Cooperative Extension - - - - University of California
No. 22 August 1980

Progress In Poultry
"THROUGH RESEARCH"

PHASE FEEDING OF LAYERS

Douglas R. Kuney, Donald D. Bell,
Carol Adams and Lori Yates*

Phase feeding of layers (changing the nutrient content of the ration corresponding to different stages of production) is a subject of considerable controversy. The reasons for considering such an approach can be primarily economical (as in the case of protein) or physiological (as in the case of calcium). One of the main areas of disagreement lies in the question: Does the hen's requirement for certain nutrients decrease, increase or remain the same with age?

In the case of protein, we can divide the hen's requirements into four categories: growth, maintenance, feather replacement, and egg production. Some researchers say that as the hen becomes older she can no longer absorb and assimilate protein as efficiently[1]; while other researchers feel that, at least for certain amino acids, efficiency improves with age[2]. Growth certainly decreases with age, and body maintenance probably increases somewhat, due to increasing weight. Feather replacement is a significant factor at the onset of lay and after a molt. Egg production is more difficult to evaluate because egg size changes with age but so does rate of lay.

Scott, Nesheim, and Young, in their book "Nutrition of the Chicken,"[2] explain that the period between 20 and 42 weeks of a pullet's life is a most critical time because of growth and rapidly increasing egg production. The chicken's requirement for protein and other nutrients is generally considered to be the greatest during this time. What about her requirements after 42 weeks of age when she will be laying larger eggs but at a lower rate of production? This is the period when the use of phase feeding is usually considered and, of course, where much controversy lies.

In a recent survey conducted by Don Bell, 11 of 14 nutritionists favored phase feeding of layers. Of those responding, 76%, 79%, and 82% felt that lysine, methionine, and the total sulfur amino acid requirements, respectively, decreased beyond 40 weeks of age.

Very little has been reported in the literature relative to the recycled hen's nutrient requirements. This subject is of considerable importance, especially to the California table egg industry, since it has been estimated that 90% or more of the laying flocks are force molted one or more times. In order to understand more about the requirements of older birds, a recent study was designed and conducted to evaluate a specific phase feeding regimen and its effects on subsequent performance of force molted hens.

The experiment consisted of 2 treatments replicated 12 times with 15 hens per treatment group, giving a total of 360 layers. Hens were force molted in September at 67 weeks of age, using the University of California method (10 day starvation with water, followed by feeding cracked milo for 18 days without artificial light). The experiment was conducted in an open-type house located at the University Field Station at Moreno.

*Staff Research Associate, UC Riverside; Farm Advisor, Riverside County; and Statisticians, UC Riverside, respectively.

The constant protein (CP) groups were fed a corn-milo-soy base ration containing 17% total protein (Tables 1, 2) for the duration of the 40-week experiment (periods 2-10). The phase fed (PF) groups were fed rations with almost the same ingredients but were subjected to a feeding program which reduced the total crude protein content in the ration every 12 weeks (Tables 1, 2). All rations were isocaloric (1264 Kcal per pound) and contained equal amounts of all other nutrients, with the exception of protein. The lysine and sulfur amino acids (methionine and cystine) were held constant at 4.7 and 3.7 percent respectively of the total protein in the ration (Table 2).

Table 1. Experimental rations

Ingredient	Estimated crude protein 17%	15%	13%
Ground corn	40.5%	40.2%	65.7%
Milo	23.0	25.2	-
Meat and bone meal	7.5	5.5	0.8
Limestone	7.5	8.0	8.0
Soybean meal	5.7	10.0	7.5
Cottonseed meal	5.0	-	-
Wheat millrun	5.0	9.2	-
Dehydrated alfalfa	2.5	-	5.0
Fish solubles	1.5	-	-
Fish meal	1.0	-	2.5
Hydrolized animal and vegetable fat	0.5	0.7	0.5
Vitamin Pak	0.25	0.2	0.2
D-L methionine	0.05	0.06	0.02
Salt	-	0.2	0.3
Grape pomace	-	-	5.0
Molasses, cane	-	-	2.5
	100.0	100.06	100.12

