



**Egg Processing, Cartoning and Transportation Costs:
2020 Update**

8/25/2021

Compiled by

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Executive Summary

The U.S. egg production industry runs on small profit margins. As a result, understanding each input cost is important to the decisions egg farmers make each day. Processing, Cartoning, and Transportation (PCT) costs are key components associated with delivering eggs to a store.

Previously, the Egg Industry Center published a special report estimating the PCT costs for 2018. This 2020 report updates the previous costs of processing eggs for the shell-egg market, and outlines the process and methodology for how results were generated.

Key findings include:

- Most costs are within the ranges estimated in the previous report for 2018.
- The largest difference with respect to the previous study is in the grade yield loss. This difference could be explained in part by the difference in the approach used to estimate it.
- Eggs sourced off-line have 0.5% greater losses and yield a slightly higher percentage of undergrades.
- Costs with higher variability among the survey respondents is probably where processors have opportunities to reduce costs.

For this update, responses were received from 16 companies representing approximately 80 million egg laying hens in the U.S. The survey responses allowed for updates to the costs of processing Gradeable Nest Run Class-1 (GNR1) eggs, but not the costs of processing graded loose eggs due to the lack of responses provided for analysis.

The report includes a section that compares the 2020 results with the 2018 results (published in 2019). It is the intention of the Egg Industry Center to continue updating these cost estimates on a regular basis to assist the egg industry.

Survey Questionnaire

The survey of U.S. egg processors was conducted to estimate costs associated with washing, weighing, packaging, and transporting eggs. The survey was based on a previously developed work created by the Egg Industry Center and modified after discussions with egg farmers to ensure that the questions could be answered with readily available farm information.

The survey contained seven questions, some of which had multiple subsections. These questions elicited information on the cost of packaging materials, processing (washing, weighing, packaging), and other relevant factors which influence costs.

The survey included questions for egg type, packaging type, case type, and miscellaneous.

There were four different types of eggs included in the survey:

- Gradeable Nest Run Class-1 (GNR1) sourced in-line,
- Gradeable Nest Run Class-1 (GNR1) sourced off-line,
- Graded Loose large, and
- Graded Loose extra-large.

In-line sourced eggs are processed on the farm where they are produced. Off-line sourced eggs are eggs that are trucked from the farm to a different facility for processing.

For each egg type, the percentage of eggs of different sizes and classes were surveyed and then used to estimate the associated grade yield loss or gain.

Five different packaging types options were provided in the survey:

- 12-pack carton,
- 18-pack carton,
- “twin-18” packs (i.e. 36 eggs),
- 5-dozen packs, and
- filler flats.

This latter category was not included in our previous 2018 survey.

Two types of cases were provided:

- regular corrugated cardboard case and
- reusable plastic containers.

The corrugated cardboard case costs were further separated by 30-dozen and 15-dozen cases.

The survey also included three questions related to:

- finishing costs for putting boxes of eggs in pallets, wrapping them, etc.
- losses from store returns, and
- differences in costs between USDA-graded eggs and non-USDA-graded eggs.

The entire survey questionnaire is reproduced in this report as Appendix 1.

Anonymous Data Collection

In February of 2021, the survey was sent to more than 100 egg producer/processor companies for which the Egg Industry Center had contact information. One person per company was chosen to receive the survey to avoid the possibility of duplicate responses. Participants were offered a variety of ways to return their surveys, all of which ensured that their identity was not traceable, therefore guaranteeing anonymity of the respondents and their companies.

The survey specifically asked for responses based on the PCT costs for the year 2020. Data collection was finished by April of 2021.

Method of Analysis

The analysis was conducted in three stages, each of which is described in detail below. Briefly, outliers (extremely high or low values) were flagged and discarded prior to analysis. Then, two alternative measures of central location (a trimmed mean and the median) and the data dispersion (i.e. the interquartile range, IQR) were calculated. Finally, for responses with substantial scattering in their distribution, cluster analyses were conducted to identify groups within the distribution with high degrees of similarity within each group but with significant differences among groups. This step was conducted to understand whether a unique cost estimate could reasonably characterize all responses, or whether other influencing factors should be included.

Outliers

Outliers were identified using Tukey's method (1977) which consists of the following steps:

- Compute the interquartile range (IQR), i.e. the difference between the values of the 75th and 25th percentiles
- Multiply that difference by 1.5, or 1.5IQR
- Identify and discard any values less than the 25th percentile minus 1.5 x IQR, or greater than the 75th percentile plus 1.5 x IQR

Central Location

The most used measure of central location for a distribution of numerical values is the arithmetic mean, also called the simple average (i.e., the sum of the values across all responses divided by the count of responses). The average can be sensitive to bias when computed from data having asymmetric high or low values (i.e. a skewed distribution), even after removing outliers. Some survey response data presented extreme values and some of the distributions were skewed, thus two alternative measures of central location were used instead. These are the median and the trimmed mean, both of which are more robust to the presence of extreme values in skewed distributions. The trimmed mean in this report is the arithmetic mean after eliminating the top 20% and the bottom 20% of the observations. The outliers were eliminated before estimating the median, the trimmed mean, and the 25th and 75th percentiles.

