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"THROUGH RESEARCH"

A COMPARISON OF FORCE MOLTING METHODS - III

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During the past five years, several new techniques for inducing a force molt in laying hens have been described in the popular press. In 1976, Texas A & M University reported that high levels of dietary zinc resulted in a very rapid cessation of lay, early return to production, and very good subsequent performance. Studies at North Carolina State University using a "pullet developer" feed following an initial feed withdrawal period also resulted in an earlier return to production and more eggs per hen housed when compared to more conventional methods. Both of these studies imply that there is an economic advantage to be gained when a flock is returned to production earlier than usually occurs with the more commonly used methods. The following experiment was designed to compare these two new systems with various modifications of the "California" system.

EXPERIMENTAL PROCEDURE

Location: University of California, Moreno Ranch, Riverside County

Housing: California open-type with curtains and hot weather foggers. Three hens per 12" wide by 16" deep back-to-back cages.

Feeding: *Ad libitum* hand feeding front feeder

Watering: One Hart cup for four cages, in rear

Duration of experiment: September 27, 1978 to July 3, 1979 (40 weeks)

Stock: Shaver 288

Age: 67 to 107 weeks of age

Experimental design: Randomized block, 8 replicates of 15 hens each, 6 treatments

Measurements: Daily: egg production, feed consumption, mortality. First 4 days: egg weight, shell thickness. Every 4 weeks: egg weight. End of test: percent cracks, shell score, Haugh units, shell thickness. Body weight was measured at 4, 8, and 40 weeks.

Treatments:

1. 25,000 ppm (2½%) zinc from zinc oxide in control ration *ad libitum* for 10 days, then *ad libitum* control ration (Zn-10)
2. Same as #1 except for 7 days (Zn-7)
3. Ten days no feed, then *ad libitum* control ration (U.C. Fast)
4. Ten days no feed with ½lb oyster shell per hen in empty trough, then *ad libitum* control ration mixed in with remaining oyster shell (U.C. Fast + Shell)
5. Ten days no feed, 18 days *ad libitum* pullet developer, then *ad libitum* control ration (P.D.-18)
6. Ten days no feed, 18 days *ad libitum* cracked milo, then *ad libitum* control ration (U.C. + milo-18)

Ration Composition:

Control ration

Ingredient	Percent
Ground corn	40.7
Burr milo	22.7
Meat and bone meal	7.5
Limestone	7.5
Soybean meal	5.7
Cottonseed meal	5.0
Wheat millrun	5.0
Dehydrated alfalfa meal	2.5
Fish soluble	1.5
Fish meal	1.0
Fat	.5
Vitamins, trace minerals, salt	.4

Calculated analysis:

Energy Kcal M.E.	1269
Crude protein (%)	17.0
Fat (%)	4.0
Fiber (%)	3.4
Ash (%)	11.6
Calcium (%)	3.8

Pullet Developer

Ingredient	Percent
Burr milo	57.2
Ground corn	10.0
Wheat millrun	7.5
Meat and bone meal	7.5
Dehydrated alfalfa meal	6.0
Cottonseed meal	4.0
Soybean meal	2.5
Fish solubles	2.0
Molasses	2.0
Vitamins, minerals, methionine	1.3

Calculated analysis:

Energy Kcal M.E.	1293
Crude protein (%)	16.0
Fat (%)	3.4
Fiber (%)	4.2
Ash (%)	5.9
Calcium (%)	1.2

Artificial lights were turned off on day 1 through day 28 of the experiment. The natural day length during the first 4 weeks of the experiment declined from 12 hours at the start to 10.8 hours on day 28. Seventeen hours of light were given from day 29 to the end of the experiment. Water was available at all times.

TABLES OF RESULTS

Table 1. Egg weight and shell thickness -- first four days

	Days from initiation of test			
	1	2	3	4
Egg weight (grams)				
With zinc feed	60.2	58.6	58.9	56.7
With no feed	61.1	58.6	58.0	57.9
With oyster shell	60.8	57.7	57.5	55.9
Shell thickness (inches)				
With zinc feed	.0127	.0109	.0104	.0101
With no feed	.0126	.0110	.0100	.0100
With oyster shell	.0126	.0120	.0100	.0101

Table 2. Egg production -- first six days

Treatment	Days from initiation of test					
	1	2	3	4	5	6
	(percent)					
1 ZN-10	65.0	53.3	33.3	23.3	1.7	0
2 ZN-7	67.2	50.4	36.1	16.8	.8	0
3 UC-Fast	70.8	54.2	36.7	22.5	8.3	0
4 UC-Fast + Shell	75.8	52.9	45.4	15.1	10.1	0
5 P.D. 18	71.7	58.3	35.0	22.5	10.0	0
6 UC + Milo-18	75.0	56.7	40.0	21.7	9.2	0

