

# OBSERVATIONS ON CELLULOSE FILM OVER- WRAPPING OF EGG CARTONS UNDER QUEENSLAND CONDITIONS

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## SUMMARY

The effect of overwrapping cartons of eggs with MSAT300 Cellulose film was investigated with batches of eggs having a range of initial qualities and stored for one and two weeks at room temperature.

No significant differences in weight loss between overwrapped and unwrapped eggs were observed although there was a trend towards decreased weight loss in the overwrapped group.

Highly significant differences in Haugh Unit values favouring the overwrapped group were observed after one and two weeks of storage.

The interpretation of Haugh Unit rating on break-out in terms of South Queensland Egg Marketing Board grade standards showed an even more definite advantage in favour of overwrapped eggs.

The rapid decline in quality of unwrapped eggs held at room temperatures is very obvious, the rate of decline being of the order of 2.5 Haugh Units per day.

## I. INTRODUCTION

The water and carbon dioxide loss from an egg can be minimized by coating the egg with an oil to seal the pores or by packaging it in an airtight container. Both of these methods are used in North America to prevent rapid deterioration of quality. It is obvious that for maximum results the treatments should be carried out as soon as possible after laying. In at least some States of America oiling is carried out on the farm within 24 hr of laying (Skinner 1960). In Queensland many eggs are a number of days old before they reach the egg-grading floor. Oiling is carried out only where eggs are to be stored at low temperatures for several months or for export as "chilled" eggs. The experiment reported here was designed to determine the value of airtight cartons in slowing down the rate of deterioration of quality where eggs are to be sold as "fresh" eggs.

## II. PROCEDURE

At present all eggs sold by the South Queensland Egg Marketing Board are packed in cartons. The age of these eggs varies from one to about seven days, and consequently the Haugh Unit values (Haugh 1937) for internal quality of these eggs would be variable. The egg samples used for this experiment were therefore taken in a manner to correspond with this variation.

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In all, eight batches of 72 eggs were examined. They were taken from six different farmers' consignments so that the eggs in each particular batch were from the same source and of the same age. Batches 1 and 2 were one day old at the commencement of the experiment, Batches 3, 4, 5 and 6 were two days old and Batches 7 and 8 were five days old.

Each batch of 6 doz eggs was randomly divided into three groups, A, B, and C, each of 2 doz eggs. Group A of each batch was used as a control and was broken out at the commencement of the experiment, thus making the total control sample 192 eggs. Group B of each batch was divided into two lots of 1 doz each. Both lots were cartoned in the usual manner, but in one lot the cartons were overwrapped with MSAT300 Cellulose film. All Group B eggs were broken out and measured after one week in storage. Group C eggs were treated in the same manner as Group B except that the storage period was two weeks, this being the time for which the South Queensland Egg Marketing Board guarantees eggs sold to retailers. Storage was at room temperature. The average daily maximum temperature during the trial was approximately 85°F.

The overwrapping of the cartons with cellulose film was carried out by hand and the wrapping was heat-sealed to make an airtight pack.

All egg quality measurements were made in Haugh Units, which were later converted to A and B grades used for scoring internal quality on U.S. standards, A grade being 55 Haugh Units and above. Grade A eggs correspond to First quality South Queensland Egg Marketing Board eggs.

### III. RESULTS

(i) *Loss of Weight.*—The average weight of each group is shown in Table 1.

TABLE 1  
EFFECT OF OVERWRAPPING ON MEAN EGG WEIGHT

Batch	Initial Value	Mean Egg Weight (g) After 1 Week		Mean Egg Weight (g) After 2 Weeks	
		Unwrapped	Overwrapped	Unwrapped	Overwrapped
1	59.17	59.00	59.04	58.17	58.71
2	57.04	56.38	56.50	56.46	56.42
3	58.21	55.54	56.16	55.71	57.21
4	56.81	55.29	56.12	55.21	56.21
5	62.33	60.68	61.62	61.83	62.00
6	59.90	57.96	58.82	58.33	59.00
7	55.46	54.88	55.67	55.12	55.29
8	59.46	59.46	58.38	56.83	58.08
Average	58.55 ± 0.24	57.40 ± 0.34	57.79 ± 0.34	57.21 ± 0.34	57.86 ± 0.34

When the average weights of all Group B eggs (overwrapped and unwrapped) are compared with the initial weights there is a significant weight loss of  $0.95 \pm 0.34$  g per egg ( $P < 0.05$ ). There is, however, no evidence of a further loss of weight during the second week of storage. In all but two cases, the

overwrapped eggs did not lose as much weight as the unwrapped eggs, but the differences are not significant. After one week, the overwrapped eggs were heavier by  $0.39 \pm 0.48$  g and after two weeks by  $0.66 \pm 0.48$  g. The average of the two weeks shows the overwrapped eggs heavier by  $0.52 \pm 0.34$  g.

(ii) *Haugh Unit Values and Grading.*—The average Haugh Unit value of each group is shown in Table 2.

