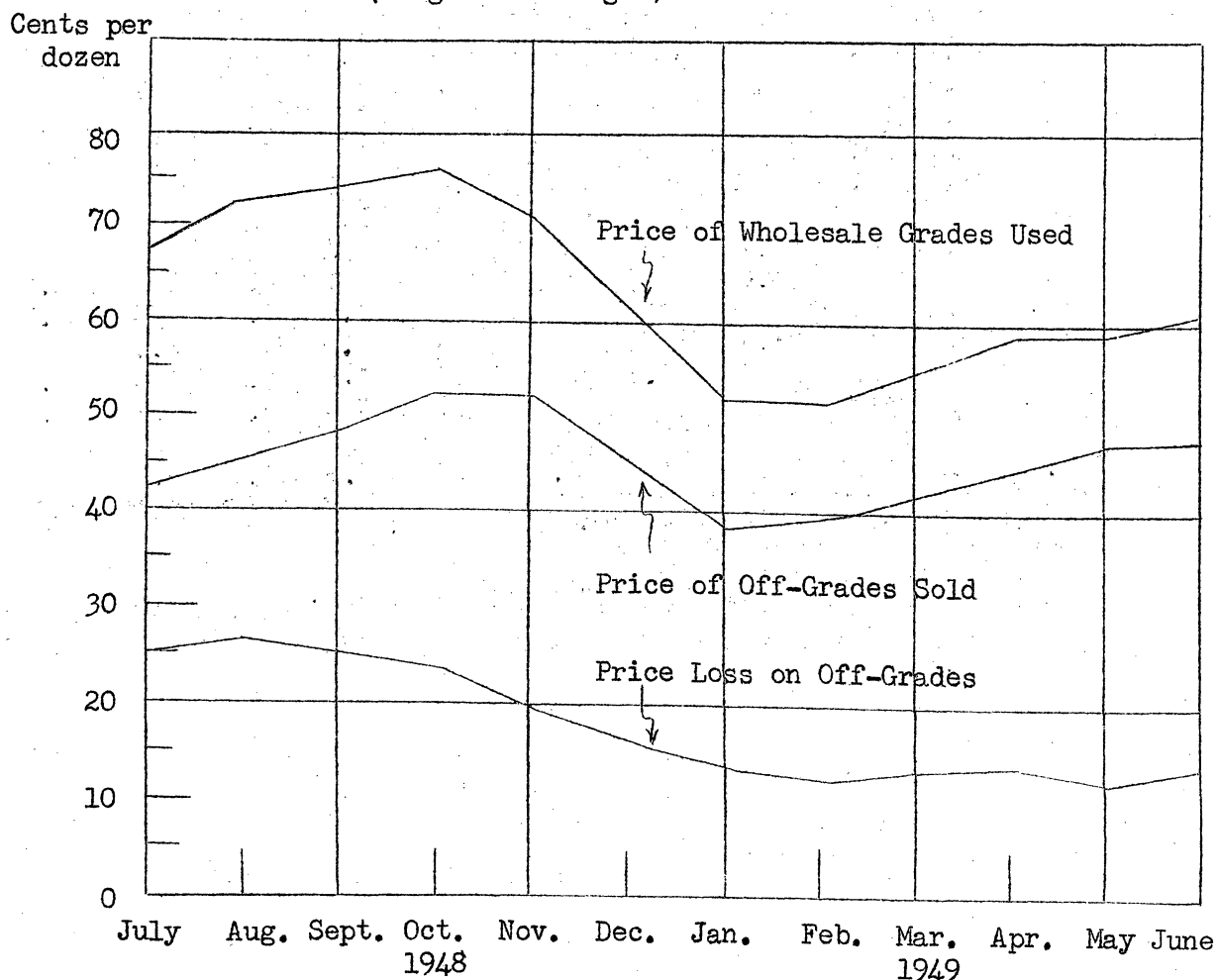1948 - 49.
(weighted averages)

Table 5. Average Selling Price of Selected Wholesale Grades of Large White Eggs, Four Pennsylvania Cooperatives, 1947, 1948 and 1949.*

Month	Fancy			Extras			Standards			Cracks**		
	1947	1948	1949	1947	1948	1949	1947	1948	1949	1947	1948	1949
						cents per dozen						
Jan.	54.9#	64.3	60.6	53.4#	62.3	58.0	48.2#	57.2	55.4	37.4	46.6	44.6
Feb.	48.8#	61.7	51.7	48.1#	59.2	49.1	43.6#	53.1	46.2	35.1	43.1	41.0
Mar.	54.5#	56.0	54.3	53.7#	54.2	52.1	48.5#	50.6	48.7	38.3	40.6	40.5
April	55.9#	56.1	60.7	54.8#	54.8	59.0	50.2#	50.2	54.5	39.9	40.4	41.7
May	53.9	57.2	59.4	52.2	56.1	57.4	48.3	51.5	53.3	37.5	39.8	41.1
June	58.5	64.3	63.0	57.2	63.2	61.0	52.2	58.5	56.6	39.1	41.3	40.5
July	67.1	70.6	69.9	65.7	69.3	67.8	59.3	61.8	61.9	41.7	41.3	39.6
Aug.	72.9	77.0	75.4	71.5	75.7	73.4	61.7	66.8	65.8	41.5	41.2	37.3
Sept.	78.9	80.9	79.5	76.7	79.5	76.9	66.2	69.0	67.9	45.7	43.1	41.5
Oct.	77.4	85.3	71.7	75.6	82.8	68.6	67.3	73.2	60.2	47.8	46.2	39.9
Nov.	76.0	78.1	65.4	74.8	75.8	62.2	67.1	70.2	55.6	47.0	49.0	40.6
Dec.	72.5	65.9	53.1	70.4	63.6	49.9	66.4	60.4	45.0	49.8	48.1	35.9
Ave.	64.3	68.1	63.7	62.8	66.4	61.1	56.5	60.2	55.9	41.8	43.4	40.4

*Flat and filler pack in 30-dozen cases.
**Price for both white and brown eggs from two cooperatives.
#Average selling price at three cooperatives.

Table 6. Average Selling Price of Selected Wholesale Grades of Large Brown Eggs, Four Pennsylvania Cooperatives, 1947, 1948 and 1949.*

Month	Fancy			Extras			Standards			Cracks**		
	1947	1948	1949	1947	1948	1949	1947	1948	1949	1947	1948	1949
						cents per dozen						
Jan.	48.3#	58.0	55.7	47.4#	56.2	54.6	40.0#	53.2	51.2	37.4	46.6	44.6
Feb.	46.5#	56.0	49.1	45.6#	54.3	48.1	42.5#	50.1	45.1	35.1	43.1	41.0
Mar.	50.7#	53.2	51.9	50.0#	52.3	50.9	46.8#	48.5	47.1	38.3	40.6	40.5
April	52.3#	53.2	57.1	51.3#	52.4	56.3	48.6#	48.3	52.6	39.9	40.4	41.7
May	51.7	56.5	58.2	50.7	55.7	57.2	47.0	50.7	52.7	37.5	39.8	41.1
June	57.1	63.8	62.1	55.9	62.9	60.8	51.0	57.4	55.9	39.1	41.3	40.5
July	66.0	70.9	69.1	64.6	69.5	67.4	58.4	61.0	61.4	41.7	41.3	39.6
Aug.	71.2	76.9	72.6	69.3	75.5	70.8	60.1	66.1	63.6	41.5	41.2	37.3
Sept.	74.5	80.2	72.0	72.0	78.7	70.1	63.0	67.9	63.9	45.7	43.1	41.5
Oct.	70.9	81.5	61.5	68.9	80.2	60.5	63.9	72.0	54.0	47.8	46.2	39.9
Nov.	65.8	73.6	56.7	64.6	72.6	55.8	60.8	69.5	51.2	47.0	49.0	40.6
Dec.	67.6	61.1	44.8	66.2	59.8	44.1	63.3	57.6	41.8	49.8	48.1	35.9
Ave.	60.2	65.4	59.2	58.9	64.2	58.1	54.1	58.5	53.6	41.8	43.4	40.4

*Flat and filler pack in 30-dozen cases.
**Price for both white and brown eggs from two cooperatives.
#Average selling price at three cooperatives.

Figure 3. Three Year Average Selling Price of
Selected Wholesale Grades of Large White Eggs,
Four Pennsylvania Cooperatives, 1947, 1948, and 1949.*

*Flat and filler pack in 30-dozen cases.
**Contains both white and brown eggs.

