MP-296

Effect of Temperature and Relative Humidity on Market Egg Quality

AUGUST 1958

TEXAS AGRICULTURAL EXPERIMENT STATION

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SUMMARY

Egg cooling studies were conducted at College Station, Texas in 1955-56 under ten different temperature and humidity storage conditions for periods of 1 to 8 days.

Relative humidity at temperatures of 45° F., 55° F. and 65° F. had little or no effect on U. S. Grade of market eggs held for cumulative periods ranging from 1 to 8 days.

A temperature of 45° F. maintained the highest percentage of Grade AA eggs held for cumulative periods ranging from 1 to 8 days.

A temperature of 55° F. maintained as many Grade A eggs as 45° F., for cumulative periods ranging from 1 to 8 days.

The number of Grade A eggs decreased after 3 days' cumulative storage when temperatures exceeded 65° F.

The loss in weight of eggs during holding periods of 1 to 7 days was slight, regardless of the humidity level at which eggs were kept.

These studies show that mechanical refrigeration is needed if eggs are to be marketed on a quality basis. If eggs are sold on a Grade AA market, 45° F. is recommended; if they are sold on a Grade A market, 55° F. or lower is recommended.

Window air conditioning units are not recommended for egg cooling because they are not designed to maintain temperatures as low as 45° to 55° F. under Texas conditions.

Evaporative coolers are not recommended for egg cooling because they cannot lower temperatures down to 45° to 55° F. under normal Texas conditions. The evaporative coolers used in these studies maintained average temperatures of about 80° F.

Mechanical refrigeration units especially designed for egg cooling are available on the market and are recommended for commercial egg producers.

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Effect of Temperature and Relative Humidity on Market Egg Quality

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TEXAS EGG PRODUCERS have become more conscious of egg quality in recent years, and most egg buying stations now purchase eggs on grade. Quality buying programs offer an incentive to producers to deliver better quality eggs.

Objectives

These studies were conducted to obtain information needed by producers so that they may deliver high quality eggs to the buying stations. The specific objectives were to determine:

1. The rate of quality deterioration during short-time storage under different combinations of temperature and humidity.

2. The optimum combination of humidity and temperature that will best hold eggs at high quality for short periods of storage.

3. The cooling equipment that will provide optimum conditions for quality maintenance under Texas conditions.

4. The time interval between marketing of Texas eggs during the summer that will give producers the most profits.

Experimental Procedure

Fresh eggs were gathered at the A&M College Poultry Farm directly from nests and candled to remove broken eggs and eggs with loose air cells or large blood spots. They were then divided into lots of 10 to 30 eggs each and handled under the following conditions:

Lot 1. Eggs were first graded on the basis of USDA grades of shell eggs. They were then broken out of the shell and interior quality was measured on the basis of Haugh Units for albumen quality (initial quality sample).

Lot 2. Held at room conditions designed to simulate ordinary farm conditions where no cooling was available (control sample).

Lot 3. Held in a room cooled with a conventional evaporative-type cooler.

Lot 4. Held in a room cooled with a conventional refrigerated window air conditioner.

Lot 5. Held in a room cooled with a mechanically refrigerated unit at 65° F. temperature and a low relative humidity (below 50 percent R.H.).

Lot 6. Held in a room cooled with a mechanically refrigerated unit at 65° F. temperature and a high relative humidity (average 85 percent R.H.).

Lot 7. Held in a room cooled with a mechanically refrigerated unit at 55° F. temperature and a low relative humidity.

Lot 8. Held in a room cooled with a mechanically refrigerated unit at 55° F. temperature and a high relative humidity, Figure 1.

Lot 9. Held in a room cooled with a mechanically refrigerated unit at 45° F. temperature and a low relative humidity.

Lot 10. Held in a room cooled with a mechanically refrigerated unit at 45° F. temperature and a high relative humidity.

Eggs were placed under each of the above conditions for 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days and 8 days. At the end of each holding period, eggs were removed from storage, graded by candling and given a U. S. Grade, and then removed from the shell and given a Haugh Unit score.

