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Progress In Poultry
"THROUGH RESEARCH"

A COMPARISON OF FORCE MOLTING METHODS

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Numerous procedures to force molt chickens have been developed through the years. Most involve a severe stress such as feed and/or water removal. Others simply limit various essential nutrients. Some dilute the ration with fiber to give the same effect. In addition, there have been several drugs or feed additives developed which will cause chickens to cease production.

The University of California lists the following criteria for an optimum force molting method:

- It must rapidly get the entire flock out of production.
- It must keep the flock out until it has adequate rest.
- It must bring the flock back into production rapidly.
- It must be simple and foolproof.
- It must be low in cost.
- It should result in low mortality.
- It should lead to high subsequent performance.

In recent years, there has been considerable interest in nutrient restriction as a means of forcing a molt. Some of this has been a result of public pressure against the more conventional feed withdrawal systems. Great Britain has been a leader in this area since their anti-ovulatory drugs were removed from the market.

The objective of the present study was to determine if any of these newer techniques would offer additional benefits compared to the molting systems now in use. Because of the test's short duration, it should only be considered as a screening experiment.

EXPERIMENTAL DESIGN

Stock: 864 White Leghorn hens, 120 weeks of age. Two strains - A and B. One-half of these hens had been molted once at 76 weeks of age; the other half had been molted twice, at 56 and at 88 weeks of age. Prior to the start of this experiment, the hens were mixed within each strain so that both molting histories were represented equally in each of the new test groups.

Duration of experiment: 16 weeks (May 1975 to September 1975).

Location: Moreno Ranch facility of the Riverside Campus.

Housing: California open-type with curtains and hot-weather foggers. Three hens per 12" x 16" cage placed back to back.

Feeding: Ad lib hand feeding, front feeder. 17% lay mash, following molting period.

Watering: One Hart cup for every two cages.

Treatments:

1. University of California method:		
No feed	Days	1-10
Ad lib cracked milo		11-28
2. Low calcium:		
Ad lib low calcium diet	Days	1-28
3. Low sodium:		
Ad lib low sodium diet	Days	1-28
4. High fiber ration:		
No feed	Days	1- 3
Ad lib high fiber ration		4-28
Ad lib 18% lay ration		29-56

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Treatments: (continued)

5. Corn:
   Ad lib ground corn — Days 1-28

6. Milo:
   Ad lib ground milo — Days 1-28

7. Modified Florida method (modified from 3 days w/o water to 2 days):
   No water — Days 1- 2
   No feed — 1- 7
   Ad lib low-protein mash — 8-28

8. Modified UC method:
   No water — Days 1- 2
   No feed — 1-10
   Ad lib cracked milo — 11-28

All groups had no artificial lights for days 1 through 28. Seventeen hours of light were provided following the 28th day.

Design: Completely randomized block. Two Strains x 8 treatments x 4 blocks = 64 groups. A group consisted of 4 or 5 three-bird cages.

Measurements: Daily egg production, feed consumption and mortality. Periodic body weights. Egg weights at 8, 12 and 16 weeks.

Table 1 describes the composition and cost of the various molting diets.

Table 1. Composition and cost of molting diets

Treatment	Milo	Corn	48½% SBOM	Lime-stone	Dical. phos-phate	Salt	Vitamin & Min.	Dollars/ 100 lbs
				- percent -				$
1. U of Calif.	100.0	-	-	-	-	-	-	6.09
2. Low calcium	-	82.0	16.0	-	-	.25	1.75	6.87
3. Low sodium	71.25	-	19.0	6.0	2.0	-	1.75	6.33
4A.High fiber	Commercial ration (12% fiber, 10.8% protein, 4.7% calcium)							4.36
4B.18% lay	Commercial ration							6.78
5. Corn	-	100.0	-	-	-	-	-	6.54
6. Milo	100.0	-	-	-	-	-	-	6.09
7. Modified Fla.	-	90.0	-	6.0	2.0	.25	1.75	6.36
8. Modified UC	100.0	-	-	-	-	-	-	6.09

RESULTS

Obviously, a 16-week force molting experiment is too short to fully evaluate a molting method. Most second or third cycles of production (including the molting period) are at least 30 to 40 weeks in length. This experiment was conducted to aid in selecting promising programs for further study.