Figure 4. Three Year Average Selling Price of
Selected Wholesale Grades of Large Brown Eggs,
Four Pennsylvania Cooperatives, 1947, 1948 and 1949.*

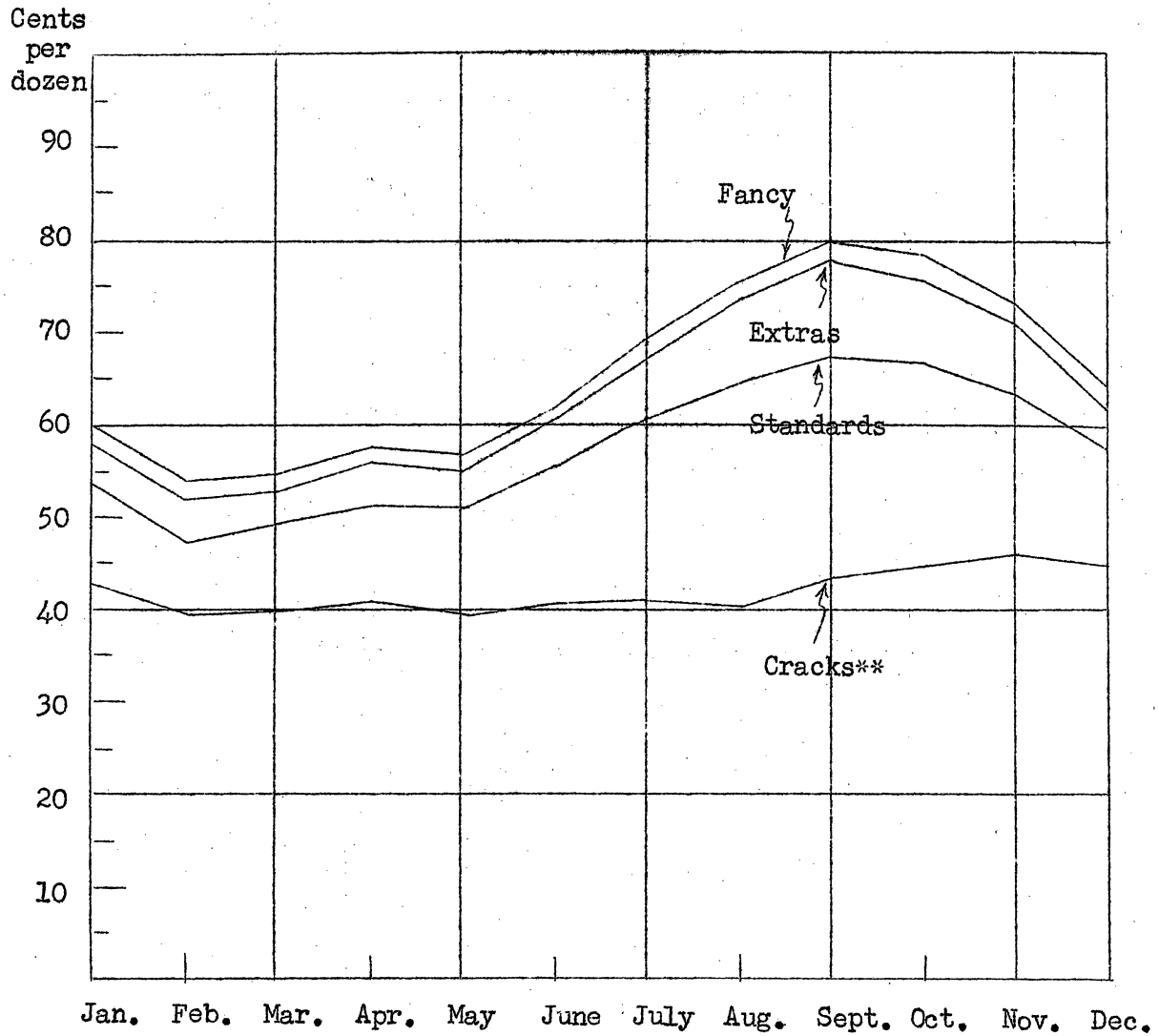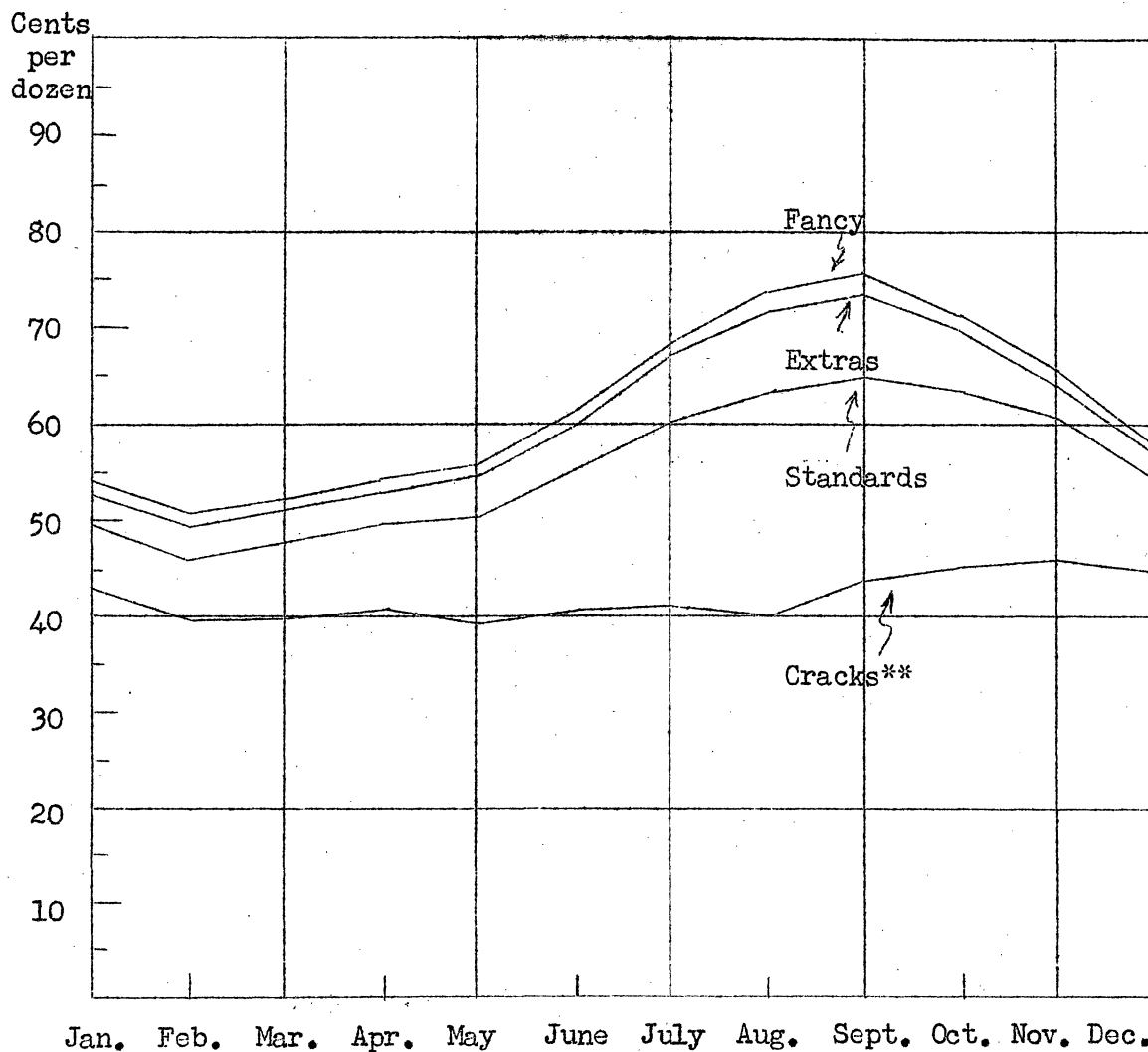*Flat and filler pack in 30-dozen cases.
**Contains both white and brown eggs.

The price spread among grades for both white and brown eggs was narrowest when the supply of eggs was heavy in the late winter and spring months and widest when the supply was light in the late summer and fall months. When eggs were in short supply, large eggs of high quality commanded a premium price and the price spread between high and low quality eggs widened. When the supply of eggs was abundant, the larger supply of high quality eggs narrowed the spread. For example, comparing the three year average price of Extras large white eggs with the Standards large white eggs, the price difference was 4.5 cents in February when eggs were abundant and prices lowest, but for the same grades the price spread was 10.4 cents in September, the month of highest prices, table 5. The spread in price between Extras large white and Standards large white changed 130 per cent from February to September. The spread in price between Extras large white eggs and Cracks varied from 12.4 cents per dozen in February to 34.3 cents in September, a change of 176 per cent. Thus the spread in price between the eggs used in cartoning and the off-grades sold followed the seasonal pattern typical of the spread between high and low quality eggs sold through the wholesale departments.

