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A Comparison of Induced Molting Programs on Production Parameters of Laying Hens

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Introduction

At the end of the laying cycle, when egg quality and production are poor, some producers induce-molt the flock to give the layers a rest and restore production. After the rest both egg quality and production improve compared to the pre-molt period. Several procedures have been used to initiate molting, including: (1) feed withdrawal up to 10 days (Christmas *et al.*, 1985); (2) water withdrawal up to two days (North and Bell 1990); (3) photoperiodic reduction (Hembree *et al.*, 1978); (4) feeding of low calcium (Johnson 1992); or low sodium (Berry and Brake 1985); and (5) feeding high dietary zinc (Berry and Brake 1984). Each method can be used alone or in combination as all molting programs necessitate body weight loss and cessation of egg production (Shippee *et al.*, 1979).

Generally, most researchers report that induced molting improves the post-molt performance of the laying hens when compared to the pre-molt performance. This improvement includes egg size, shell quality, internal egg quality and rate of egg production. Egg size increases significantly after a molt, with a higher percentage of large eggs; for example, 1 g per egg (Zeelen 1975) and 0.42 g per shell increase (Zimmermann and Andrews 1987). There is also a marked increase in the interior egg quality as measured by the Haugh units; for example, 3.9 Haugh units per egg increase (Zimmermann and Andrews 1987). Most important is the increase in egg production rate (Christmas *et al.*, 1985, Wilson *et al.*, 1967).

Although many studies have been conducted on various molting programs, direct, simultaneous, comparisons of several programs have seldom been conducted. In addition, the various molting programs presented here have not been evaluated in terms of the stress they impose on immune function. While this study was conducted to accomplish both, only the production aspects are presented here.

Materials and Methods

Table 1. High dietary zinc (ZN), California (CAL) and conventional (CONV) induced molting programs.

<i>Days</i>	<i>Feed</i>	<i>Water</i>	<i>Light</i>	
High dietary zinc program (ZN); n=150				
1 to 5	Layer ration containing 20,000 PPM of zinc, <i>ad libitum</i>	provided	8 hrs	
6	Layer ration <i>ad libitum</i>	provided	16 hrs	
California program (CAL); n=150				
1 to 10	None	provided	8 hrs	
11 to 30	Corn and oyster shell, <i>ad libitum</i>	provided	8 hrs	
31	Layer ration, <i>ad libitum</i>	provided	16 hrs	
Conventional program (CONV); n=150				
<i>Days</i>	<i>Feed</i>	<i>Oyster Shell</i>	<i>Water</i>	<i>Light</i>
1 to 2	none	provided	none	8 hrs

The three molting programs used to compare their effects on production parameters were high dietary zinc (ZN), California method (CAL) and conventional method (CONV).

Body weights of 25 birds from each group were measured at the beginning of the experiment; at day 5 for ZN and CONT groups; at day 10 for all groups; and at peak post-molt production for all groups. Egg production and mortality were recorded daily, starting at the beginning of the experiments and lasting until two weeks after the peak of post-molt production for each treatment, including the out-of-production period. These measurements were used to determine when egg production stopped and restarted. At the peak of post-molt production of each treatment, 60 eggs were collected (30 eggs from the treated group and 30 eggs from the control group). These eggs were weighed; shells were dried and weighed; and the internal quality of the eggs was determined, as indicated by Haugh unit values.

3	45 g/hen	provided	provided	8 hrs
4	none	provided	none	8 hrs
5	45 g/hen	provided	provided	8 hrs
6	none	provided	none	8 hrs
7	45 g/hen	provided	provided	8 hrs
8	none	provided	none	8 hrs
9	45 g/hen	provided	provided	8 hrs
10 to 60	90 g/hen	provided	provided	8 hrs
61	layer ration <i>ad libitum</i>	provided	provided	16 hrs

Oyster shell was provided until day 30 and 60 for California and conventional programs, respectively.

Statistical Analysis

Data were analyzed using a one way analysis of variance (ANOVA) using the SAS (1988) general linear models procedure.