Production after initiation of a force molt is characterized by an increase in the number of defective eggs. Table 2 summarizes these changes for the first 4 weeks of this trial.

The low sodium and high fiber molting methods yielded the least number of defective eggs. The low-calcium method has more defective eggs during the second week and also for the 4 weeks as a whole. Although the all-corn and all-milo methods were also very low in calcium, their use resulted in significantly fewer defective eggs. This may have been due to the fact that these rations caused the birds to cease production more completely during the second week. As a result, fewer thin-shelled eggs subject to breakage were produced.

Methods 1 and 8 are essentially identical except for the addition of 2 days of water withdrawal in method 8. It is interesting to note that this additional stress of water removal increased the number of soft shelled eggs produced from 4% to 9%.

Table 2. Percentage of defective eggs[1/]

	Week 1		Week 2		Week 3		Week 4		Total	
Treatment	Crax	Soft shells	Crax	Soft shells	Crax	Soft shells	Crax	Soft shells	Crax	Soft shells
					- percent -					
1. UC	25ab	5bc	-	-	-	-	7b	2a	18b	4b
2. Low calcium	20ab	2c	50a	3a	34a	1a	23a	6a	27a	2b
3. Low sodium	14b	1c	11bc	2a	7c	1a	3b	0a	9c	1b
4. High fiber	16b	2bc	5c	-	4c	1a	2b	0a	9c	1b
5. Corn	16b	2bc	14bc	4a	18b	2a	32a	1a	20b	2b
6. Milo	17ab	1c	29b	2a	12bc	0a	18a	1a	17b	1b
7. Modified Fla.	28a	7b	-	-	7c	1a	6b	0a	12b	2b
8. Modified UC	18ab	12a	-	-	-	-	5b	6a	15b	9a
Strain A	20	5	20	2	13	1	12	2	16	3
	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Strain B	19	3	23	2	14	0	12	2	15	2

1/ Values in columns followed by different letters are significantly different ($P < 0.05$)
n.s. = Not significant

The hen-day production pattern was analyzed for each of the first 8 weeks and also for each of the 4-week periods. Table 3 gives the first 8-week results.

All 3 groups subjected to 7 to 10 days of feed removal dropped to zero production in the second week and held it for 1 or 2 weeks. The Florida method, with only 7 days of feed withdrawal, came back at a significantly faster rate and by the 8th week was laying 70%. Field experience would indicate that a 50% rate of production during the 8th week would be more typical of molting programs now in use in the California poultry industry.

The low-sodium group did not drop below 27 percent during the course of the experiment. This may be due, in part, to the relatively high sodium content of the drinking water--0.01%. It is conceivable that a better response could have been obtained with the use of a lower sodium water. Because of the failure to induce a proper rest, the results should not be considered as typical of this technique.

Table 3. Hen-day production by week[1/]

	Week							
Treatment	1	2	3	4	5	6	7	8
				- percent -				
1. UC	13c	0d	0d	5d	15bcd	38a	54ab	69abc
2. Low calcium	28b	10b	9c	6cd	9de	30b	46b	60c
3. Low sodium	35a	27a	33a	35a	39a	42a	49ab	61bc
4. High fiber	17c	4c	15b	7cd	5e	22b	48b	66abc
5. Corn	25b	6c	16b	10cd	15bcd	46a	52ab	70ab
6. Milo	26b	6c	14b	12c	14cd	43a	50ab	61bc
7. Modified Fla.	14c	0d	9c	26b	18bc	43a	55ab	70ab
8. Modified UC	14c	0d	0d	7cd	21b	46a	58a	71a
Strain A	23	7	11	14	16	38	53	66
	*	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Strain B	20	6	12	13	18	40	51	66

1/ Values in columns followed by different letters are significantly different ($P < 0.05$).
* Differences significant at the 5% level.
** Differences significant at the 1% level.
n.s. = Not significant.