Applying the seasonal variation in price spread to the cartoning operation, the wider the spread in price among grades, the greater was the price loss on off-grades removed. The greater the price loss on off-grades removed, the higher was the replacement cost per dozen cartoned. The replacement cost, therefore, followed in general much the same pattern as the price loss on off-grades, figure 5. Deviations of the replacement cost per dozen of eggs cartoned from the seasonal pattern of price loss on off-grades were caused by differences in yield of cartoned eggs, table 4.

Figure 5. Replacement Cost per Dozen of Cartoned Eggs and Price Loss on Off-grades, Four Pennsylvania Cooperatives, 1948 - 49. (weighted averages)
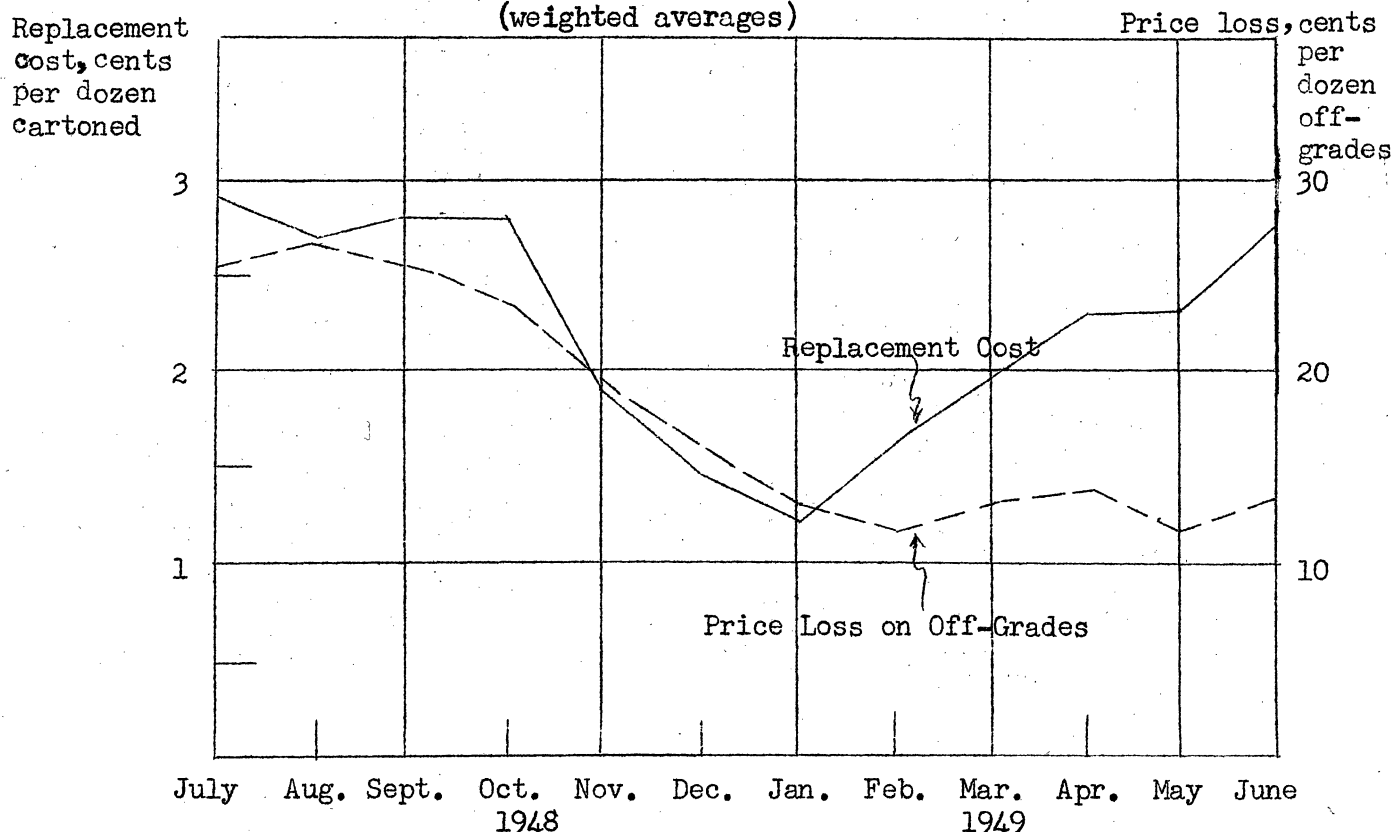
Labor Cost

The second major direct cost in candling and cartoning was the labor involved. Labor cost per dozen cartoned varied with the following three factors:

1. Hourly wage rate paid cartoning department labor.
2. Dozens of eggs candled per hour.
3. Per cent yield of cartoned eggs.

Wage Rate - The average hourly wage rate for the cartoning operations of the four associations varied from a low of about 81 cents per hour to a high of 92 cents per hour and averaged 87.2 cents per hour for the year, table 7.

Table 7. Wage Rate, Dozens Candled per Hour, Yield of Cartoned Eggs, and Labor Cost per Dozen Cartoned, Four Pennsylvania Cooperatives, 1948 - 49.
(weighted averages)

Period	Wage rate	Dozens candled per hour	Yield of cartoned eggs	Labor cost per dozen cartoned
	cents per hour	dozens	per cent	cents per dozen
July	82.9	45	89.71	2.04
August	82.6	43	90.85	2.10
September	83.9	46	89.95	2.02
October	80.8	44	89.50	2.04
November	84.4	45	91.24	2.04
December	90.6	53	91.73	1.85
January	90.2	55	91.32	1.80
February	90.8	53	88.09	1.93
March	91.9	58	87.24	1.83
April	90.6	53	85.47	2.00
May	87.7	54	84.07	1.94
June	87.7	50	82.81	2.12
Average	87.2	50	88.68	1.96

The wage rate per hour increased over the course of the year due to pay raises received by employees. Other month to month variations in the average hourly rate were due to transfer of help between departments and to and to the turnover of personnel. New employees, either replacements or additions to the cartoning labor force, were started at lower hourly rates than were received by experienced employees. Variations in the amount of help needed in slack and rush periods in the candling operation were met partially by transfer of employees between departments thus resulting in more or less hours of a particular wage rate being charged to the cartoning payroll during a given month.

Dozens of Eggs Candled per Hour - Eggs were candled at an average rate of 50 dozens per hour, but varied from a low of 43 dozens per hour in August to a high of 58 dozens per hour in March. These figures represent the dozens of wholesale grades moving into the cartoning department divided by the total hours of payroll time charged to the cartoning department. The cartoning payroll included the time spent in actually candling the eggs plus time of the cartoning department foreman, and time spent bringing eggs and supplies to the candling room, setting up cartons and 15 dozen units, placing filled cartons in units, closing, sealing and labeling filled units, sick leave, paid vacations, morning and afternoon rest periods, and time lost in changeover in grades and orders. By comparison, time records for the actual candling operation showed some of the more proficient candlers worked more than 100 dozens per hour.

The number of dozens of eggs candled per hour tended to vary directly with the total volume of cartoning, figure 6. This difference in the number of dozens candled per hour was partly accounted for by the rather constant amount of time required to change over to the next order in a custom candling operation wherin the size of the orders varied seasonally. Also the tendency to maintain the same labor force because of the time required to properly train employees in the skill of candling, the effort to give employees job security, and the need of sufficient help for peak loads undoubtedly contributed to the considerable seasonal variation in dozens of eggs candled per hour