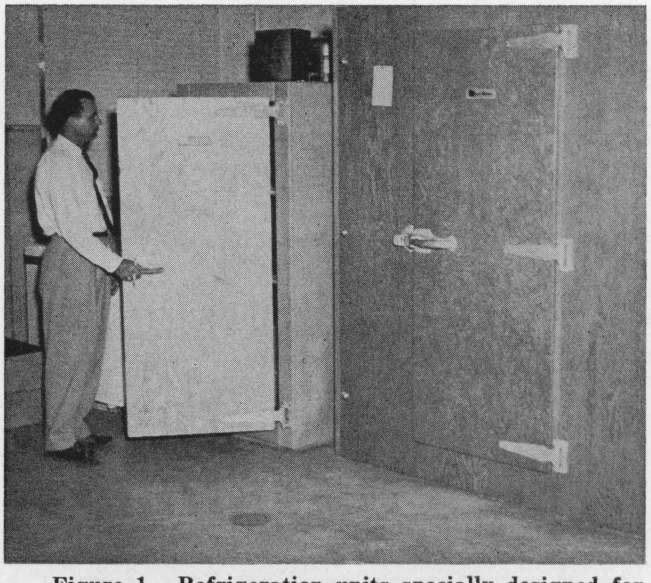

Figure 1. Refrigeration units specially designed for egg cooling are commercially available.

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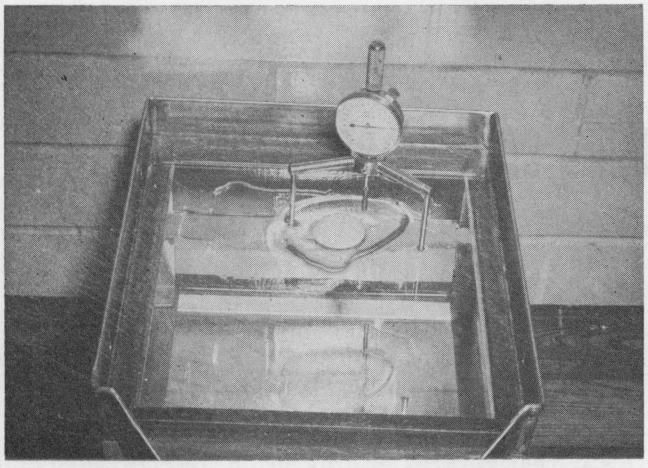

Figure 2. The Haugh Unit scores each egg by weight and albumen height.

All eggs were weighed at the beginning and at the end of each storage test, and the moisture losses were computed.

Each treatment was replicated twice on different dates in 1955 and twice on different dates in 1956.

A careful record was kept of the temperature and the relative humidity in the immediate environment where each lot of eggs was held.

Haugh Unit Score

The Haugh Unit score for each egg was computed by a slide-rule type calculator which takes into account the albumen height of each egg in millimeters and the weight of the egg in grams. Figure 2.

Eggs scoring 79 Haugh Units or more were graded as AA quality according to USDA standards. Eggs scoring 55 to 79 Haugh Units were graded as A quality, eggs scoring 31 to 55 Haugh Units as B quality and those scoring 31, or below, were C quality.

To simulate farm conditions, the 1-day, 2-day and 3-day storage samples were combined to give a cumulative sample representing twice-a-week delivery. The same procedure was followed to simulate once-a-week delivery, which included eggs held from 1 to 7 days.

Results

Figure 3 shows the effect of temperature and relative humiditiy on the quality of market eggs, expressed in Haugh Units, held for a 3-day cumulative period. There was little difference in the quality of eggs held at the same temperature but at different relative humidities. However, considerable difference in quality was found at different temperatures.