A loss in body weight is another major change evident in birds being force molted. In this experiment, birds were weighed just prior to the start of the test, 10 days later, and after 4, 8, 12, and 16 weeks of the test period. Table 4 gives these results on the basis of percentage change from the original weight.

Ten days after the beginning of the experiment, the hens treated with the severe feed withdrawal methods (1 and 9) had lost over 20% of their initial body weight; but by 28 days they regained nearly all of it. On the other hand, the birds fed the high fiber feed were still 14% below their initial weight on the 28th day. The average weight of the hens without feed for 10 days was slightly under 3.1 pounds at the end of the withholding period.

Table 4. Percentage of body weight change1/

Treatment	Initial weight	Time of measurement: 10 days	4 weeks	8 weeks	12 weeks	16 weeks
	pounds	- percentage change -				
1. U of Calif.	3.96	-23d	- 1a	+ 7a	+ 6a	+ 5ab
2. Low calcium	4.26	- 2a	- 2ab	+ 2ab	+ 2a	+ 3ab
3. Low sodium	4.10	- 5b	- 2ab	+ 3ab	+ 3a	+ 2ab
4. High fiber	4.06	- 8bc	-14c	+ 3ab	- 1a	+ 3ab
5. Corn	3.97	- 7bc	- 5ab	+ 2ab	+ 4a	+ 1ab
6. Milo	4.23	- 6b	- 6b	+ 1b	- 1a	- 2b
7. Modified Fla.	3.97	- 9c	- 3ab	+ 3ab	+ 2a	+ 2ab
8. Modified UC	3.95	-21d	- 2ab	+ 6a	+ 3a	+ 5a
Strain A	4.02	- 9	- 4	+ 5	+ 3	+ 4
	n.s.	n.s.	n.s.	**	n.s.	*
Strain B	4.10	-11	- 5	+ 2	+ 1	+ 1

1/ Values in columns followed by different letters are significantly different ($P < 0.05$).
* Differences significant at the 5% level.
** Differences significant at the 1% level.
n.s. = Not significant.

Eight weeks is usually considered to be the molting period. The net cost of molting is the feed cost per survivor minus the income from eggs. These data are shown in Table 5. Table 6 summarizes the hen-day production rates for each of the 4-week periods.

Table 5. Cost of molting 1/

Treatment	Feed: Lbs./ survivor	Feed: Cost/ survivor	Eggs: No./ survivor	Eggs: Value/ survivor 2/	Net cost per survivor
	pounds	cents	no.	cents	cents
1. U of Calif.	9.7b	64e	13.9cd	41cd	23bc
2. Low calcium	10.1b	70b	14.6cd	43cd	27c
3. Low sodium	11.1a	74a	22.4a	65a	09a
4. High fiber	11.2a	65cde	12.8d	37d	28c
5. Corn	10.1b	68bc	16.6b	48b	20b
6. Milo	10.5b	70b	16.7b	49b	21b
7. Modified Fla.	10.1b	68bcd	16.5b	48b	20b
8. Modified UC	9.7b	64de	15.0c	44c	20b
Strain A	10.6	69	16.0	47	22
	**	**	n.s.	n.s.	*
Strain B	10.1	67	16.1	47	20

Table 6. Hen-day production by period 1/

Treatment	Period 1	Period 2	Period 3	Period 4	Overall
		- percent -			percent
1. U of Calif.	4d	46a	65ab	60a	43bc
2. Low calcium	13bc	38b	62ab	58a	42bc
3. Low sodium	32a	49a	58b	59a	49a
4. High fiber	10c	36b	62ab	58a	41c
5. Corn	14b	47a	61ab	58a	45abc
6. Milo	14b	44a	63ab	60a	45abc
7. Modified Fla.	12bc	48a	67a	63a	47ab
8. Modified UC	5d	50a	67ab	59a	45abc
Strain A	13	44	64	60	45
	n.s.	n.s.	n.s.	n.s.	n.s.
Strain B	13	45	62	59	44

1/ Values in columns followed by different letters are significantly different ($P < 0.05$).
2/ Eggs valued at 35¢/ dozen during the molting period.
* Difference is significant at the 5% level.
** Difference is significant at the 1% level.
n.s. = Not significant.