Figure 6. Index of Dozens of Eggs Candled per Hour and Cartoning Volume, Four Pennsylvania Cooperatives, 1948 - 49.
(weighted averages)
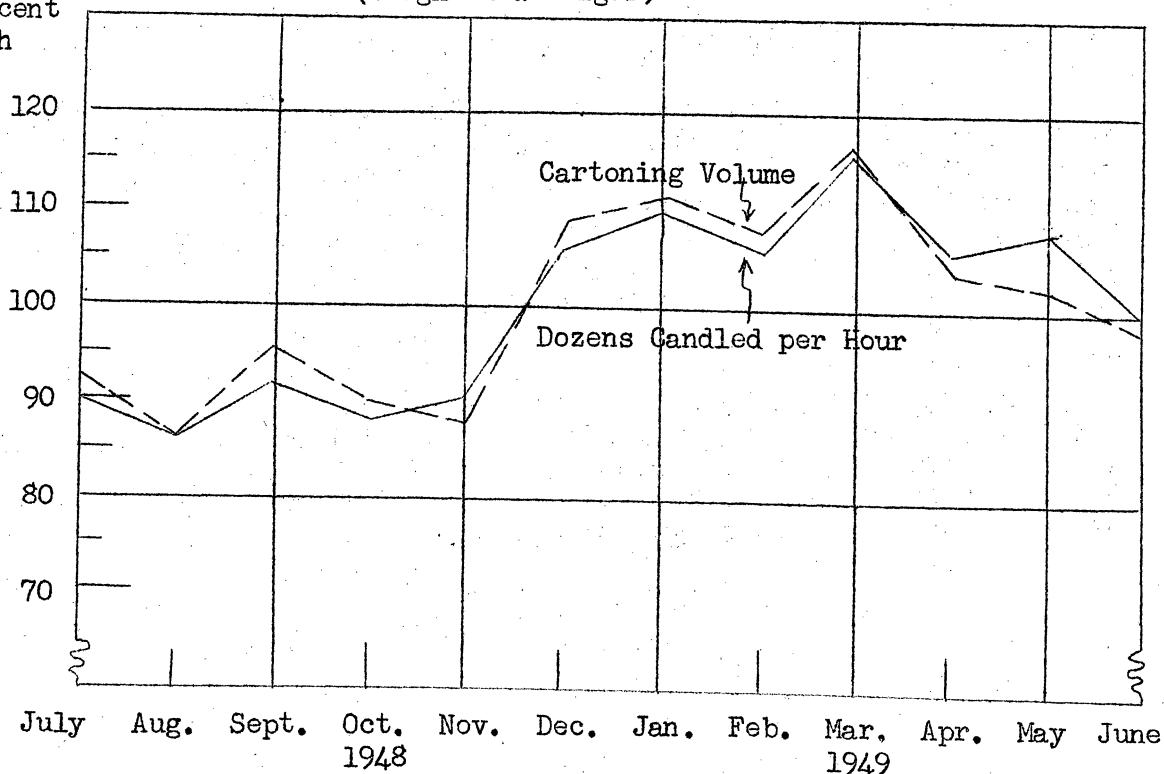
Yield - The third factor affecting labor costs per dozen cartoned was the proportion of eggs candled which met the carton grade requirements. The cost varied inversely with yield, high yields resulting in reduced costs per dozen because of the greater number of dozens over which wages were pro-rated. While such differences were not measured in this study, eggs that yielded higher percentages of carton grades also tended to result in higher candling speeds than lower qualities. Variations in labor costs per dozen with varying yields and speed of candling are shown in table 7. The month to month differences in labor costs per dozen for the associations included in the study were a result of varying combinations of wage rates, speed of candling, and yield, table 7.

Supplies Costs

The third direct cost of the cartoning operation was that of the various types of supplies used to package the product. Cartons were the major cost item of packaging. They ranged in price from $12.50 to $18.00 per thousand, with an average of about $16.00 per thousand over the year. In some cases the buyer supplied his own cartons, while for other orders the cooperatives supplied the cartons. Still other buyers ordered eggs candled and graded to their specifications but delivered "loose" or uncartoned. The latter orders were packed in flats and fillers in 30-dozen cases or 15-dozen units. Due to the wide variation in price of cartons and method of packaging, the cost of cartons was not included in calculating the cost of supplies. Since cartons are the most important supply item, it would be much more accurate to add the price of the specific carton used to an average cost for all other supplies.

Excluding the cartons, the supplies used included the following: 15 dozen units at $107 to $114 per thousand, gummed tape two and three inches wide at 85 cents to 89 cents per 600 foot roll, carton seals at $1.25 (plain) to $2.12 (printed) per roll of 4,500 seals, 15-dozen unit labels at 45 to 60 cents per thousand, flats at $7.80 to $8.95 per thousand, fillers at $15.00 to $16.70 per thousand, candler slips at 20 to 63 cents per thousand. Processing oil at 41 1/2 cents per gallon and wire at $3.11 a bundle were used on some special orders. Some of the range in price was due to price increases during the year, different sources of supply, and reductions on quantity purchases. An attempt was made to include all costs. Therefore, freight charges were added to the cost of supplies where the data were available, but this could not be done consistently due to incomplete data. However, the omission of freight charges in some instances is a very minor item of expense.

Where inventories were taken at the close of each period, the volume of supplies used was obtained from the purchases and inventories. Where no inventories were taken regularly, the supplies used were computed from the volume of eggs handled during the period. In the latter case loss and wastage of supplies were estimated. Some buyers of cartoned eggs returned the 15-dozen units used for packing the cartons. This resulted in the use of less new units and reduced the cost of supplies. The cost of supplies ranged from 60 cents to 88 cents during the year with an average cost of 76 cents per dozen cartoned, table 8.

Table 8. Inspection, Rental, and Supplies* Cost per Dozen of Cartoned Eggs and Case Return Allowance, Four Pennsylvania Cooperatives, 1948 - 49.
(weighted averages)

Period	Supplies*	Rental	Inspection	Total	Case return allowance
			cents per dozen cartoned		
July	.83	.02	.03	.88	.93
August	.81	.02	.04	.87	.94
September	.72	.02	.03	.77	.94
October	.79	.02	.03	.84	.93
November	.78	.03	.03	.84	.92
December	.72	.02	.02	.76	.78
January	.88	.02	.03	.93	.75
February	.74	.02	.03	.79	.81
March	.76	.02	.03	.81	.82
April	.83	.03	.04	.90	.81
May	.64	.03	.03	.70	.86
June	.60	.03	.04	.67	.87
Average	.76	.02	.03	.81	.85

*Excluding cartons.

Three of the cooperatives have installed carton set-up machines, conveyor belts and machines to automatically close and seal the cartons. The set-up and closing and sealing machines cannot be purchased but must be rented from the manufacturers. Two of the cooperatives installed additional equipment during the year, thus increasing the rental charge in the later periods, table 8. The rental charge is a fixed amount per month, so the larger the cartoning volume the less the rental charge per dozen of cartoned eggs.

When eggs are cartoned and labeled as to U. S. Consumer Grades, they must be checked by a Federally licensed inspector to insure that the cartoned product meets the minimum grade standards. A charge was made for this inspection, table 8.

The combined costs of supplies, excluding cartons, but including rental and inspection averaged .81 cents per dozen cartoned, table 8.

Since most of the cartoned eggs were packed in 15-dozen units, the cartoning operations were credited with the value of all 30-dozen cases returned to the wholesale department for resale to producers. At three of the cooperatives these complete cases were valued at 30 cents each. At the fourth cooperative where a special scale was used to determine the value each period, the value varied from 23 cents to 25 cents. Case shells without flats and fillers were valued at 10 cents each at all cooperatives. The case return allowances and costs of supplies, rental, and inspection per dozen cartoned practically canceled each other. The greatest difference in any one period was but two-tenths of one cent in June, table 8. Thus, for all practical purposes the net cost of supplies for the four cooperatives was the cost of the carton used. However, if the case were not sold with the eggs or had no resale value to off-set the cost of miscellaneous supplies, a charge of nearly one cent would have to be made to cover the cost of supplies other than cartons.

Total Direct Costs of the Over-all Cartoning Operation

The direct costs of candling and cartoning, namely replacement cost, labor cost, and cost of supplies including cartons, averaged 6.58 cents per dozen cartoned with a net cost of 5.73 cents after deducting the allowance made for the value of cases resold, table 9. In totaling the direct costs the average cost of individual cartons was included for each month at the figure representing the average for the entire period. Actually there were slight variations due to changes in price of cartons and in the proportions of various sizes and types of cartons used. This cost was relatively constant compared with other direct costs.

The replacement cost and labor charges were the most important items, and accounted for approximately 70 per cent of the average direct costs. These were also the only cost items that showed significant variations through the year. The percentage yield of cartoned eggs accounted for part of the variation in both of these cost items. This strongly emphasized the importance of the quality of eggs used in determining the margin that must be obtained over the price of wholesale grades to cover the cost of the candling and cartoning operation.

Table 9. Summary of Direct Costs of Cartoning, Four Pennsylvania
Cooperatives, 1948 - 49.

(weighted averages)

Month	Replacement cost	Labor	Supplies* rental and inspection	Carton	Total direct costs	Case return allowance	Net direct cost
			cents per dozen cartoned				
January	2.93	2.04	.88	1.60	7.45	.93	6.52
February	2.71	2.10	.87	1.60	7.28	.94	6.34
March	2.85	2.02	.77	1.60	7.24	.94	6.30
April	2.78	2.04	.84	1.60	7.26	.93	6.33
May	1.86	2.04	.84	1.60	6.34	.92	5.42
June	1.45	1.85	.76	1.60	5.66	.78	4.88
July	1.26	1.80	.93	1.60	5.59	.75	4.84
August	1.61	1.93	.79	1.60	5.93	.81	5.12
September	1.91	1.83	.81	1.60	6.15	.82	5.33
October	2.32	2.00	.90	1.60	6.82	.81	6.01
November	2.23	1.94	.70	1.60	6.47	.86	5.61
December	2.72	2.12	.67	1.60	7.11	.87	6.24
Average	2.21	1.96	.81	1.60	6.58	.85	5.73

*Excluding cartons.

