



Progress In Poultry

"THROUGH RESEARCH"

A FIELD STUDY OF THE EFFECT OF SODIUM BICARBONATE ON EGG SHELL QUALITY

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Several research reports and many field observations have shown that egg shell quality is depressed by heat stress. Other studies have demonstrated that heat stress results in a lowering of blood bicarbonate level in laying hens. This effect was reversed by putting hens in an atmosphere with added carbon dioxide (CO₂). The increased CO₂ atmosphere also improved shell thickness in these tests.

Since this higher CO₂ level is probably not practical for commercial hens, several attempts have been made to improve shell quality by adding sodium bicarbonate to the feed or water of hens. The results of these experiments have been inconsistent, with some showing better shell quality and others no improvement. There could be several reasons for these differing results. One possibility is that improvement is impossible unless hens are under heat stress and actually have a depressed blood bicarbonate level. A second reason might be that the sodium and chloride level of the ration may influence results; one study clearly showed that the sodium to chloride ratio in diet influenced blood bicarbonate levels in hens. A 3:1 sodium to chloride ratio in the feed increased blood bicarbonate in this study.

This field study was designed to test the effect of using a 2.5:1 sodium to chloride ratio in the diet of laying hens during late summer to see if shell quality could be improved.

Experimental Design

The test was conducted in a commercial laying house using 8 rows with approximately 800 hens per row. An experimental ration was formulated as nearly like the

commercial ration as possible except for the addition of sodium bicarbonate (Table 1). The experimental ration had 25 lbs. of sodium bicarbonate added per ton.

Table 1. Calculated analysis of diets

	<u>Commercial ration</u>	<u>Experimental ration</u>
Crude protein (%)	17.02	17.18
Crude fat (%)	4.53	3.11
Crude fiber (%)	5.45	3.40
Ash (%)	12.41	11.37
Calcium (%)	3.55	3.47
P total (%)	0.68	0.65
P available (%)	0.46	0.43
Sodium (%)	0.29	0.49
ME (Kcal/kg)	2671	2706
Xanth. (Mg/kg)	11.9	11.7

Egg samples of 120 eggs per row were collected weekly by randomly picking up eggs from each of the replicates. The eggs were stored for 24 hours in a 55°F egg storage room and specific gravity was determined by flotation in salt solutions held at the same temperature. The salt solutions were calibrated from 1.065 to 1.090 in increments of 0.005 using a hydrometer.

Yolk pigmentation was estimated from a subsample of 20 eggs per replicate by comparing the yolks with a Roche color fan. Feed samples were analyzed twice during the test for xanthophylls. The calculated level of xanthophyll was a little lower in the experimental diet due to dilution with sodium bicarbonate.

Results and Discussion

The weather was unusually cool for California during this experiment, with only two short periods of high temperatures.

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The first high temperature period occurred just before the second weekly sample was collected. The eggs from the control group had a significantly reduced specific gravity ($P < 0.01$) on this sample date (Figure 1), which could have resulted from the previous heat stress when the maximum daily temperature exceeded 95°F on three consecutive days. The eggs from the control group did not exhibit this drop in specific gravity.

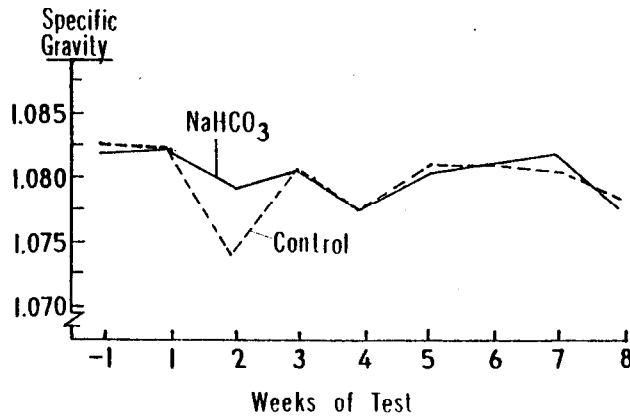


Fig. 1. Specific Gravity of Eggs by Treatment

The second heat stress of two days over 95°F occurred between the 5th and 6th weeks of the test and did not appear to influence the specific gravity of either group (Figure 1). This lack of effect may have been due to: 1) the shorter (two days over 95°F) heat stress; 2) the fact that it occurred five days before sampling vs three for the previous heat stress; or 3) a greater high temperature acclimatization of the hens later in the season (September 4 vs August 8).

Yolk color was determined in this test because sodium bicarbonate in the diet has been reported to enhance the yellow

skin color of broilers. No apparent differences were found in xanthophyll levels of two random samples of feed which were chemically analyzed by a commercial laboratory (Table 2).

Table 2. Xanthophyll levels

Date sampled	Xanthophyll (mg/lb)	
	Commercial ration (control)	Experiment ration (NaHCO ₃)
8/26	5.4	5.1
9/10	5.0	4.8

Similarly, no significant differences were found in the mean yolk color scores of eggs from hens receiving the two rations (Table 3). It was concluded there was no evidence that sodium bicarbonate, at a level of 25 lbs. per ton of laying ration, had any influence on egg yolk pigmentation.

Table 3. Color scores on egg yolks

	Color score ^{1/}
Experimental ration (NaHCO ₃)	6.03
Commercial ration (control)	6.07

^{1/} Means are not significantly different ($P > 0.05$).

Summary

The results of this test suggest that a Na:Cl ratio of 2.5:1 in a laying ration may prevent egg shell thinning due to heat stress. Since there have been conflicting results from previous tests with sodium bicarbonate addition to laying rations, it appears that additional testing of this procedure is needed.

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