Results

The results of this study are summarized in Table 2.

Table 2. The effect of high dietary zinc (ZN), California (CAL), conventional (CONV) and control (CONT) treatments on the production parameters.¹

<i>Molt-parameters</i>	<i>ZN</i>	<i>CAL</i>	<i>CONV</i>	<i>CONT</i>
Maximum body loss, %	+15.2	+25.5	+12	-11
Minimum body wt., g (n=25)	1577.2 ^b	1383.2 ^c	1670 ^b	1808 ^a
Last day of egg production	d 6	d 7	d 82	none
First egg after molt	d 14	d 44	d 64	—
Days out of production	7	36	55*	none
Day of return to 50-60% production	19	58	76	—
Mortality throughout entire	3	2.8	2.1	4

experiment, %

Post-molt peak parameters

Hen-day egg production, % (n=134-144)	77 ^b	83 ^a	83 ^a	64 ^c
Egg wt, g (n=30)	70+1.1 ^a	68+.90 ^a	70+1.2 ^a	67+1.2 ^a
Shell wt, g (n=30)	6.3+.12 ^a	6.4+.10 ^a	5.7+.18 ^b	5.3+.10 ^b
Haugh units (n=30)	81.3+1.7 ^b	85.9+1.1 ^a	87.3+1.3 ^a	80.4+.88 ^b

1. Values are means + SEM. Values within each parameter with different letters are significantly different ($P < 0.05$); n=25, 134-144, and 30 for body weight, rate of egg production, and egg quality, respectively.
2. Hens subjected to CONV method did not cease egg production; rather, d 8 was the lowest rate of egg production with 4 eggs/144 hens.

Discussion

Based on the results of this study, several comments can be made. Mortality throughout the entire experiment for all groups was in the normal range, indicating none of the molting programs used in this study were too severe.

Egg weight at the peak of post-molting production was greater among the molted hens when compared to the CONT, but the difference was not significant. This agrees with the finding of Christmas *et al.* (1985), Said and Sullivan (1984) and Wilson *et al.* (1967) who found different induced molting programs did not significantly affect egg weight when compared to non-molted birds. Although egg weights were not affected, molting did increase shell weight at the peak of production in all groups, perhaps because involution of the uterus leads to an increase in the efficiency of glandular epithelium (Blake, 1992; Brake, 1980). Although we found that induced molting increased shell weight in both groups, the increase in the CONV group was not significant when compared to the control, whereas ZN and CAL did significantly improve shell quality. This could be explained by the fact that the CONV group lost the least amount of body weight and these hens did not completely stop egg production. In the present study, Haugh units were higher for the CAL and CONV, but not ZN groups, when compared to the control. These results are explained by the fact that ZN group was out of production for the shortest period of time (seven days) compared to other groups, which did not allow for uterus or egg quality restoration to the degree realized for the CAL or CONV.

Although on the surface the CAL method appears to have been the most effective in terms of post-molt peak rate of egg production (83 percent), egg shell quality (6.4 g Ca) and total egg mass (68 g - 6.4 g = 61.6 g), closer scrutiny may offer economic trade-offs in favor of another method. In the ZN group, the total PM egg wt (70 g), less the shell wt (6.3 g), yielded 61.7 g egg mass, equal to that of the CAL hens. Peak post-molt production for ZN hens was only 77 percent, compared to 83 percent for CAL, resulting in a decrease in 100 ZN hens of 208 g egg mass produced compared to CAL. However, if the length of time required to return to 50 - 60 percent production is only 19 days for ZN compared to 56 days for CAL, it could be economically advantageous to opt for ZN, even though the total post-molt cycle may be shorter. The same scrutiny could be applied to the CAL-CONV

comparison, in which equal post-molt production levels (83 percent) and increased CONV egg mass (70 g - 5.7 g = 64.3 g) and Haugh units are offset by 76 days to reach 50 - 60 percent peak production. This study was concluded before the total post-molt cycle was realized and additional investigation would be interesting.

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