The median is a robust central measure (Rice, 2006), but one of its key disadvantages is that it ignores the values outside the center, and such information might be valuable. An advantage of the trimmed mean over the median is that it incorporates information not only from the center of the distribution, but also from the 60% of the sample that was left after eliminating the top 20% and the bottom 20% of the observations.

Both median and trimmed mean have advantages and disadvantages but in general there is no best central measure for all skewed distributions and utilizing two measures is preferred by some (Rice, 2006) whereas the median is considered most appropriate by others (Snedecor and Cochran, 1989).

Dispersion of Responses

While the standard deviation is commonly used to represent the dispersion of data about a central location, in this study the single measure of dispersion is the IQR because it represents the dispersion around the median.

Clustering Analysis

Hierarchical clustering analysis was conducted to identify groups of responses with similar values within each cost category.

Definitions and detailed information regarding the median, percentiles, trimmed mean and clustering analysis are fully described in the 2018 study report (Ibarburu et al., 2019).

Survey Results

A total of 16 responses were received, compared to 23 in the 2018 survey. Although it is impossible to know the production of the laying hens represented by the responses due to the anonymity of the respondents, some rough estimates suggest this represents approximately 80 million layers. The

assumptions used for that estimation were derived from the February 2021 edition of magazine *Egg-Industry*, published by WATT Media. This publication shares data about egg company rankings and helped provide the foundational data for the following assumptions:

- Farmers that process more than three million cases in a year would have on average 10.7 million layers,
- Farmers that process less than three million cases would have on average 1.6 million layers.

Under these assumptions, the survey responses represent approximately 25% of the U.S. laying hen inventory, and 35% of the laying hens dedicated to shell egg production.

It was estimated that approximately 74% percent of the eggs processed by the respondents were nest-run in-line eggs, 24% were nest-run off-line eggs, and 2% were graded loose eggs. If a respondent indicated they didn't process any of the four egg types listed above, their responses related to those eggs were not included in the analysis.

Packaging costs:

Table 1 presents the results of the survey for the various types of packaging materials and their associated costs. The total number of usable responses is shown as well as the calculated median and trimmed mean costs, the dispersion, and the difference between the median and the trimmed mean expressed in both cents per dozen eggs and in percent.

Table 1. Packaging material for cartoned eggs in cents per dozen

| | Usable responses | Percentiles | | | Trimmed mean | Difference* | |
|---------------------------------|------------------|-------------|-----------------|-----------------|--------------|-------------|-----|
| | | Median | 25th Percentile | 75th Percentile | | cents/doz. | % |
| Carton cost: 12 - Pack | 16 | 9.95 | 9.58 | 10.56 | 10.04 | -0.09 | -1% |
| Carton cost: 18 - pack | 16 | 9.95 | 9.14 | 12.02 | 10.36 | -0.41 | -4% |
| Other packaging: "5 dozen" | 13 | 9.30 | 9.05 | 12.00 | 9.88 | -0.58 | -6% |
| Other packaging: "filler flats" | 15 | 2.90 | 2.74 | 3.15 | 2.92 | -0.02 | -1% |
| Case cost (30 dozen) | 15 | 3.60 | 3.31 | 4.25 | 3.72 | -0.12 | -3% |
| Case cost (15 dozen) | 13 | 4.10 | 3.82 | 4.26 | 4.07 | 0.02 | 1% |
| Finishing costs: | 14 | 1.14 | 0.78 | 1.48 | 1.13 | 0.00 | 0% |

* Difference is the difference between the median and the trimmed mean estimates

There were 16 responses for the 12-egg carton cost. The median cost of the 12-egg carton was 9.95 cents/dozen and the trimmed mean was 10.04 cents/dozen. The dispersion around the median is small, i.e. the IQR is 0.98 cents/dozen and the difference between median and trimmed mean is also small.

There were 16 responses for the 18-egg carton cost. While median cost was the same as for the 12-egg carton, the data were organized into two distinct clusters ($p < 0.05$): the 1st cluster consisted of 12 observations with a median value of 9.55 cents/dozen, and the 2nd cluster consisted of 4 observations with a median value of 14.95 cents/dozen. The suspicion is that there was a possible problem with the respondents' interpretation of this question; the median value for the 2nd cluster was approximately 1.5 times larger than the median of the 1st cluster (14.95 cents/dozen vs. 9.34 cents/dozen). This suggests that some producers may have responded on a cents/dozen basis and others responded on a cents per "18-pack" basis (because the "18-pack" package contains 1.5 dozen). Overall, the median cost of the

18-pack was 9.95 cents/dozen and the trimmed mean was 10.36 cents/dozen (a 4% difference between these two estimates).

There were 14 responses for the 5-dozen package cost. One of them was determined to be an outlier, leaving 13 usable responses. The median cost of the 5-dozen package was 9.30 cents/dozen and the trimmed mean was 9.88 cents/dozen. The dispersion around the median is medium, but the difference between median and trimmed mean was large at 6%.

There were 16 responses for the filler flats cost. One of them was determined to be an outlier, leaving 15 usable responses. The median cost of the filler flats was 2.90 cents/dozen and the trimmed mean was 2.92 cents/dozen. The dispersion around the median is small at 0.41 cents/dozen.