TABLE 2  
EFFECT OF OVERWRAPPING ON MEAN HAUGH UNIT VALUE

Batch	Group A Initial Value	Group B (After 1 Week)		Group C (After 2 Weeks)	
		Unwrapped	Overwrapped	Unwrapped	Overwrapped
1	82.6	66.5	72.8	55.4	65.1
2	76.5	53.1	60.6	42.4	59.5
3	76.1	60.0	66.7	47.1	58.1
4	77.0	51.2	64.0	49.7	54.2
5	68.7	51.0	52.6	42.3	47.0
6	62.0	51.6	59.8	46.5	45.5
7	72.6	58.3	60.7	52.4	58.4
8	71.5	53.7	61.1	47.6	58.1
Average	$73.38 \pm 0.63$	$55.67 \pm 0.90$	$62.27 \pm 0.90$	$47.92 \pm 0.90$	$55.73 \pm 0.90$

The Haugh Unit values converted to grades are shown in Table 3.

TABLE 3  
EFFECT OF OVERWRAPPING ON GRADE OF EGGS

Batch No.	Group A Initial Grade		Group B* After 1 Week				Group C After 2 Weeks			
			Unwrapped		Overwrapped		Unwrapped		Overwrapped	
	No. A	No. B	No. A	No. B	No. A	No. B	No. A	No. B	No. A	No. B
1	24	0	11	1	11	1	6	6	11	1
2	24	0	6	6	10	2	0	12	10	2
3	24	0	11	1	12	0	2	10	8	4
4	24	0	2	10	12	0	4	8	8	4
5	23	1	3	8	5	7	1	11	4	8
6	20	4	6	6	7	4	2	10	2	10
7	23	1	8	4	10	2	5	7	7	5
8	24	0	5	7	10	2	3	9	7	5
Total	186	6	52	43	77	18	23	73	57	39
Percentage A Quality	$96.9 \pm 1.25$		$54.7 \pm 5.10$		$81.0 \pm 4.02$		$24.0 \pm 4.35$		$59.4 \pm 5.01$	

\* Two eggs were broken and could not be measured.

In all but one case the overwrapped eggs were of higher quality than the unwrapped eggs. After one week of storage, the overwrapped eggs were better by  $6.59 \pm 1.27$  units, and after two weeks of storage by  $7.82 \pm 1.27$  units. Averaging the two periods of storage gives a significant difference of  $7.21 \pm 0.90$  units in favour of the overwrapped eggs. These differences in internal quality evaluation are highly significant ( $P < 0.001$ ).

It would appear from these results that overwrapping reduced loss in internal quality. At the end of one week, the number of First grade eggs in the overwrapped group was  $26.3 \pm 6.5$  per cent. higher than in the unwrapped group and after two weeks was  $35.4 \pm 6.6$  per cent. higher. The differences in percentage quality are highly significant ( $P < 0.001$ ).

#### IV. DISCUSSION

The average initial Haugh Unit value of eggs in the experiment was 73.38. This is of the order of the Haugh Unit value of eggs handled by the South Queensland Egg Marketing Board as estimated by Moffatt and Byrnes (1961). However, this sample contained  $96.9 \pm 1.25$  per cent. of First quality eggs, which is higher than previous estimates. This would indicate that the sample used was not so variable as would normally be expected in a sample of eggs from this Board. The results expressed here may therefore be slightly better than would be expected from an average sample of eggs from the South Queensland Egg Marketing Board.

The overwrapping would be expected to create a micro-climate with high humidity and high partial pressure of carbon dioxide due to loss of water and carbon dioxide from the egg. Once the humidity and carbon dioxide partial pressure built up within the wrapping, then the loss of water and carbon dioxide from the eggs should be diminished. The weight loss from overwrapped eggs should therefore be less than that from unwrapped eggs. However, although there was a trend in this direction the differences were not statistically significant. A larger sample may be necessary to show these differences as real.

Prior to the experiment it was considered that a difference of 16 Haugh Units in favour of overwrapped eggs would be necessary after two weeks of storage to warrant the use of overwrapping. The differences obtained, although highly significant, fall far short of 16 Haugh Units. However, when the eggs are graded according to South Queensland Egg Marketing Board standards instead of Haugh Units the overwrapped eggs are decidedly better. After two weeks of storage the overwrapped eggs are at least as good as unwrapped eggs after one week of storage. The advantage could be sufficient to warrant overwrapping (provided costs are not excessive), especially where eggs are to be transported long distances, which is often the case in Queensland.

This experiment indicates that overwrapping of eggs does tend to reduce quality loss even though the eggs are more than 24 hr old. Further experiments would be necessary to ascertain whether this applies throughout the various seasons

of the year. It could well be that the greatest benefits are to be obtained in the summer months, when keeping quality is adversely affected by high temperatures. The effectiveness of overwrapping may also be increased by including in the carton a small pellet of dry ice to give a high initial partial pressure of carbon dioxide.

An important point which is obvious in this experiment yet which is not generally recognised in Australia is the rapid decline in quality that takes place when eggs are held at ordinary room temperatures. This experiment was carried out in March, when temperatures are not so high as in midsummer. Even after one week of storage comparable to a similar period in a retail shop, the unwrapped eggs contained only 54.7 per cent. of First quality eggs. The average rate of decline is approximately 2.5 Haugh Units per day. The need for air-conditioned storage is obvious.

### V. ACKNOWLEDGEMENTS

The overwrapping of the cartons was carried out by a representative of Austraphane Converting Co., which supplied the MSAT300 Cellulose Film. The statistical analysis was carried out by Mr. A. W. Beattie (Biometrician). The eggs were supplied by the South Queensland Egg Marketing Board.

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