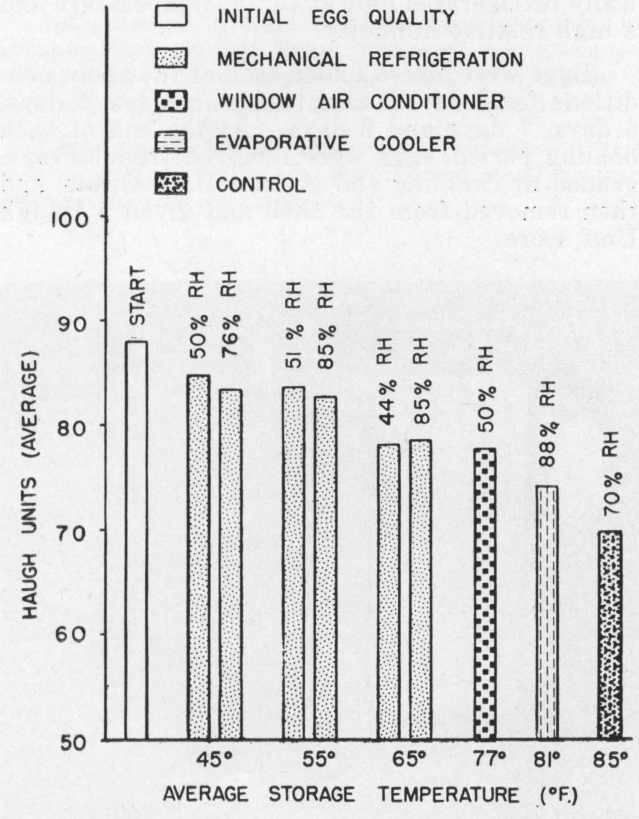

Figure 3. Effect of relative humidity and temperature on market egg quality, Haugh Units (average), 3-day storage (cumulative).

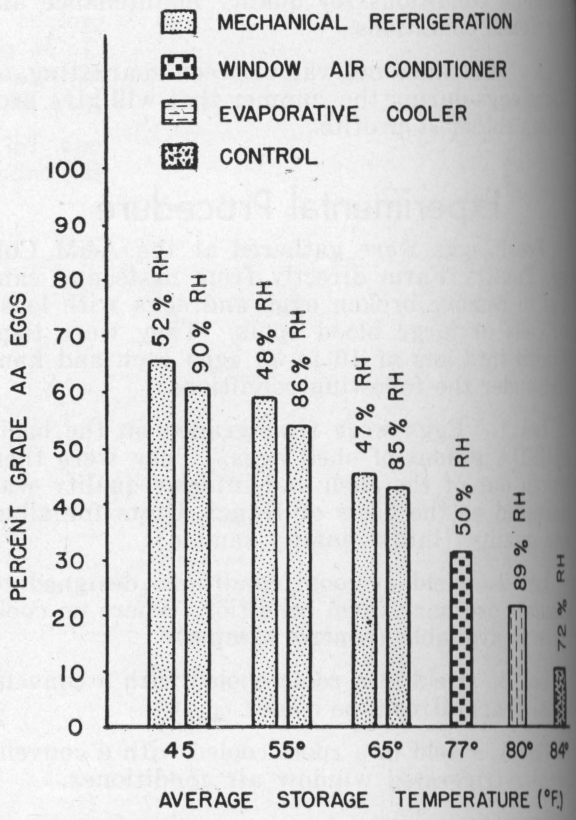

Figure 4. Effect of relative humidity and temperature on market egg quality, Haugh Units (average), 7-day storage (cumulative).

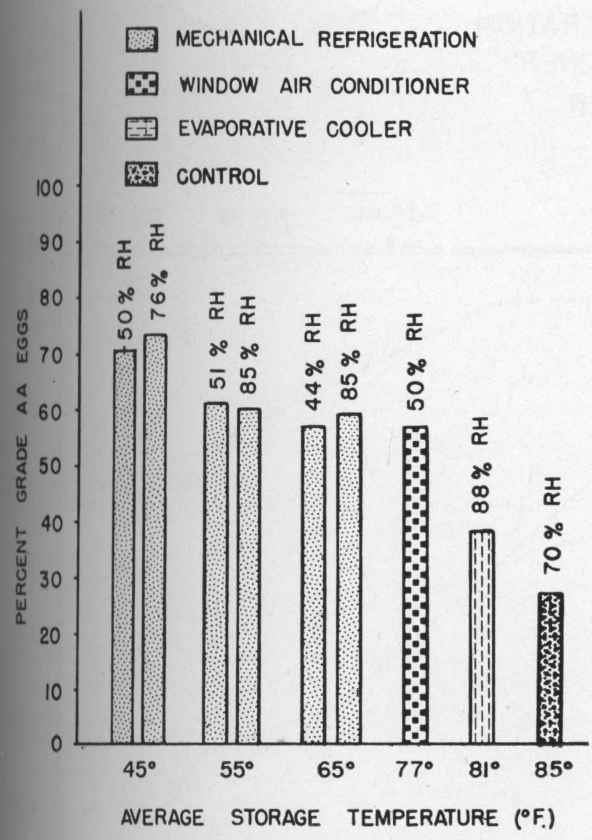

Figure 5. Effect of relative humidity and temperature on market egg quality, percent Grade AA eggs, 3-day storage (cumulative).