Both University of California methods succeeded in getting the birds out of production significantly better in the first period. By the 4th period, all groups were producing at essentially the same rate. A continuation of the numerical difference in production rate over a complete normal cycle could have resulted in significant differences in overall production beyond those demonstrated in the 16 weeks of this experiment. Other performance traits averaged for the entire experiment are shown in Table 7.

The low-sodium group exceeded several of the other groups in hen-housed production because they failed to go out of production during the molting period. While this appears to be a desirable trait, their overall production in a normal cycle would likely be substantially below that of several of the other groups.

Mortality among replicates was quite variable, but the modified University of California method showed a significant reduction when compared to both the low-calcium and all-milo diets. This is an interesting result because many would consider this particular molting method to be the most severe of all.

Table 7. Other performance traits1/

Treatment	Eggs per hen housed	Feed per hen day	Feed per dozen	Mortality	Average egg weight
		pounds	pounds	percent	oz/dozen
1. U of Calif.	47b	.199b	5.55b	4.8ab	26.3a
2. Low calcium	45b	.199b	5.69ab	9.8a	26.6a
3. Low sodium	54a	.210a	5.20b	5.6ab	26.4a
4. High fiber	45b	.208ab	6.13a	5.6ab	26.7a
5. Corn	49ab	.205ab	5.49b	2.7ab	27.0a
6. Milo	47b	.207ab	5.59b	10.4a	26.9a
7. Modified Fla.	51ab	.203ab	5.21b	4.8ab	26.5a
8. Modified UC	50ab	.201ab	5.38b	.8b	26.4a
Strain A	49	.205	5.51	4.4	26.3
	n.s.	n.s.	n.s.	n.s.	**
Strain B	48	.203	5.56	6.8	26.9

1/ Values in columns followed by different letters are significantly different ($P < 0.05$).
* Differences significant at the 5% level.
** Differences significant at the 1% level.
n.s. = Not significant.

An economic analysis of these data was made using the feed costs listed in Table 1, an egg price of 40¢ per dozen, and a fowl price of 20¢ each. The relative ranking of the 8 molting methods is shown in Table 8.

Table 8. Economic ranking of molt methods[1/]

Treatment	Egg and fowl income minus feed cost cents per hen
3. Low sodium	45a
7. Modified Fla.	42ab
8. Modified UC	38abc
5. Corn	32abc
1. U of California	32abc
6. Milo	30abc
4. High fiber	27bc
2. Low calcium	24c
Strain A	35
	n.s.
Strain B	32

1/ Values followed by different letters are significantly different ($P < 0.05$)
n.s. = Not significant.

Since the low-sodium birds really failed to molt, the results must be interpreted leaving out this particular group. As previously noted, their production over a normal cycle would not be as high as some of the other systems. However, this does not eliminate the low-sodium technique from further consideration, especially if a lower sodium drinking water were available.

Applications of the Duncan's Multiple Range test to the data in Table 8 show only one significant difference -- that between the Florida method and the low-calcium method. Through 16 weeks, this difference amounted to 18 cents, and egg production differences appeared to be 5% in favor of the Florida method over the low-calcium method.

Another interesting observation is that when the low-sodium method is excluded, the Florida and modified UC methods are number 1 and 2. These two methods were very similar in that both included water removal, feed removal, and low-protein molt mashes.

DISCUSSION

It is apparent to the authors that the selection of the correct molting procedure is a very critical factor in determining performance responses and economic success. More research is needed to determine the physiological causes for improved performance following a force molt. Although non-conclusive, our experimentation does tend to support the more conventional molting techniques (feed and water withdrawal), but longer experiments in different seasons are required for final proof. A second experiment is now in progress comparing the Florida and California methods, and a third experiment is planned for the fall of 1976 to explore these and other programs.

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