In addition to the direct costs for replacement, labor and
supplies, the cartoning operation also involved indirect or overhead
costs. These costs included general supervision, merchandising, procurement,
and accounting expenses; building and equipment costs including depreciation,
interest, repairs, taxes and insurance expenses; and other general overhead
costs. If sales direct to retail stores involved an increase in the number
of customers served and the amount of credit extended as compared to whole-
sale sales in case lots, accounting and credit costs (accounting, interest,
collection and possibly bad debt losses) probably would be increased. In
operations such as those of the four associations included in the study, the
amount of the indirect of overhead expenses must be based on estimated
allocations of these expenses for the entire business operation.

Replacement and Labor Costs by Grades

The second part of the report deals with differences in costs
among the various wholesale grades used in cartoning eggs of U. S. Consumer
Grade "A" and "AA". Information obtained from the four cooperatives permitted
determining only replacement and labor costs by grade. However, these were
the two most important items of expense and were the direct costs that were
highly variable.

Replacement Cost

Two of the associations kept records which provided replacement cost figures by grades for their entire cartoning operation. At the other two cooperatives, representing the larger operations, these data were obtained from records kept for this purpose during each month on part of their cartoning volume. Data were obtained on 35,556 30-dozen cases, or 30 per cent of the total cartoning volume of the four associations. The average yield of these eggs was 88.12 per cent of cartoning grade compared with 88.68 per cent for the over-all candling and cartoning volume. The replacement cost averaged 1.82 cents per dozen for these eggs compared with 2.21 cents for the over-all volume. The difference was due to the fact that the data by grades were obtained from a sample with the proportion of the sample obtained from each cooperative differing from the proportion each contributed to the total cartoning volume, in total and from month to month.

Although the data indicated variations in yield and costs by grades from month to month only the aggregate yearly comparisons were summarized since the sample for individual grades in some periods was too small for reliable comparisons.

The average replacement cost per dozen cartoned varied among the grades from a low of .35 cents for Consumer Grade AA Brown cartoned from Wholesale Grade Extras to a high of 2.12 cents for Consumer Grade AA White cartoned from Wholesale Grade Fancy. The differences in the yield and in the price differential between wholesale grades used and off-grades removed accounted for this variation, table 10.

Yield - For each wholesale grade the average yield of Grade A quality was higher than the yield of Grade AA, and brown eggs out yielded white eggs of the same wholesale grade, table 10. To summarize those comparisons, the yield data of all white eggs and of all brown eggs, regardless of wholesale grade, were combined and the average yield of Grade AA and Grade A eggs calculated, separately and combined. The cartoned yield of Grade AA from brown eggs was nearly nine per cent higher than from white eggs, while brown eggs out yielded white by nearly four per cent in cartoning Grade A, table 11. The average yield for both consumer grades combined was over five per cent higher for brown eggs, table 11.

Table 10. Summary of Replacement Cost by Grades, Four Pennsylvania Cooperatives, 1948 - 1949.

(weighted averages)

Wholesale grade used	Consumer grade cartoned	Yield of cartoned eggs	Price of eggs used	Price of off-grades sold	Price loss on off grades	Replacement cost per dozen cartoned
		per cent	- - -	cents per dozen	- - -	cents
Fancy Large White	AA	84.98	64.96	52.99	11.97	2.12
Fancy Large Brown	AA	93.20	63.01	51.84	11.17	.81
Extras Large White	AA	54.49	59.07	56.99	2.08	1.74
Extras Large Brown	AA	71.15	58.10	57.23	.87	.35
Fancy Medium White	AA	90.28	60.85	46.68	14.17	1.53
Fancy Medium Brown	AA	94.45	59.09	48.14	10.95	.64
Extras Medium White	AA	66.26	54.21	51.52	2.69	1.37
Extras Medium Brown	AA	76.68	53.45	51.49	1.96	.60
Fancy Large White	A	91.30	65.77	45.26	20.51	1.95
Fancy Large Brown	A	93.40	62.50	45.50	17.00	1.20
Extras Large White	A	89.72	65.01	46.58	18.43	2.11
Extras Large Brown	A	93.28	61.63	42.28	19.35	1.39
Fancy Medium White	A	95.06	62.27	40.45	21.82	1.13
Fancy Medium Brown	A	95.77	60.06	43.10	16.96	.75
Extras Medium White	A	92.85	59.71	44.77	14.94	1.15
Extras Medium Brown	A	94.46	58.64	42.68	15.96	.94
Pullets White	Pullets white	95.04	51.51	31.70	19.81	1.03

Table 11. Yield of Consumer Grades Cartoned from White and Brown Eggs, Four Pennsylvania Cooperatives, 1948 - 1949.

(weighted averages)

Shell Color	Consumer grade cartoned	Yield of cartoned eggs
		per cent
White	AA	83.86
	A	90.31
	Both AA and A	87.17
Brown	AA	92.16
	A	94.12
	Both AA and A	92.34

Price Loss - The second factor determining replacement cost was price loss per dozen of under-grades removed during candling. For all whole-sale grades used the price loss of off-grades was less in cartoning U. S. Consumer Grade AA than when U. S. Consumer Grade A was cartoned, table 10. For both white and brown eggs the average price loss per dozen of off-grades was slightly over eight cents higher in cartoning Grade A than in cartoning Grade AA eggs, table 12.

Table 12. Price of Eggs Used, Price of Off-Grades Sold, and Price Loss on Off-Grades per Dozen of Consumer Grades Cartoned from White and Brown Eggs, Four Pennsylvania Cooperatives, 1948 - 1949. (weighted averages)

Shell Color	Consumer grade cartoned	Price of eggs used	Price of off-grades sold	Price loss on off-grades
		------ cents per dozen --------		
White	AA	62.62	52.17	10.45
	A	64.94	46.19	18.75
	Both AA and A	63.81	49.85	13.96
Brown	AA	60.44	51.01	9.43
	A	60.58	43.05	17.53
	Both AA and A	60.45	50.44	10.01

The lower price loss in cartoning Grade AA was due partly to the lower price of wholesale grades used, a condition resulting from the use of relatively lighter weight eggs, and variations in the proportion of Extras and Fancies used for cartoning the two consumer grade classes. The principal cause, however, was the higher value of the off-grades removed in cartoning Grade AA. This higher value was due primarily to the fact that Grade A eggs represented a high percentage of the off-grades removed in cartoning Grade AA. Those Grade A eggs were cartoned as A's and resulted in little or no loss in value. In computing the price loss they were valued at prices equal to the price of the corresponding wholesale grade plus the replacement cost in candling Grade A from that grade and thus at a price representing the product cost of Grade A cartoned eggs. In cartoning Grade A orders, the associations did not remove Grade AA eggs but included them in the Grade A pack. This practice resulted in packs of a higher level of quality than required for Grade A dozens and higher per dozen replacement costs than if Grade AA eggs had been removed and sold as Grade AA.

Comparing white and brown eggs, the price loss of off-grades was one to two cents less for brown eggs because the wholesale price of brown eggs was lower while the off-grades of the two colors sold for about the same price, table 12

Although the yield in cartoning Grade AA eggs was lower, the higher return from off-grades resulted in a somewhat lower replacement cost than for the Grade A pack for both white and brown eggs, table 13. Brown eggs had a replacement cost of about one cent per dozen less than white eggs as a result of higher yields of cartoned eggs and less price loss on off-grades, table 13.

Table 13. Replacement Cost per Dozen of Consumer Grades Cartoned from White and Brown Eggs, Four Pennsylvania Cooperatives, 1948 - 1949. (weighted averages)

Shell Color	Consumer grade cartoned	Replacement cost per dozen cartoned
		cents
White	AA	1.86
	A	2.02
	Both AA and A	1.94
Brown	AA	.71
	A	1.11
	Both AA and A	.75

Labor Cost

None of the cooperatives kept records that permitted determining the candling time by grades for the entire candling operation. To provide data on the time spent in working various grades, record forms were prepared on which the candlers recorded for each 30-dozen case worked, the wholesale grade, time to candle the case, the grade and count of eggs cartoned and the various types of off-grades removed. The responsibility of keeping these records was rotated through the entire line of candlers. From one to three candlers, depending on the size of the operation, kept records for a period of one week during each rotation. Keeping these records reduced the candlers' daily out-put and during periods of heavy cartoning volume recording the sample data was abandoned. As a result, none of the cooperatives had consistent labor records for each operating period. Therefore, the data were analyzed on an annual basis only. Candling time was secured on 4,511 30-dozen cases or 3.8 per cent of the total cartoning volume.