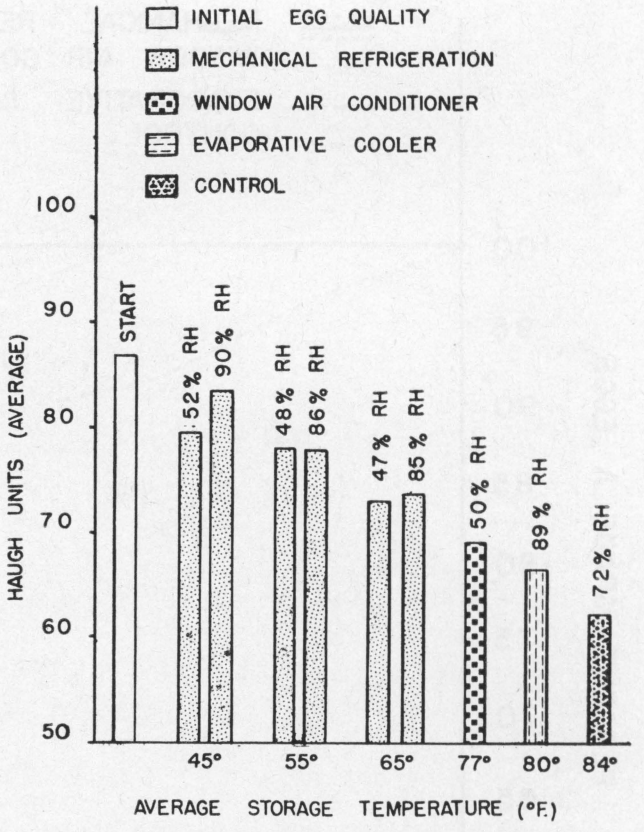

Figure 6. Effect of relative humidity and temperature on market egg quality, percent Grade AA eggs, 7-day storage (cumulative).

The effect of temperature and relative humidity on egg quality, expressed in Haugh Units, for a 7-day cumulative period is shown in Figure 4. Again, relative humidity shows little effect on quality, but as temperature increases, egg quality decreases.

Figures 5 and 6 show the effect of temperature and relative humidity on egg quality expressed in terms of Grade AA eggs when held for 3-day and 7-day cumulative periods.

Since relative humidity shows no appreciable effect on eggs held at 45°, 55° and 65° F., the results of the high and low relative humidity conditions for each of the temperatures were combined. Figure 7 shows the percent of Grade A eggs obtained at the various temperatures for cumulative periods ranging from 1 to 8 days.

Weight Loss

Table 1 shows the weight loss in eggs held for cumulative periods of 3 days and 7 days.

Loss in weight of the eggs was not appreciable. The greatest loss occurred in the eggs held at room temperature. However, this amounted to only 1.5 grams (.064 ounces) per egg when the eggs were held for 7 days.

TABLE 1. MOISTURE LOSS IN EGGS DURING STORAGE

Storage condition	3-day cumulative storage, average weight, grams			7-day cumulative storage, average weight, grams		
	Start	End	Loss	Start	End	Loss
Mechanical refrigeration						
45° F. - Low RH	57.90	57.74	0.16	58.90	58.66	0.24
45° F. - High RH	59.37	59.14	0.23	59.88	59.74	0.14
55° F. - Low RH	58.49	58.13	0.36	58.72	58.37	0.35
55° F. - High RH	58.67	58.46	0.21	59.17	58.97	0.20
65° F. - Low RH	59.54	59.32	0.22	59.42	58.95	0.47
65° F. - High RH	60.06	59.84	0.22	59.60	59.36	0.24
Window air conditioner	58.42	57.70	0.72	58.48	57.76	0.72
Evaporative cooler	59.73	59.47	0.26	59.37	59.06	0.31
Control room	59.04	58.60	0.44	58.71	57.79	0.92