Table 3. Body weight -- 7 and 10 days

Treatment	Weight (lb)			Percent change	
	0	7 days	10 days	0 to 7 days	0 to 10 days
Zinc	3.92	3.17	3.04	- 19.1	- 22.4
No feed	3.79	2.99	2.99	- 21.1	- 21.1

Table 4. Zinc feed and shell consumption

	Total lb/hen	Grams/hen/day
Zinc feed - 10 days	.133	6.04
Zinc feed - 7 days	.107	6.94
Oyster shell - 10 days	.008	.36

Table 5. Egg production, egg weight, feed consumption and mortality -- first 8 weeks[1/]

Treatment	Egg production		Egg weight	Feed consumption	Mortality
	Hen-day	Hen-housed			
	(%)	(eggs)	(g)	(lb/hen/day)	(%)
1 ZN-10	24.5a	13.6a	65.6a	.179ab	1.7ab
2 ZN-7	24.1ab	13.2a	65.5a	.185a	5.0a
3 UC - Fast	22.4ab	12.5ab	65.1ab	.179ab	1.7ab
4 UC - Fast + Shell	17.4d	9.6d	63.6b	.172bcd	.8b
5 P.D. 18	21.4bc	12.0abc	65.2ab	.178abc	0 b
6 UC + Milo - 18	19.1c	10.7cd	64.9ab	.166d	1.7ab

1/ Treatment means in the same column with different small letters are significantly different ($P < 0.05$).

Table 6. Hen-day egg production by 4-week period[1/]

Period	Weeks	Treatment 1 (ZN-10)	2 (ZN-7)	3 (UC-Fast)	4 (UC-Fast + Shell)	5 (P.D. 18)	6 (UC+Milo-18)
		(percent)					
1	68 - 71	7.0	7.9	7.4	8.0	7.3	7.3
2	72 - 75	42.1a	40.8ab	37.6abc	26.7e	35.6bcd	31.0de
3	76 - 79	81.8	78.3	77.7	78.5	78.0	79.1
4	80 - 83	80.8	82.3	78.6	79.7	79.7	79.2
5	84 - 87	75.5	79.4	73.8	77.1	74.5	75.6
6	88 - 91	73.4bc	79.0a	70.5c	76.3ab	74.4abc	77.4ab
7	92 - 95	65.5bc	70.1a	62.1c	66.5ab	67.2ab	69.1ab
8	96 - 99	66.7	68.3	64.5	67.9	68.9	67.3
9	100 -103	67.1	69.0	65.9	67.3	68.6	69.5
10	104 -107	65.4ab	67.8a	60.4b	66.0ab	64.6ab	69.3a

1/ Treatment means in the same column with different small letters are significantly different ($P < 0.05$).

Table 7. Egg production, mortality, egg weight, and egg value-- 40 weeks[1/]

Treatment	Egg production: Hen-day (%)	Egg production: Hen-housed (eggs)	Mortality (%)	Egg weight (g)	Egg weight: Lg & above (%)	Avg egg value[2/] (¢/dozen)
1 ZN-10	62.1ab	169	5.8	65.8	97.1	44.6
2 ZN-7	64.3a	171	8.3	65.1	96.8	44.5
3 UC-Fast	59.6b	161	5.8	65.3	97.7	44.6
4 UC-Fast + Shell	61.2ab	168	5.8	64.4	96.2	44.5
5 P.D. 18	61.9ab	172	3.3	65.8	98.1	44.7
6 UC + Milo - 18	62.3ab	171	4.2	64.2	95.5	44.5

1/ Treatment means in the same column with different small letters are significantly different ($P < 0.05$).

2/ 45¢/dozen for large eggs, 40¢/dozen for medium, 25¢/dozen for small eggs.

Table 8. Feed consumption, feed conversion, and feed cost per dozen eggs 40 weeks[1/]

Treatment	Feed: Consumption (lb/hen-day)	Feed: Conversion (lb/dozen)	Feed: Conversion (lb/24-oz dozen)	Feed:Eggs	Feed cost[2/] (¢/dozen)
1 ZN-10	.240ab	4.65ab	4.01ab	2.67ab	30.3abc
2 ZN-7	.242ab	4.53b	3.94b	2.63b	29.4b
3 UC-Fast	.236ab	4.76a	4.14a	2.76a	31.0a
4 UC-Fast + Shell	.238ab	4.67ab	4.11ab	2.74ab	30.3abc
5 P.D. 18	.244a	4.73a	4.08ab	2.72ab	30.7ab
6 UC + Milo-18	.234b	4.52b	3.99ab	2.66ab	29.0c

1/ Treatment means in the same column with different small letters are significantly different ($P < 0.05$).

