DECREASING EGGSHELL DAMAGE

by

Bruce E. Lederer
Marketing Specialist, USDA, AMS
Beltsville, Maryland

Author found that the individual carton design of the cartons tested was more critical to a carton's protective capability than was carton material.

INTRODUCTION

The annual cost of damage to shell eggs along the distribution channel in the U.S. ranges between $170 and $250 million.[1] A factor affecting these losses is the carton in which the eggs are packed for retail distribution.

Most comprehensive shell-egg packaging studies in the past have been limited to laboratory research. Small scale egg carton studies have been conducted in the field, but because of the often narrow tolerances among damage rates of different cartons and the limited number of trials to which these cartons were subjected, it has been difficult to come to any decisive conclusions about the protective capability of the test cartons.

PURPOSE

The purpose of this study was to evaluate the protective capability of 10 commonly used 12-egg cartons at both the originating packing plant and at a shipping destination when packed and transported in two types of master containers.

PROCEDURES

The test cartons included six plastic foam and four molded pulp designs. Fifteen-dozen baskets (wire or plastic) or 30-dozen fiberboard cases were used for packing and shipping the cartons. It was not within the scope of this research to evaluate the master containers except as variables in transporting eggs. However, another publication[2] may be a useful guide in determining the differences in the protective capabilities of 15-dozen baskets and 30-dozen cases, depending on stacking patterns of cartons within them regardless of carton type.

State licensed inspectors graded the eggs at eight large packing plants, nine central distribution warehouses, and 11 retail supermarkets. Data were based on 42 truck shipments, each having 20 master containers of test eggs. Straight body trucks or tractor trailers drove an average of 135 miles one-way to deliver the test shipments to their destinations.

Eggs for each shipment came from the same flock of birds and were all grade A or AA large. Each master container within each individual shipment was of the same type, and was handled the same as all other containers in the shipment.

Shipments represented three age categories of laying hens for each season of the year: under 40 weeks old; 40-60 weeks old; or over 60 weeks old. These variables were chosen to be representative of the relative damage that could be expected during normal year-round operations.

Egg cartons were parallel-stacked in 15-dozen baskets, and cross-stacked in 30-dozen cases for each of their respective shipments. This stacking arrangement has been shown to result in the least damage.

During grading at the plant, checks were identified with a penmark on the end of the damaged egg, recorded on a worksheet, then returned to their original position in the carton. Leakers were recorded, after which they were removed and replaced with sound shell eggs.

Master containers were placed on pallets after grading. Each pallet held 20 master containers, one shipment. Each of the ten types of test cartons was represented in two master containers in each shipment.

After being stored in the cooler for up to four days, a pallet of eggs was transported to the loading dock, handstacked randomly at the rear of a delivery vehicle, and then delivered.

At destination, eggs were moved to the grading area and inspected for damage that might have occurred after initial inspection at the packing plant. If checks from the plant become leakers at destination, the latter damage was not counted a second time. All the newly damaged eggs were recorded on the worksheet and their cell location within the cartons noted.

RESULTS

Average shell damage within all test cartons and master containers amounted to 4.75 percent at the plant and 1.93 percent at destination. Slightly more than 40 percent of destination damage occurred at the front of the test cartons and close to 60 percent occurred at the rear.

Thirty-dozen cases - There was no significant difference in total shell damage between the foam (F) and pulp (P) carton groups when packed in 30-dozen fiberboard cases (Table 1).

When comparing shell damage rates among the ten carton designs within the fiberboard cases (Table 2), the total damage in carton F1 with 4.18 percent was significantly less than cartons F4, P3, F5, and P4 with 7.12, 6.04, 5.94, and 5.79 percent, respectively.

Fifteen-dozen baskets - Pulp cartons packed in 15-dozen baskets had 8.03 percent shell damage compared with the foam cartons 8.94 percent (Table 3). Most of the difference occurred at the plant with eggs in foam cartons receiving an appreciably higher rate of checks than eggs in pulp cartons.

When comparing rates among all carton designs within 15-dozen baskets (Table 4), the total rate within carton F2 with 6.96 percent was significantly less than cartons F3, F6, F5, and P3 with 11.10, 10.75, 9.19, and 9.17 percent, respectively.

CONCLUSIONS AND RECOMMENDATIONS

Three major conclusions have been drawn from the results of this study:

1. Although not emphasized in this brief article, the research results indicated that there was a greater range of shell damage observed among foam cartons than among pulp cartons.