Candling and Cartoning Time - When the cooperatives cartoned U. S. Consumer Grade AA eggs they simultaneously placed in cartons the eggs that were of Grade A quality. In computing the time required to carton a dozen of eggs, dozens cartoned included the yield of both Grade AA and A eggs. The average time to carton a dozen of eggs, based on the total sample, was .6669 minutes per dozen. This varied from a low of .4321 to a high of .8026 minutes per dozen, table 14. On a 30-dozen case basis this is equivalent to a variation of from 13 to 24 minutes per case. The time included only that of the grader in candling the eggs and, therefore, does not include contributory labor used in the over-all cartoning operations.

Table 14. Candling Time per Dozen Eggs Cartoned by Wholesale Grades Used
and Consumer Grade Cartoned, Four Pennsylvania Cooperatives,
1948 - 1949.

(weighted averages)

Wholesale grade used	Consumer grade cartoned	Minutes per dozen cartoned	Index* of labor time
Fancy Large White	AA	.6481	97
Fancy Large Brown	AA	.5269	79
Extras Large White	AA	.7029	105
Extras Large Brown	AA	.5420	81
Fancy Medium White	AA	.6081	91
Fancy Medium Brown	AA	.5092	76
Extras Medium White	AA	.6423	96
Extras Medium Brown	AA	.5463	82
Fancy Large White	A	.6760	101
Fancy Large Brown	A	.4932	74
Extras Large White	A	.7631	114
Extras Large Brown	A	.5468	82
Fancy Medium White	A	.4793	72
Fancy Medium Brown	A	.4321	65
Extras Medium White	A	.8026	120
Extras Medium Brown	A	.4722	71
Pulletts White	Pullets White	.5026	75
Average		.6669	100

*Average equals 100.

In all instances it took longer to candle and carton white eggs
than brown eggs from wholesale grades of the same size and quality, table 14.
When the data were combined by shell color, the average time spent in candl-
ing brown eggs was about 25 per cent less than for white eggs, table 15. The
cartoning rate was faster for brown eggs because the yield of cartoned eggs
was consistently higher and because the candlers actually handled brown eggs
more rapidly than white.

Table 15. Candling Time by U. S. Consumer Grades Cartoned from White and
Brown Eggs, Four Pennsylvania Cooperatives, 1948 - 49.
(weighted averages)

Shell Color	Consumer grade cartoned		Minutes per dozen cartoned	Index* of labor time
White		AA	.6581	99
		A	.7312	110
	Both	AA and A	.6914	104
Brown		AA	.5267	79
		A	.5034	76
	Both	AA and A	.5221	78
Average			.6669	100

*Average equals 100

Labor and Replacement Costs by Grades

Differences in the time required to candle and carton a dozen
eggs of consumer grade from the various wholesale grades caused similar
differences in the total labor cost. The following computation was used to
convert the variations in the rate of cartoning among the wholesale grades
into a monetary figure. In the over-all cartoning operation, the average
labor cost for the 12 months was 1.96 cents per dozen cartoned. This
included the costs of all contributory time and labor in addition to the
work of the actual candling operations. It was assumed that contributory
labor should be charged to the various wholesale grades in the same proportion
as the labor of the actual candling operation. The minutes required to
carton one dozen of eggs from each wholesale grade was expressed as a per-
centage of the average time for all wholesale grades, table 14. This per-
centage was then multiplied by 1.96 cents, the average labor cost per
dozen cartoned. The total labor cost so determined varied among the whole-
sale grades from 1.27 cents to 2.36 cents per dozen cartoned, table 16.

The labor cost in cartoning brown eggs was consistently lower
than for white eggs from all size and quality grades. For all grades
combined total labor costs, based on the index of labor time and labor
costs for the entire cartoning operation, averaged approximately one half
cent per dozen less for brown than for white eggs, table 17. Although
there were differences in the labor costs in cartoning Grades AA and A
from the various wholesale grades, these differences were of lesser magni-
tude and were not consistently in favor of either Grade AA or Grade A.

Table 16. Replacement Cost and Labor Cost by Wholesale Grades Used and
Consumer Grade Cartoned, Four Pennsylvania Cooperatives, 1948 - 49.
(weighted averages)

Wholesale grade used	Consumer grade cartoned	Replacement cost	Labor cost	Total
		---- cents per dozen- ---		
Fancy Large White	AA	2.12	1.90	4.02
Fancy Large Brown	AA	.81	1.55	2.36
Extras Large White	AA	1.74	2.07	3.81
Extras Large Brown	AA	.35	1.59	1.94
Fancy Medium White	AA	1.53	1.79	3.32
Fancy Medium Brown	AA	.64	1.50	2.14
Extras Medium White	AA	1.37	1.89	3.26
Extras Medium Brown	AA	.60	1.61	2.21
Fancy Large White	A	1.95	1.99	3.94
Fancy Large Brown	A	1.20	1.45	2.65
Extras Large White	A	2.11	2.24	4.35
Extras Large Brown	A	1.39	1.61	3.00
Fancy Medium White	A	1.13	1.41	2.54
Fancy Medium Brown	A	.75	1.27	2.02
Extras Medium White	A	1.15	2.36	3.51
Extras Medium Brown	A	.94	1.39	2.33
Pullets White	Pullets White	1.03	1.48	2.51

Table 17. Replacement Cost and Labor Cost per Dozen of Consumer Grade
Cartoned from White and Brown Eggs, Four Pennsylvania Cooperatives,
1948 - 49.
(weighted averages)

Shell Color	Consumer grade cartoned	Replacement cost	Labor cost	Total
		- - - - -cents per dozen - - - - -		
White	AA	1.86	1.93	3.79
	A	2.02	2.15	4.17
	Both AA and A	1.94	2.03	3.97
Brown	AA	.71	1.55	2.26
	A	1.11	1.48	2.59
	Both AA and A	.75	1.55	2.28

With both lower replacement and lower labor costs, the total of these two important variable costs was over one and one half cents per dozen less for all brown eggs than for all white eggs, table 17. For all sizes and wholesale grades used, these two costs for Consumer Grade AA white totaled 3.79 cents as compared to 2.26 cents for Consumer Grade AA Brown, or a difference of 1.53 cents per dozen cartoned. The average cost for Grade A was 1.58 cents per dozen higher for whites than browns.

Replacement and labor costs were lower in cartoning medium sized eggs than for comparable grades of large eggs except for brown Extras, table 16. The average cost was about three fourths of a cent less when medium sized eggs were used, table 18. Both replacement and labor costs were less for medium sized eggs principally because of a higher yield of cartoned product from medium as compared with large eggs. There was no sizeable or consistent difference in the replacement and labor costs in cartoning from Fancy or Extras wholesale grades.

Table 18. Replacement and Labor Costs per Dozen of Consumer Grade Cartoned from Large and Medium Sized Eggs, Four Pennsylvania Cooperatives, 1948 - 1949.

(weighted averages)

Size eggs used	Consumer grade cartoned	Replacement cost	Labor cost	Total
		- - - - - -cents per dozen cartoned - - -		
Large	AA	1.91	1.94	3.85
	A	2.06	2.13	4.19
	Both AA and A	2.00	2.04	4.04
Medium	AA	1.31	1.79	3.10
	A	1.11	1.96	3.07
	Both AA and A	1.29	1.81	3.10

Summary and Conclusions

The study was undertaken to determine the principal direct costs of candling and cartoning eggs at country points, factors causing variations in these costs, and possible methods of reducing them. Data were obtained from four cooperatives in Southeastern Pennsylvania which used the same wholesale and retail grades. The data provided information on the cost of labor, replacement, supplies, equipment rental, and inspection.

The direct cost of candling and cartoning averaged 6.58 cents per dozen for the over-all operation, with a net direct cost of 5.73 cents after deducting the value of the 30-dozen cases returned to the wholesale departments for resale. This total did not include overhead costs or delivery charges.

The replacement and labor costs accounted for about 70 per cent of the total. Those two costs were also the only items that showed any significant seasonal variation. The replacement cost averaged 2.21 cents per dozen cartoned, but ranged by months from 1.26 to 2.93 cents. Replacement cost varied with the yield of cartoned and various off-grades of eggs, and the spread between the price of wholesale grades used and the price of various off-grades. The yield of eggs of carton grade for the entire operation averaged 88.68 per cent, but varied by months from 82.81 to 91.73 per cent. Off-grades, other than over-sized eggs, averaged 10.84 per cent, of which 3.17 per cent were Producers or Standards. Eggs with defective shells accounted for the major portion of the off-grades in most months, averaging 5.94 per cent.