There were 15 responses for the case cost for a 30-dozen case. The median case cost was 3.60 cents/dozen and the trimmed mean was 3.72 cents/dozen (a 3% difference between these two estimates). The dispersion around the median is medium at 0.94 cents/dozen.

There were 15 responses for the case cost for a 15-dozen case. Two of them were determined to be outliers, leaving 13 usable responses. The median case cost was 4.10 cents/dozen and the trimmed mean was 4.07 cents/dozen. The dispersion around the median is small at 0.44 cents/dozen.

There were 14 responses for the finishing cost (pallets, shrink wrap, slip sheets, etc.). The median finishing cost was 1.14 cents/dozen and the trimmed mean was 1.13 cents/dozen. The dispersion around the median is large percent-wise.

There were only 8 responses for the reusable plastic containers cost, of which two were determined to be outliers, leaving six usable responses with a median value of 4.36 cents/dozen (equal to the trimmed mean).

Transportation costs:

Table 2 presents the results of the survey for three types of transportation and associated costs. The total number of usable responses is shown as well as the calculated median and trimmed mean costs, the dispersion represented by the IQR (i.e. the difference between the 25th percentile and 75th percentile in the table), and the difference between the median and the trimmed mean expressed in both cents per dozen eggs and in percent.

Table 2. Transportation costs of cartoned eggs in cents per dozen (for freight within the same U.S. region):

| | Usable responses | Percentiles | | | Trimmed mean | Difference* | |
|--------------------------|------------------|-------------|-----------------|-----------------|--------------|-------------|----|
| | | Median | 25th Percentile | 75th Percentile | | cents/doz. | % |
| Delivered to a Warehouse | 15 | 5.56 | 4.05 | 7.09 | 5.43 | 0.13 | 2% |
| Picked Up by a Warehouse | 12 | 1.14 | 0.35 | 1.85 | 1.12 | 0.01 | 1% |

* Difference is the difference between the median and the trimmed mean estimates

There were 15 responses for the cost of delivering eggs to a warehouse. The median cost of delivering eggs to a warehouse was 5.56 cents/dozen and the trimmed mean was 5.43 cents/dozen. The dispersion around the median is large percent-wise and was 3.04 cents/dozen, but a lot of this variability is

explained by the transportation distances. There is some indication that some of the variability could be explained by regional differences, but unfortunately, not enough responses were received to be able to estimate by region.

There were 12 responses for the picked-up cost. The median picked-up cost was 1.14 cents/dozen and the trimmed mean was 1.12 cents/dozen. The dispersion around the median is very large (IQR = 1.5 cents/dozen). There were few responses for this question, which may have affected the accuracy of the results.

There were only seven responses for the cost of delivering eggs to the store door and the responses were very different between them. Therefore, the results are not reported.

Processing costs:

The processing costs are divided into two components, the cost of processing (washing, weighing, etc.) and the grade yield loss (which is the sum of the losses for eggs received that are of lower value such as smaller sizes, or undergrades, and the gain for the eggs received that are of higher value such as larger size eggs).

Table 3 presents the results for the processing cost of Graded Nest Run Eggs – Class 1 (GNR1 eggs), sourced in-line and sourced off-line. The total number of usable responses is shown as well as the calculated median and trimmed mean costs, the dispersion represented by the IQR, and the difference between the median and the trimmed mean expressed in both cents per dozen eggs and in percent.

Table 3. Cost of processing Gradeable Nest Run Class-1 eggs (cents per dozen)

| Eggs sourced | Usable responses | Percentiles | | | Trimmed mean | Difference* | |
|--------------|------------------|--------------|-----------------|-----------------|--------------|-------------|------|
| | | Median | 25th Percentile | 75th Percentile | | cents/doz. | % |
| In-line | 13 | 12.90 | 12.47 | 17.18 | 14.21 | -1.31 | -10% |
| Off-line | 14 | 15.47 | 14.09 | 20.50 | 16.47 | -1.00 | -6% |

* Difference is the difference between the median and the trimmed mean estimates

There were 13 responses for the cost of processing GNR1 eggs sourced in-line. The median and trimmed mean were 12.90 and 14.21 cents/dozen, respectively. The dispersion around the median is large percent-wise and was 4.71 cents/dozen. While some of the variability could be explained by regional differences, unfortunately, not enough responses were received to be able to produce robust regional estimates.

There were 14 responses for the cost of processing GNR1 eggs sourced off-line. The median for the entire sample was 15.47 cents/dozen and the trimmed mean was 16.47 cents/dozen. The dispersion around the median is large percent-wise and is 6.41 cents/dozen. There is some indication that some of the variability could be explained by regional differences, but unfortunately, not enough responses were received to be able to generate robust regional estimates.

There were only five responses for the cost of processing graded loose eggs and the responses were very different between them. Therefore, the results are not reported.