2/ Control ration @ 6.5¢/lb, milo @ 4.5¢/lb, pullet developer @ 6.0¢/lb, zinc feed @ 7.2¢/lb, and oyster shell @ 4¢/lb.

Table 9. Egg income minus feed cost (40 weeks), egg quality (end of test)[1/]

Treatment	Egg income minus feed cost[2/]	Egg quality - end of test: Cracked eggs	Shell score[3/]	Haugh units	Shell thickness
	($)	(%)			(inches)
1 ZN-10	2.04ab	21.5	1.22	79.3	.0137
2 ZN-7	2.15ab	13.3	1.11	79.3	.0135
3 UC-Fast	1.84b	14.1	1.26	80.6	.0133
4 UC-Fast + Shell	2.00ab	14.4	1.15	79.6	.0133
5 P.D. 18	2.02ab	14.8	1.13	77.0	.0135
6 UC + Milo-18	2.21a	9.6	1.33	77.4	.0135

1/ Treatment means in the same column with different small letters are significantly different ($P < 0.05$).
2/ Hen-housed.
3/ 0 = smooth; 3 = very rough.

Table 10. Body weight and body weight change[1/]

Treatment	Week 0	Week 4	Week 40	Body weight change[2/]
	(lbs)			(%)
1 ZN-10	3.89	4.06	4.32	+ 11.1ab
2 ZN-7	3.96	4.22	4.44	+ 12.1ab
3 UC-Fast	3.91	4.10	4.28	+ 9.5b
4 UC-Fast + Shell	4.04	4.15	4.43	+ 9.7b
5 P.D. 18	3.89	4.19	4.50	+ 15.7a
6 UC + Milo-18	3.79	4.00	4.24	+ 11.9ab

1/ Treatment means in the same column with different small letters are significantly different ($P < 0.05$).
2/ Final weight compared with initial weight.

DISCUSSION

The zinc method does appear to cause a slightly more rapid cessation of lay than the other methods tested, but the significance of this is minor since all hens in the test had dropped to zero by the sixth day. Neither the zinc feed nor the availability of oyster shell had any beneficial effect on egg weight or egg shell thickness as the flock went out of production.

Body weight losses were essentially the same between the zinc method and the feed withdrawal programs (Table 10). Feed consumption during the zinc feed period was very low--representing only 6 percent of normal consumption.

The addition of oyster shell appeared to have definite advantages in conjunction with the fast U.C. molting program. This has been demonstrated in previous tests. The amount of oyster shell needed to show this advantage is not known. Obviously, .5 pounds of oyster shell per hen was in excess of the flock's consumption requirements during the first 10 days (Table 4).

The balance of the oyster shell was mixed into the control diet, thereby increasing the calcium percentage for the next several weeks. Egg production was significantly higher during the 6th and 7th periods as a result of having had access to this additional calcium source, and overall hen-housed production exceeded the non-shell group (Treatment #3) by seven eggs (Table 7).

All fast molting methods, with the exception of the U.C. fast method plus oyster shell, brought the flock back into production at a faster rate than the conventional U.C. method (Treatment #6). None of this appeared to be of value by the completion of the test because hen-housed egg numbers were not statistically different. The U.C. fast method (Treatment #3) had the lowest egg production for the last eight periods and produced approximately ten fewer eggs than the other treatments.

The patterns of lay for the pullet developer method (Treatment #5) and the U.C. conventional program (Treatment #6) were essentially identical. The birds on the pullet developer treatment consumed significantly more feed, had a poorer feed conversion and higher feed cost per dozen eggs than those on the U.C. conventional program.

Only the U.C. fast method (Treatment #3) had statistically lower egg income minus feed costs after 40 weeks. The two best methods--Treatments #6 and #2--had equal incomes through 32 weeks of age, but Treatment #6 gained a 6¢ advantage during the last 8 weeks, because of a 1 percent higher rate of lay with 2.2% less feed.

Overall test results showed no net advantages for the zinc molting method nor for fast molting methods in general. The pullet developer technique was too costly and resulted in excessive feed consumption. These results confirmed previous studies which showed that the U.C. fast molting method should not be used without some type of calcium supplementation.

New molting techniques will continue to be proposed in the future. Industry acceptance should be based upon careful comparison studies considering all important economic factors.

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