The price loss on off-grades averaged 17.33 cents per dozen, but varied from 11.75 to 26.82 cents. The variations in the price loss followed the seasonal pattern typical of the price differentials between the higher and lower quality eggs. Price loss per dozen of off-grades was lowest in the spring when egg prices were low and volume the heaviest. Losses per dozen were highest in the fall when egg prices were highest and the volume lowest. Replacement cost varied directly with the price loss on off-grades, except as altered by variations in the yield of cartoned eggs.

Labor costs per dozen cartoned averaged 1.96 cents, but varied by months from 1.80 to 2.12 cents per dozen. Labor cost varied with the hourly wage rate, dozens of eggs candled per hour, and percentage yield of cartoned eggs. The wage rate paid cartoning department employees during the period studied averaged 87.2 cents per hour, but ranged from 80.8 to 91.9 cents. The eggs were candled at an average rate of 50 dozens per hour of total payroll labor. The candling rate varied directly with the volume moved through the candling departments, ranging by months from a low of 43 to a high of 58 dozens per hour. Both replacement cost and labor cost varied considerably with the yield of cartoned eggs obtained from the eggs handled. This emphasized the importance of the initial quality of the eggs used in determining the cost of performing the candling and cartoning service.

The net cost for supplies was essentially the cost of the carton used, which for the period studied averaged 1.6 cents each. The cost for other supplies, for equipment rental, and for inspection averaged .81 cents per dozen which almost exactly matched the average case return allowance of .85 cents per dozen.

Replacement and labor costs were determined by grades from a sample drawn from the total cartoning volume. These data indicated a cost for these two items which averaged 1.69 cents less per dozen for brown than for white eggs. Because of higher yield and less price loss on off-grades, the replacement cost in cartoning brown eggs averaged .75 cents per dozen cartoned compared with 1.94 cents for white eggs. The average labor cost

for cartoning brown eggs was about one half cent per dozen less than for white eggs due to a higher yield and a faster candling rate on brown eggs. The average labor and replacement cost was about three fourths of a cent less for medium sized eggs than for large eggs. These differences suggest the possible advisability of using different pricing schedules for white and brown eggs and for large and medium sized eggs in order that the charge for cartoning would more accurately reflect actual costs and provide more equitable pricing to producers.

The data also indicated that Grade AA eggs were cartoned at slightly less cost than Grade A. The difference amounted to approximately one third cent per dozen on brown eggs and one quarter cent on white eggs. For both shell colors, replacement costs on Grade AA were lower due to less price loss on off-grades. The price loss was less because of the relatively high value of the Grade A eggs which were removed in cartoning Grade AA. In cartoning Grade A, eggs of Grade AA quality were not removed. This resulted in a higher average quality "A" pack and a slightly higher replacement cost.

APPENDIX

Replacement Cost

Following is an example of how to determine replacement cost from original data for an operating period:

I. Eggs Used

Grade	Dozens	Price cents per dozen	Value
Fancy Large White	3000	55	$ 1650.00
Fancy Large Brown (other grades)	1000	53	530.00
Extras Medium White	500	47	235.00
Total	4500		$ 2415.00
Add Beginning Inventory	800	52	416.00
	5300		$ 2831.00
Subtract Ending Inventory	300	47	141.00
	5000		2690.00

$2690.00 ÷ 5000 dozens = $.5380 average price per dozen used.

II. Eggs Sold

A. Cartoned

Grade	Dozens
AA Large White	2700
AA Large Brown (others)	850
A Medium White	450
Total	4000
Add Ending Inventory	800
	4800
Subtract Beginning Inventory	300
Net cartoned Dozens	4500

B. Off Grades

Classification	Dozens	Price cents per dozen	Value
Standards Large White	200	46	$ 92.00
Standards Large Brown (others)	50	44	22.00
Cracks	200	25	50.00
Bloods	20	10	2.00
Loss	5	--	-----
Total	475		$166.00
Add Ending Inventory	75	30	22.50
	550		$188.50
Subtract Beginning Inventory	50	35	17.50
Net off-grades sold plus loss	500		$171.00

III. Replacement Cost

500 dozens off-grades at $.5380 cost	$ 269.00
500 dozens off-grades sold for	171.00
Loss on off-grades	$ 98.00

Net cartoned dozens = 4500

$98.00 ÷ 4500 = $.0218 or 2.2 cents per dozen cartoned.

Table 19 was designed to aid in the rapid determination of replacement cost. The same data are used as in the previous example.

4500 dozens cartoned ÷ 5000 dozens used = 90 per cent yield
$2690 ÷ 5000 dozens = $.5380 average price of eggs used
$ 171 ÷ 500 dozens off-grades = .3420 average price of off-grades
.1960 price loss per dozen off-grades or
or 20 cents

With a 90 per cent yield of cartoned eggs and a price loss on off-grades of 20 cents per dozen, the replacement cost would be 2.2 cents per dozen cartoned, see table 19.

Table 19. Replacement Cost Per Dozen of Cartoned Eggs by Yield of Cartoned Eggs and Price Loss on Off-Grades*.

Yield of cartoned eggs	Price loss per dozen of off-Grades cents per dozen													
	5	7 1/2	10	12 1/2	15	17 1/2	20	22 1/2	25	27 1/2	30	32 1/2	35	37 1/2	40
Per cent	Replacement Cost cents per dozen-cartoned														
60	3.3	5.0	6.7	8.3	10.0	11.7	13.3	15.0	16.7	18.3	20.0	21.7	23.3	25.0	26.7
61	3.2	4.8	6.4	8.0	9.6	11.2	12.8	14.4	16.0	17.6	19.2	20.8	22.4	24.0	25.6
62	3.1	4.6	6.1	7.9	9.2	10.7	12.3	13.8	15.3	16.9	18.4	19.9	21.5	23.0	24.5
63	2.9	4.4	5.9	7.3	8.8	10.3	11.7	13.2	14.7	16.2	17.6	19.1	20.6	22.0	23.5
64	2.8	4.2	5.6	7.0	8.4	9.8	11.2	12.7	14.1	15.5	16.9	18.3	19.7	21.1	22.5
65	2.7	4.0	5.4	6.7	8.1	9.4	10.8	12.1	13.5	14.8	16.2	17.5	18.8	20.2	21.5
66	2.6	3.9	5.2	6.4	7.7	9.0	10.3	11.6	12.9	14.2	15.5	16.7	18.0	19.3	20.6
67	2.5	3.7	4.9	6.2	7.4	8.6	9.8	11.1	12.3	13.5	14.8	16.0	17.2	18.5	19.7
68	2.4	3.5	4.7	5.9	7.1	8.2	9.4	10.6	11.8	12.9	14.1	15.3	16.5	17.6	18.8
69	2.2	3.4	4.5	5.6	6.7	7.9	9.0	10.1	11.2	12.4	13.5	14.6	15.7	16.8	18.0
70	2.1	3.2	4.3	5.4	6.4	7.5	8.6	9.6	10.7	11.8	12.9	13.9	15.0	16.1	17.1
71	2.0	3.1	4.1	5.1	6.1	7.1	8.2	9.2	10.2	11.2	12.3	13.3	14.3	15.3	16.3
72	1.9	2.9	3.9	4.9	5.8	6.8	7.8	8.8	9.7	10.7	11.7	12.6	13.6	14.6	15.6
73	1.8	2.8	3.7	4.6	5.5	6.5	7.4	8.3	9.2	10.2	11.1	12.0	12.9	13.9	14.8
74	1.8	2.6	3.5	4.4	5.3	6.1	7.0	7.9	8.8	9.7	10.5	11.4	12.3	13.2	14.1
75	1.7	2.5	3.3	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0	10.8	11.7	12.5	13.3
76	1.6	2.4	3.2	3.9	4.7	5.5	6.3	7.1	7.9	8.7	9.5	10.3	11.1	11.8	12.6
77	1.5	2.2	3.0	3.7	4.5	5.2	6.0	6.7	7.5	8.2	9.0	9.7	10.5	11.2	11.9
78	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.1	7.8	8.5	9.2	9.9	10.6	11.3
79	1.3	2.0	2.7	3.3	4.0	4.7	5.3	6.0	6.6	7.3	8.0	8.6	9.3	10.0	10.6
80	1.2	1.9	2.5	3.1	3.8	4.4	5.0	5.6	6.2	6.9	7.5	8.1	8.8	9.4	10.0
81	1.2	1.8	2.3	2.9	3.5	4.1	4.7	5.3	5.9	6.4	7.0	7.6	8.2	8.8	9.4
82	1.1	1.6	2.2	2.7	3.3	3.8	4.4	4.9	5.5	6.0	6.6	7.1	7.7	8.2	8.8
83	1.0	1.5	2.0	2.6	3.1	3.6	4.1	4.6	5.1	5.6	6.1	6.7	7.2	7.7	8.2
84	1.0	1.4	1.9	2.4	2.9	3.3	3.8	4.3	4.8	5.2	5.7	6.2	6.7	7.1	7.6
85	.9	1.3	1.8	2.2	2.6	3.1	3.5	4.0	4.4	4.9	5.3	5.7	6.2	6.6	7.1
86	.8	1.2	1.6	2.0	2.4	2.8	3.3	3.7	4.1	4.5	4.9	5.3	5.7	6.1	6.5
87	.7	1.1	1.5	1.9	2.2	2.6	3.0	3.4	3.7	4.1	4.5	4.9	5.2	5.6	6.0
88	.7	1.0	1.4	1.7	2.0	2.4	2.7	3.1	3.4	3.8	4.1	4.4	4.8	5.1	5.5
89	.6	.9	1.2	1.5	1.9	2.2	2.5	2.8	3.1	3.4	3.7	4.0	4.3	4.6	4.9
90	.6	.8	1.1	1.4	1.7	1.9	2.2	2.5	2.8	3.1	3.3	3.6	3.9	4.2	4.4
91	.5	.7	1.0	1.2	1.5	1.7	2.0	2.2	2.5	2.7	3.0	3.2	3.5	3.7	4.0
92	.4	.7	.9	1.1	1.3	1.5	1.7	2.0	2.2	2.4	2.6	2.8	3.0	3.3	3.5
93	.4	.6	.8	.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.4	2.6	2.8	3.0
94	.3	.5	.6	.8	1.0	1.1	1.3	1.4	1.6	1.8	1.9	2.1	2.2	2.4	2.6
95	.3	.4	.5	.7	.8	.9	1.1	1.2	1.3	1.4	1.6	1.7	1.8	2.0	2.1
96	.2	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2	1.4	1.5	1.6	1.7
97	.2	.2	.3	.4	.5	.5	.6	.7	.8	.8	.9	1.0	1.1	1.2	1.2
98	.1	.2	.2	.3	.3	.4	.4	.5	.5	.6	.6	.7	.7	.8	.8
99	.0	.1	.1	.1	.2	.2	.2	.2	.3	.3	.3	.3	.4	.4	.4
100	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