Large variability in the grade yield loss was reported and some clustering was found in the 2018 PCT data. One hypothesis is that part of the observed variability and clustering might be explained by egg size price differentials with respect to the white large egg prices. Therefore, this survey asked for proportions of different egg sizes and class obtained when the egg farmers process GNR1 eggs and graded loose eggs. There were not enough responses for graded loose eggs, therefore the published values are for GNR1 eggs only. The results for GNR1 eggs both in-line and off-line are shown in Table 4. To avoid skewing the results with outlier values, the proportions were estimated in three steps. The first step was to estimate the median value for the proportion of eggs in each size category. The second step was to calculate the sum of the median values. Finally, the share of each size category with respect to the sum of median values was defined as the estimated percentage of eggs by size so that the estimated proportions add up to 100%. These proportions of eggs of different classes and sizes were then used to estimate the grade yield loss published in table 5.

Table 4. Percentage of eggs of different sizes and class for processing Gradeable Nest Run Class-1 eggs

| Eggs sourced | Usable responses | Percentage of eggs of different sizes and class | | | | | | |
|--------------|------------------|---|-------------|-------|--------|-------|-------------|------|
| | | Jumbo | Extra-Large | Large | Medium | Small | Undergrades | Loss |
| In-line | 12 | 3.9% | 27.5% | 53.0% | 9.3% | 1.0% | 4.1% | 1.4% |
| Off-line | 12 | 3.7% | 23.0% | 54.7% | 10.9% | 0.7% | 5.1% | 1.9% |

The grade yield loss associated with processing GNR1 eggs both in-line and off-line were estimated using the 2020 prices of white eggs of different sizes and classes for each region. The prices reported by USDA for eggs delivered to warehouses were used for: extra-large, large, and medium sizes (all white). USDA doesn't report warehouse prices for small or jumbo size eggs. Therefore, the prices for jumbo eggs were estimated as 13 cents/dozen higher than the extra-large egg prices based on the price difference between these 2 sizes of eggs reported by Uner Barry for 2020. Similarly, the prices for small eggs were estimated as 29 cents/dozen lower than the medium egg prices based on the prices difference between these 2 sizes of eggs reported by Uner Barry for 2020. The prices used for California is for "eggs delivered to 1st recipients" as published by USDA. USDA doesn't report warehouse prices for the Northwest region, the prices for the Northwest region were estimated as 15 cents/dozen lower than the Midwest region prices based on the prices difference between these 2 regions reported by Uner Barry for 2020. The estimated grade yield loss is different between regions with the lowest estimated values in the Midwest and Northeast and the highest values in California as shown in Table 5. Losses are higher for off-line eggs in all regions. There is also a large amount of variability by company in reported proportions of types and sizes of eggs, this variability is not reflected in Tables 4 or 5.

Table 5. Estimated grade yield loss from processing Gradeable Nest Run Class-1 eggs

| Eggs sourced | Estimated Grade Yield Loss using Uner Barry prices for each region (cents/dozen) | | | | | |
|--------------|--|------|------|------|------|-------|
| | MW | NE | SE | SC | NW | CA |
| In-line | 5.63 | 5.97 | 6.60 | 5.40 | 6.42 | 9.80 |
| Off-line | 7.22 | 7.75 | 8.43 | 7.59 | 8.25 | 12.95 |

A grade yield loss was estimated for each company using the company's reported proportion of eggs in different classes and sizes, and the prices of different types of eggs in the region where each company

was operating. If a company had facilities in more than one region, a simple average of the egg prices in those regions was used. The median and trimmed mean are shown in Table 6. The values obtained are in the lower range of the estimated grade yield loss by region given in Table 5, which can be explained by a large proportion of responses obtained from companies located in the Midwest region, and the lack of responses with proportions of eggs of different sizes from companies located in the West regions.

Table 6. Estimated grade yield loss from processing Gradeable Nest Run Class-1 eggs using respondent region and percentages of eggs of different classes and sizes obtained

| Eggs sourced | Percentiles (cents/dozen) | | | Trimmed mean (cents/dozen) | Difference* | |
|--------------|---------------------------|-----------------|-----------------|----------------------------|-------------|-----|
| | Median | 25th Percentile | 75th Percentile | | cents/doz. | % |
| In-line | 5.52 | 4.45 | 6.00 | 5.35 | 0.17 | 3% |
| Off-line | 6.97 | 5.50 | 10.63 | 7.58 | -0.61 | -8% |

* Difference is the difference between the median and the trimmed mean estimates

Additional costs statistics:

There were 13 responses for the difference in processing costs between standard and USDA certified graded eggs. The median and trimmed means were 1.09 and 1.00 cents/dozen, respectively. The 25th percentile was 0.95 cents/dozen and the 75th percentile was 1.40 cents/dozen.

There were only five responses for the loss from store returns and the responses were very different. Therefore, the results are not reported.

Sum of packaging, processing and transportation costs (excluding grade yield loss and loss from store returns):

To estimate aggregate costs of packaging, processing and transporting eggs to warehouses, the following costs were summed: the 12-pack carton, the case, finishing, processing, and the cost of transporting eggs to warehouses, for both in-line and off-line GNR1 eggs. The grade yield loss is an important component of the cost but is not only different by region but also changes as the prices of different types and sizes of eggs change with respect to the large white egg prices. Therefore, it is better to estimate them for each period based on the proportions published in Table 4 as shown in Table 5. The estimated values using the year 2020 average prices are summarized in Table 7.