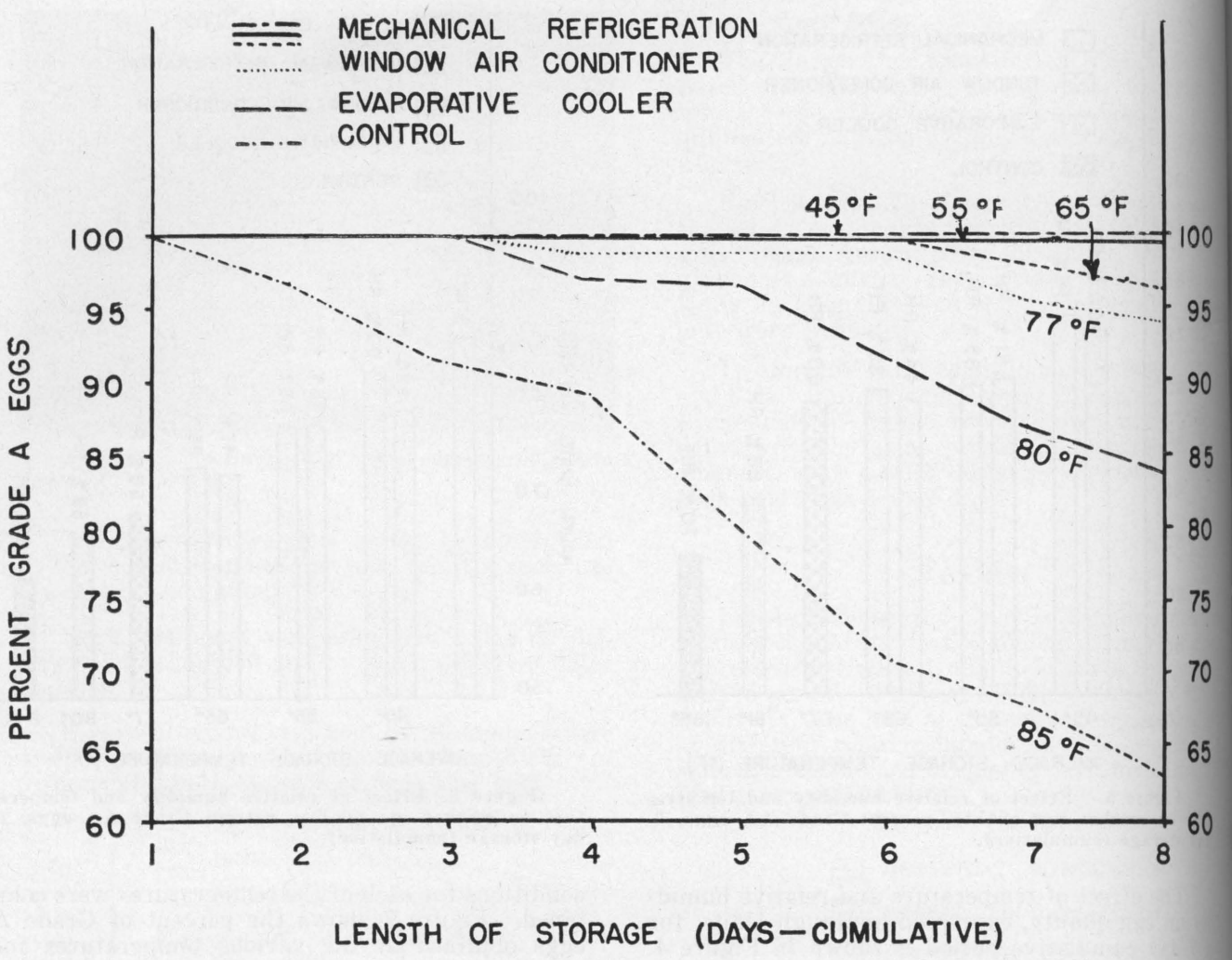

Figure 7. Effect of length of storage and temperature on quality of market eggs, percent Grade A eggs.