*Computed by using the following formula, which can be used to find the replacement cost for any combination of factors:

$$\text{Replacement cost per dozen cartoned} = \frac{(100 - A) \times B}{A}$$

A = Per cent yield of cartoned eggs.

B = Price loss per dozen of off-grades (Spread between average price per dozen of eggs used and average price per dozen of off-grades sold).

Labor Cost

Following is an example of how labor costs can be computed from original data.

Net dozens used = 5000
Net dozens cartoned = 4500

(The above items are determined as in the example of calculating replacement cost)

Cartoning department payroll

Total hours = 100
Total cost = $85.00

For a given period, labor cost per dozen cartoned may be calculated by dividing the net dozens cartoned into the total labor cost, as:

$85.00 ÷ 4500 dozens cartoned = $.0188 or 1.88 cents per dozen cartoned.

Since the number of dozens cartoned per hour varies considerably with yield, table 20 was set up on the basis of percentage yield of cartoned eggs and dozens of eggs worked per hour. When the average hourly wage rate paid cartoning department employees is $1.00, the labor cost per dozen of cartoned eggs are as shown in the table. Cost at any other hourly rate can be obtained by expressing the wage rate as a percentage of $1.00 and applying this percentage to the values shown in the table.

Applying the above data to the table:

4500 net dozens cartoned ÷ 5000 net dozens used = 90 per cent yield of cartoned eggs.

5000 dozens used ÷ 100 hours cartoning = 50 dozens worked per hour.

From the table the labor cost is determined as 2.2 cents per dozen cartoned, but with a wage rate at $1.00 per hour. With the given rate at 85 cents per hour ($85.00 ÷ 100 hours = $.85) the labor cost per dozen is 85 per cent of 2.2 cents or 1.86 cents per dozen. (2.2 x .85 = 1.86. The slight difference is due to rounding of the table values.)

Table 20. Labor Cost Per Dozen of Eggs Cartoned as Affected by Dozen of Eggs Worked Per Hour and Per Cent Yield of Cartoned Eggs When Wage Rate Is $1.00 Per Hour*.

Yield of cartoned eggs	Dozens of eggs worked per hour **														
	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Per cent	Labor cost per dozen cartoned, cents per dozen														
60	5.6	4.8	4.2	3.7	3.3	3.0	2.8	2.6	2.4	2.2	2.1	2.0	1.9	1.8	1.7
61	5.5	4.7	4.1	3.6	3.3	3.0	2.7	2.5	2.3	2.2	2.0	1.9	1.8	1.7	1.6
62	5.4	4.6	4.0	3.6	3.2	2.9	2.7	2.5	2.3	2.2	2.0	1.9	1.8	1.7	1.6
63	5.3	4.5	4.0	3.5	3.2	2.9	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6
64	5.2	4.5	3.9	3.5	3.1	2.8	2.6	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.6
65	5.1	4.4	3.8	3.4	3.1	2.8	2.6	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5
66	5.0	4.3	3.8	3.4	3.0	2.8	2.5	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5
67	5.0	4.3	3.7	3.3	3.0	2.7	2.5	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.5
68	4.9	4.2	3.7	3.3	2.9	2.7	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.5
69	4.8	4.1	3.6	3.2	2.9	2.6	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4
70	4.8	4.1	3.6	3.2	2.9	2.6	2.4	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4
71	4.7	4.0	3.5	3.1	2.8	2.6	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4
72	4.6	4.0	3.5	3.1	2.8	2.5	2.3	2.1	2.0	1.9	1.7	1.6	1.5	1.5	1.4
73	4.6	3.9	3.4	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.4
74	4.5	3.9	3.4	3.0	2.7	2.5	2.3	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.4
75	4.4	3.8	3.3	3.0	2.7	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3
76	4.4	3.8	3.3	2.9	2.6	2.4	2.2	2.0	1.9	1.8	1.6	1.5	1.5	1.4	1.3
77	4.3	3.7	3.2	2.9	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.4	1.4	1.3
78	4.3	3.7	3.2	2.8	2.6	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3
79	4.2	3.6	3.2	2.8	2.5	2.3	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.3
80	4.2	3.6	3.1	2.8	2.5	2.3	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2
81	4.1	3.5	3.1	2.7	2.5	2.2	2.1	1.9	1.8	1.6	1.5	1.5	1.4	1.3	1.2
82	4.1	3.5	3.0	2.7	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.4	1.4	1.3	1.2
83	4.0	3.4	3.0	2.7	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.3	1.2
84	4.0	3.4	3.0	2.6	2.4	2.2	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2
85	3.9	3.4	2.9	2.6	2.4	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2
86	3.9	3.3	2.9	2.6	2.3	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2
87	3.8	3.3	2.9	2.6	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.4	1.3	1.2	1.1
88	3.8	3.2	2.8	2.5	2.3	2.1	1.9	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1
89	3.7	3.2	2.8	2.5	2.2	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1
90	3.7	3.2	2.8	2.5	2.2	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1
91	3.7	3.1	2.7	2.4	2.2	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1
92	3.6	3.1	2.7	2.4	2.2	2.0	1.8	1.7	1.6	1.4	1.4	1.3	1.2	1.1	1.1
93	3.6	3.1	2.7	2.4	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.3	1.2	1.1	1.1
94	3.5	3.0	2.7	2.4	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1
95	3.5	3.0	2.6	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.1
96	3.5	3.0	2.6	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0
97	3.4	2.9	2.6	2.3	2.1	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0
98	3.4	2.9	2.6	2.3	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0
99	3.4	2.9	2.5	2.2	2.0	1.8	1.7	1.6	1.4	1.3	1.3	1.2	1.1	1.1	1.0
100	3.3	2.9	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.2	1.1	1.1	1.0

*Computed by using the following formula:

$$\text{Labor cost per dozen cartoned} = \frac{\text{Wage rate per hour}}{(\text{Dozens worked per hour}) \times (\text{Yield of cartoned eggs})}$$

** Dozens of Eggs worked per hour of total candling and cartoning time. (Candlers time plus all contributory labor).