Table 7. Sum of the following costs for processing Gradeable Nest Run Class-1 eggs: packaging materials, processing and transporting to a warehouse (grade yield loss and loss from store returns not included)

| Eggs sourced | Percentiles (cents/dozen) | | | Trimmed mean (cents/dozen) | Difference* | |
|--------------|---------------------------|-----------------|-----------------|----------------------------|-------------|-----|
| | Median | 25th Percentile | 75th Percentile | | cents/doz. | % |
| In-line | 33.14 | 30.19 | 40.56 | 34.53 | -1.39 | -4% |
| Off-line | 35.71 | 31.82 | 43.88 | 36.78 | -1.08 | -3% |

* Difference is the difference between the median and the trimmed mean estimates

The median aggregate costs of packaging, processing and transporting eggs to warehouses (excluding loss from store returns and grade yield loss) were 33.14 and 35.71 cents/dozen for GNR1 sourced in-line and off-line, respectively. The trimmed mean aggregate costs of processing and transporting eggs

to warehouses (excluding loss from store returns and grade yield loss) were 34.53 and 36.78 cents/dozen for GNR1 sourced in-line and off-line, respectively. The IQR was substantial, 10.37 cents/dozen for GNR1 sourced in-line and 12.06 cents/dozen for GNR1 sourced off-line.

Total PCT Costs (delivered to warehouses):

A total of 180 combinations are possible with the responses obtained through this survey. These include: types of eggs processed (two types included in the survey), packaging sizes (five types included in the survey), cases or reusable plastic containers (three options), transportation modes (three types included in the survey), and grading (USDA graded or not). These can potentially provide estimates of PCT costs for 180 combinations in each region, provided that enough responses were received. The example below (Table 8), is the estimated PCT cost of in-line or off-line non-USDA certified graded eggs, packaged in 12-pack cartons in regular cases, and delivered to a warehouse.

The total PCT costs are normally estimated for eggs delivered to the store door. Unfortunately, not enough responses were obtained about the cost of transporting eggs to a store door to be able to publish it. Alternatively, the PCT cost of eggs delivered to a warehouse was estimated, which is normally lower than the cost delivered to a store door.

The median total PCT costs of eggs delivered to warehouses (calculated as the sum of the median cost of packaging, processing, and transportation to a warehouse within the same region) were: 38.66 cents/dozen for GNR1 sourced in-line, and 42.67cents/dozen for GNR1 sourced off-line (Table 8). For USDA certified graded eggs, the cost difference between standard and USDA should be added. The dispersion of values around these median estimates is substantial, ranging between 11.9 and 17.2 cents/dozen depending on the type of egg processed. The trimmed mean total PCT costs were 39.88 and 44.36 cents/dozen for GNR1 sourced in-line and off-line, respectively. The difference between the trimmed mean estimates and the median estimates range between 3% and 4%. The loss from store returns wasn't included in this sum because of the concerns outlined on page 9, but they should be part of the total PCT costs reported below.

A main factor of the PCT cost is the grade yield loss calculation. This depends on the differences between the prices of eggs of different classes and sizes with respect to the price of grade A large white eggs. The prices of different classes and sizes of eggs are different between regions and change frequently. Therefore, this estimate is constantly changing throughout the entire year and varies between regions of the country as illustrated in Table 5

Table 8. PCT costs for processing Gradeable Nest Run Class-1 eggs, packaged in 12-pack cartons, in regular cases, non-USDA certified, and delivered to a warehouse (loss from store returns not included)

| Eggs sourced | Percentiles (cents/dozen) | | | Trimmed mean (cents/dozen) | Difference* | |
|--------------|---------------------------|-----------------|-----------------|----------------------------|-------------|-----|
| | Median | 25th Percentile | 75th Percentile | | cents/doz. | % |
| In-line | 38.66 | 34.64 | 46.56 | 39.88 | -1.22 | -3% |
| Off-line | 42.67 | 37.32 | 54.51 | 44.36 | -1.69 | -4% |

* Difference is the difference between the median and the trimmed mean estimates

Comparison with previous results

The results reported above are not directly comparable to the results from our previous 2018 survey because of three key methodological differences. First, in 2018 egg processors were asked to provide their estimated grade yield loss and in 2020 it was estimated from the proportions of eggs of different classes and sizes obtained from processing nest run eggs and the prices in different regions. Second, the 2020 survey would allow us to calculate transportation and processing costs by region provided that enough responses were received while the 2018 survey did not differentiate costs across regions, providing only one national average to report. Third, the sample size in 2020 was smaller than in 2018, and therefore the national representation of the results could have declined between surveys.

While acknowledging that results from the two surveys are not directly comparable, in this section the median and trimmed mean responses obtained in 2020 are evaluated for how closely they fall within the IQRs from the 2018 survey.