2. The foam carton group had a significantly higher total damage rate than the pulp carton group when packed and shipped in 15-dozen baskets.

TABLE 1. AVERAGE RATE OF EGGSHELL DAMAGE BY CARTON MATERIAL WITHIN 30-DOZEN FIBERBOARD CASES[1]

Material	Plant		Destination		Total[2]	
	# of obs.[3]	% damage	# of obs.[3]	% damage	# of obs.[3]	% damage
Foam	308	3.68	295	1.53	294	5.34
Pulp	223	3.52	215	1.96	214	5.55

[1]Numbers connected by the same line do not differ significantly at the 5-percent level of probability.

[2]Total damage rates are based only on those observations for which a value was available at both plant and destination.

[3]One observation was comprised of 100 eggs within one master container.

TABLE 2. DESCENDING EGGSHELL DAMAGE RATES OF ALL CARTONS WITHIN 30-DOZEN FIBERBOARD CASES[1]

Plant		Destination		Total	
Carton identification number	Percent damage	Carton identification number	Percent damage	Carton identification number	Percent damage[2]
F4	4.66	F4	2.28	F4	7.12
F5	4.46	P3	2.17	P3	6.04
P4	4.14	P2	2.14	F5	5.94
P3	3.73	P1	1.86	P4	5.79
F6	3.52	F6	1.83	F6	5.54
F2	3.34	P4	1.72	P2	5.50
P2	3.19	F3	1.35	P1	4.89
F3	3.13	F5	1.35	F2	4.66
P1	3.00	F2	1.26	F3	4.59
F1	2.89	F1	1.20	F1	4.18

[1]Numbers connected by the same line do not differ significantly at the 5-percent level of probability.

[2]Total damage rates are based only on those observations for which a value was available at both plant and destination.

TABLE 3. AVERAGE RATE OF EGGSHELL DAMAGE BY CARTON MATERIAL WITHIN 15-DOZEN BASKETS[1]

Material	Plant		Destination		Total[2]	
	# of obs.[3]	% damage	# of obs.[3]	% damage	# of obs.[3]	% damage
Foam	173	7.44	148	2.17	148	8.94
Pulp	127	5.82	111	2.63	111	8.03

[1]Numbers connected by the same line do not differ significantly at the 5-percent level of probability.

[2]Total damage rates are based only on those observations for which a value was available at both plant and destination.

[3]One observation was comprised of 100 eggs within one master container.

TABLE 4. DESCENDING EGGSHELL DAMAGE RATES OF ALL CARTONS WITHIN 15-DOZEN BASKETS[1]

Plant		Destination		Total	
Carton identification number	Percent damage	Carton identification number	Percent damage	Carton identification number	Percent damage
F6	9.42	P3	3.17	F3	11.10
F3	8.44	F6	2.80	F6	10.75
F4	7.09	F3	2.62	F5	9.19
F1	7.09	P1	2.54	P3	9.17
F5	6.83	P4	2.52	F1	8.43
P2	6.42	F5	2.50	F4	8.07
F2	6.35	P2	2.28	P2	7.93
P3	6.00	F2	2.00	P1	7.71
P1	5.72	F4	1.75	P4	7.16
P4	5.03	F1	1.64	F2	6.96

[1]Numbers connected by the same line do not differ significantly at the 5-percent level of probability

[2]Total damage rates are based only on those observations for which a value was available at both plant and destination.

3. Cartons F1, F2, P1, and P2 consistently performed at or above average and did not differ significantly from each other.

This research has shown that individual carton design of the cartons tested was more critical to a carton's protective capability than was carton material. It is therefore recommended that choice of cartons be made on their individual performance based on type of master container being used.

These research results are not the only criteria for determining choice of cartons or master containers. Marketing strategies relating to sales appeal, and handling systems costs need to be examined and the optimum mix obtained.

FOOTNOTES

[1]O. F. Johndrew, Jr., J. Bespa, and W. J. Toleman, Eggshell Damage From Processor to Consumer in Stores, Information Bulletin 86, Cornell University, 1975.

[2]Lederer, Bruce E. Eggshell Damage From End of Packing Line to Supermarket. U.S. Department of Agriculture, Agricultural Research Service, ARS-NE-93, 1978.