Table 9 compares 2020 and 2018 median, trimmed mean, and IQR for some of the costs. The median value for the cost of the 12-egg carton was within the IQR obtained in 2018, while the trimmed mean value for the cost of the 12-egg carton was 0.02 cents/dozen above the 2018 75th percentile. The median and trimmed mean values for the cost of the 18-egg cartons were within the IQR obtained in 2018. The median value for the cost of the 30-dozen cardboard cases was 0.05 cents/dozen below the 2018 25th percentile while the trimmed mean value was within the IQR obtained in 2018, although the 2018 cost didn't differentiate between 30-dozen and 15-dozen case sizes. The median and trimmed mean values for the cost of the 15-dozen cardboard cases were within the IQR obtained in 2018. The median and trimmed mean values for the finishing costs were 0.05 cents/dozen higher than the 75th percentile values obtained in 2018.

Table 9. Comparison of costs between 2020 and 2018 (cents per dozen)

| | Results for 2020 | | | | Results for 2018 | | | |
|--|------------------|-----------------|-----------------|--------------|------------------|-----------------|-----------------|--------------|
| | Median | 25th Percentile | 75th Percentile | Trimmed mean | Median | 25th Percentile | 75th Percentile | Trimmed mean |
| Carton cost: 12 - Pack | 9.95 | 9.58 | 10.56 | 10.04 | 9.80 | 9.54 | 10.02 | 9.78 |
| Carton cost: 18 - pack | 9.95 | 9.14 | 12.02 | 10.36 | 9.53 | 9.03 | 11.18 | 9.87 |
| Case cost (30 dozen)* | 3.60 | 3.31 | 4.25 | 3.72 | 4.00 | 3.65 | 4.10 | 3.89 |
| Case cost (15 dozen)* | 4.10 | 3.82 | 4.26 | 4.07 | | | | |
| Finishing costs: | 1.14 | 0.78 | 1.48 | 1.13 | 0.90 | 0.62 | 1.08 | 0.89 |
| <u>Transportation Cost:</u> | | | | | | | | |
| Delivered to Warehouse | 5.56 | 4.05 | 7.09 | 5.43 | 5.50 | 4.00 | 6.00 | 5.21 |
| Picked up by Warehouse | 1.14 | 0.35 | 1.85 | 1.12 | 2.00 | 1.00 | 2.50 | 1.93 |
| <u>Processing Cost for processing Gradeable Nest Run Class-1 eggs:</u> | | | | | | | | |
| Eggs Sourced In-line | 12.90 | 12.47 | 17.18 | 14.21 | 13.27 | 10.55 | 17.21 | 13.54 |
| Eggs Sourced Off-line | 15.47 | 14.09 | 20.50 | 16.47 | 15.75 | 11.35 | 18.49 | 15.27 |

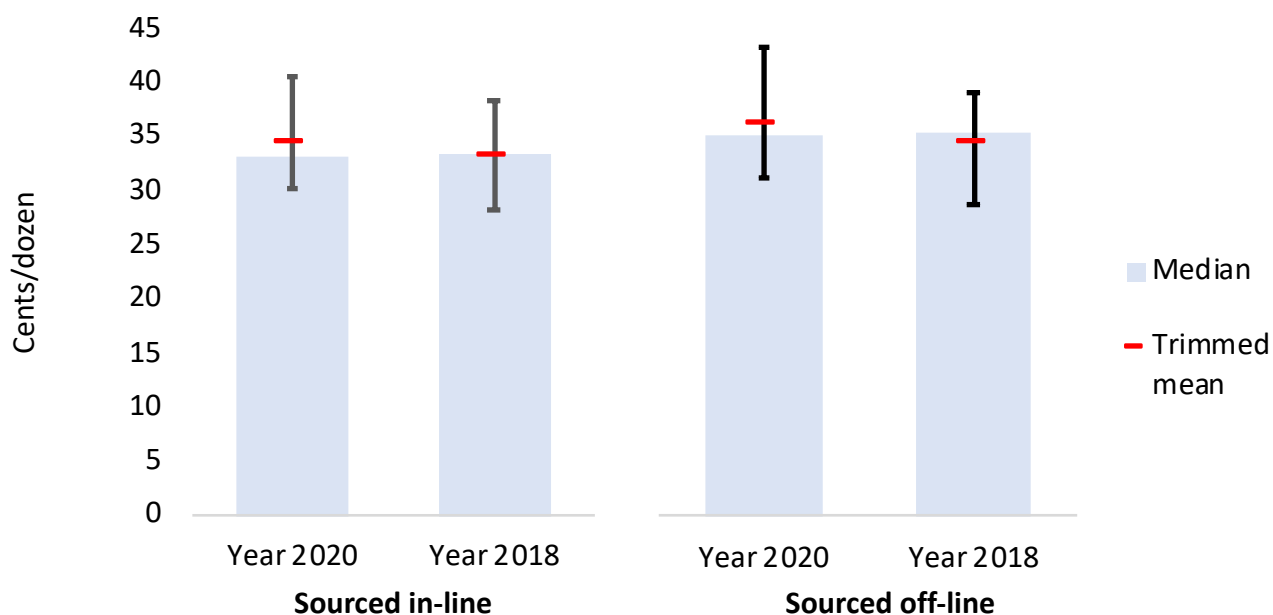
* The value for 2018 is the average of 30 dozen and 15 dozen cases

The median and trimmed mean values for the cost of delivering eggs to a warehouse, and the cost of pick-up by warehouse option, were within their respective IQRs of 2018. However, the ranges were substantial in both surveys.

The median and trimmed mean values for the cost of processing GNR1 eggs sourced in-line were within the IQR obtained in 2018, as were the values for the cost of processing GNR1 eggs sourced off-line. The ranges were substantial in both surveys.

Figure 1 compares the aggregate costs of packaging, processing and transporting eggs to warehouses (excluding loss from store returns and grade yield loss) obtained this year with the data from 2018, for GNR1 eggs sourced both in in-line and off-line. The median and trimmed mean values were within their respective IQRs of 2018 for both.

Figure 1. PCT costs of Gradeable Nest Run Class-1 eggs, packaged in 12-pack cartons in regular cases, non-USDA certified, and delivered to warehouses. [Without including the grade yield loss and loss from store returns.](#)



Note: Vertical lines represent the Interquartile range

The largest difference between the 2018 and 2020 studies is grade yield loss from processing GNR1 eggs sourced both in-line and off-line (Table 10). In 2018, a concern identified about the distribution of the responses for the grade yield loss was: “two clusters of data with very different median values where the median value of the higher cluster is almost two times larger than the median value of the lower cluster.” The dispersion around the median was very large as well. The hypothesis was that this variability “... might be explained, in part, by different markets with different price structures,” or it could be explained in part by “... the use of different methods to estimate grade yield loss.” Therefore, for this update of the estimated costs a change was made in the method: instead of asking egg processors their estimated grade yield loss, the questions elicited information on the proportions of eggs of different sizes or classes obtained from processing GNR1 eggs (in-line or off-line), and used

these proportions to estimate the grade yield loss based on prices published by USDA and Urner Barry. This change in methodology along with differences in the composition of egg farmers responses to the survey might explain the differences in results with respect to the 2018 survey.

Table 10. Comparison of grade yield losses between 2020 and 2018 for Gradeable Nest Run Class-1 eggs (cents per dozen)

| Eggs sourced | Results for 2020 | | | | Results for 2018 | | | |
|--------------|------------------|-----------------|-----------------|--------------|------------------|-----------------|-----------------|--------------|
| | Median | 25th Percentile | 75th Percentile | Trimmed mean | Median | 25th Percentile | 75th Percentile | Trimmed mean |
| In-line | 5.52 | 4.45 | 6.00 | 5.35 | 7.04 | 5.34 | 11.03 | 7.57 |
| Off-line | 6.97 | 5.50 | 10.63 | 7.58 | 10.00 | 7.79 | 10.74 | 9.50 |

Concluding Comments

This study updates processing, cartoning, and transportation cost estimates for the U.S. egg industry in 2020, with the objective to create a benchmark useable for an industry standard. The findings presented in the previous sections are limited by the low number of responses obtained, which made regional cost estimates especially challenging.

It is evident from the study that the price difference between different egg sizes in California result in a much greater grade yield loss than in the other regions.

The estimated median and trimmed mean PCT costs of processing GNR1 eggs sourced in-line and delivered to warehouses were 38.66 cents/dozen and 39.88 cents/dozen respectively. The median and trimmed mean PCT costs of processing GNR1 eggs sourced off-line and delivered to warehouses were 42.67 cents/dozen and 44.36 cents/dozen respectively. A larger sample size would be needed to actually estimate if there are regional differences and by how much they differ.

While some categories of reported costs are fairly concentrated around the median (e.g. 12-pack carton costs and case cost), other categories show high degrees of dispersion (e.g. processing cost and transportation). Consequently, any practical use of the estimates presented in this study must be qualified by the uncertainty surrounding the median and trimmed mean estimates.

The results from this survey are mostly within the range of values obtained in 2018, except the grade yield loss that was estimated using a different approach. The large difference for the grade yield loss might be explained in part by the change in the information collection method and subsequent estimation, and in part by the proportion of answers from regions with higher grade yield loss such as California.

Acknowledgments

The authors thank Dr. Alicia Carriquiry, Iowa State University Distinguished Professor of the Department of Statistics, for her guidance about the best way to analyze this data. Also, a special thanks goes to the egg farmers/processors that collaborated with the study responding to the surveys.

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Appendix 1. Survey Questionnaire

Confidential
PROCESSING, CARTONING, and TRANSPORTATION (PCBT) SURVEY

Time period represented in this survey should be: January 2020 through December 2020

Please answer N/A on any question you don't have an answer for it.

OF EGGS REPRESENTED IN THIS SURVEY (check one)

More than 3 million cases

Less than 3 million cases

Question 1. NUMBER OF EGGS PROCESSED IN PLANT AS A % OF TOTAL

| NEST RUN SOURCED IN-LINE | NEST RUN SOURCED OFF-LINE | GRADED LOOSE EGGS | TOTAL |
|--------------------------|---------------------------|-------------------|-------|
| 0 | | | 0 |

Question 2. PACKAGING MATERIAL FOR CARTONED EGGS

(please specify units):

| CARTON COST | COST/UNIT | UNITS USED (select from drop down) |
|--|-----------|---------------------------------------|
| 12 - pack | - | - |
| 18 - pack | - | - |
| OTHER PACKAGING: 18 pack overwrap aka twin 18s * | - | - |
| 3 dozen * | - | - |
| filler flats * | - | - |

* Please include additional materials and labor and pro-rata handling and freight if applicable.

| CASE COST (30 dozen case): | COST/UNIT | UNITS USED (select from drop down) |
|---|-----------|---------------------------------------|
| CASE COST (15 dozen case): | - | - |
| Reusable Plastic Containers (Service fee and/or shrink + sanitation costs if owned): | - | - |
| FINISHING COSTS (Pallets, Shrink Wrap, Slip Sheets, etc): | - | - |

Question 3. PROCESSING COST: FOR EACH CATEGORY OF EGG PROCESSED, PLEASE INCLUDE THE SUM OF LABOR, BENEFITS, INTERNAL INSPECTIONS, FOOD SAFETY AUDITS + COMPLIANCE (SQF/HAACP), UTILITIES, MAINTENANCE, RENT, BUYING AND SELLING COSTS, ADMINISTRATIVE/FOOD SAFETY, BIOSECURITY AND WAREHOUSE (cents/dozen).
Costs should not include any marketing fee or discount given to the retailer for product placement or slotting.
For the food safety costs. Don't include the costs incurred in the layer houses such as testing and controlling rodent in the layer houses. These should be the costs associated with the egg processing only.

Please see regions map in the last page

| | Northeast (cents/dozen) | Southeast (cents/dozen) | Midwest (cents/dozen) | South Central (cents/dozen) | West (cents/dozen) |
|---|----------------------------|----------------------------|--------------------------|--------------------------------|-----------------------|
| Gradeable Nest Run Class 1 - Sourced IN-LINE (GNR 1) | | | | | |
| Gradeable Nest Run Class 1 - Sourced OFF-LINE (GNR 1) | | | | | |
| Graded loose LG (plant grade) | | | | | |
| Graded loose XL (plant grade) | | | | | |



Appendix 1. Survey Questionnaire (continue)

Question 4. DATA TO ESTIMATE GRADE YIELD LOSS: FOR EACH CATEGORY OF EGG PROCESSED, PLEASE ANSWER WHICH PROPORTION OF THE DIFFERENT TYPES OF EGGS YOU END UP GETTING AFTER PROCESSING.

| | GNR 1 - Sourced IN-LINE | GNR 1 - Sourced OFF-LINE | Graded loose LG (plant grade) | Graded loose XL (plant grade) |
|-------------------------------------|----------------------------|-----------------------------|----------------------------------|----------------------------------|
| Percent of JUMBO | | | | |
| Percent of EXTRA-LARGE | | | | |
| Percent of LARGE | | | | |
| Percent of MEDIUM | | | | |
| Percent of SMALL | | | | |
| Percent of UNDERGRADES ^A | | | | |
| Percent of LOSS | | | | |
| TOTAL | 0 | 0 | 0 | 0 |

^A sum of class B, pews, and checks eggs

Question 5. TRANSPORTATION COSTS OF CARTONED EGGS (for freight WITHIN the same U.S. region):

INCLUDE FUEL, EQUIPMENT, ALL LABOR, ALL FEES, TOLLS

Please answer for all regions you know these costs.

Please see regions map in the last page

| | Northeast to Northeast | Southeast to Southeast | Midwest to Midwest | South Central to South Central | West to West |
|--|---------------------------|---------------------------|-----------------------|-----------------------------------|--------------|
| DELIVERED - COST/TRUCKLOAD | | | | | |
| STORE DOOR - AVG. MILES/TRIP | | | | | |
| DELIVERED - COST/TRUCKLOAD | | | | | |
| WAREHOUSE - AVG. MILES/TRIP | | | | | |
| PICKED UP - WAREHOUSE (only the cost of loading the truck) | | | | | |

| | |
|------|---|
| Note | all fees should include lumper fees for example |
| | all labor should include loading labor for example |
| | don't include customer allowance under picked-up costs because it might end up in double counting |

Question 6. Loss from store returns:

Percent of eggs that are returned from the store

Not applicable

Average loss per dozen eggs returned (cents/dozen)

| |
|--|
| |
| |

Question 7. What's the processing cost difference between standard and top grade USDA certified?

COST Difference

UNITS USED (select from drop down)

| | |
|--|--|
| | |
|--|--|

Note: Please include only USDA fee per case inspected. Don't include associated costs such as: stop production because of the plant is out of specification, diverted eggs because of wrong expiration date on a carton, etc.



Appendix 1. Survey Questionnaire (continue)

OPTIONS TO RETURN YOUR SURVEY

- Submit online at:
<https://www.eggindustrycenter.org/industry-analysis/wash-pack-trans-cost-survey/>
- Mail it to the Egg Industry Center, 1029 N. University Blvd., 1202 NSRIC, Ames, Iowa 50011 (and write this information in the return address area as well)

Please call (515-294-8132) or e-mail Maro (maro@iastate.edu) with any questions or concerns you have.

Thank you, in advance, for your cooperation!

Please return your survey by March 15th, 2021