Table 2. Feed price and selected nutrient content of rations

	Periods 2-4		Periods 5-7		Periods 8-10	
	CP[1/]	PF[1/]	CP	PF	CP	PF
Feed price	$6.50	$6.50	$6.50	$6.25	$6.50	$6.00
% Protein	17	17	17	15	17	13
Calories/lb	1264	1264	1264	1264	1264	1264
% Calcium	3.80	3.80	3.80	3.80	3.80	3.80
% Total phosphorus	0.69	0.69	0.69	0.75	0.69	0.77
% Available phosphorus	0.53	0.53	0.53	0.52	0.53	0.58
% Methionine	0.35	0.35	0.35	0.32	0.35	0.29
% Methionine + cystine	0.62	0.62	0.62	0.55	0.62	0.48
% Lysine	0.80	0.80	0.80	0.71	0.80	0.62

1/ CP = Constant Protein; PF = Phase Fed.

The data collected included daily feed consumption, egg production, and mortality, and 4-week egg weights. Body weights were sampled after the molt and again at the end of the experiment. Haugh unit measurements were made at the end of the experiment. All data were summarized by 28-day periods, three period phases, and over the 40-week experiment for statistical analysis.

DISCUSSION AND RESULTS

Feed consumption of both groups was similar throughout the 40-week experiment (Table 3). Total protein consumption, as well as that of the essential amino acids, was significantly reduced by applying the phase feeding regimen.

Table 3. Nutrient intakes and feed efficiency

	Periods 2-4		Periods 5-7		Periods 8-10		Periods 2-10	
	CP[1/]	PF[1/]	CP	PF	CP	PF	CP	PF
Feed/HD - lb	.242	.241	.258	.257	.241	.240	.247	.246
Feed/HH - lb	20.3	20.2	21.5	20.9	20.2	19.3	61.9	60.4
Kilos feed/kilos eggs	3.1	3.2	2.5	2.5	2.5	2.8	2.7	2.8
Energy/HD - kcal	306	305	326	324	305	303	312	311
Methionine/HD - mg	384	383	409**	373	383**	315	392**	357
Meth. + cystine/HD - mg	680	678	725**	640	679**	522	694**	614
Lysine/HD - mg	877	875	935**	827	876**	674	896**	793
Protein/HD - g	18.6	18.6	19.9**	17.5	18.6**	14.1	19.0**	16.8
Calcium/HD - g	4.2	4.2	4.4	4.4	4.2	4.1	4.3	4.2
Total phosphorus/HD - g	0.76	0.76	0.81**	0.87	0.76**	0.84	0.77**	0.82
Avail. phosphorus/HD - g	0.58	0.58	0.62	0.61	0.58**	0.63	0.59	0.60
Feed/dozen eggs - lb	-	-	-	-	-	-	4.6	4.8
Feed/24-oz. dozen - lb	-	-	-	-	-	-	4.0	4.2

1/ CP = Constant Protein; PF = Phase fed.

** Means are statistically different ($P \leq 0.01$). All other data were not statistically significant ($P \leq 0.01$).

The phase feeding regimen had no significant effect on feed conversion (Table 3), body weight (Table 4), percent hen-day production (Table 5), egg size or egg quality (Table 6). The overall analysis detected a significant effect on livability in favor of the higher protein control diet. The actual significance of the mortality is difficult to evaluate because the phase fed treatment group suffered higher mortality during the first three 28-day periods when they were being fed the same diet as the control group. Although not statistically significant in all cases, hen-housed data were influenced by the mortality and showed numerical changes resulting from the greater mortality in the phase fed treatment groups.

During the first phase of the experiment (periods 2-4), the phase fed treatment group produced eggs at a lower rate than control birds (Table 5) even though, at that time rations were the same for both groups. This difference in rate of production was not a result of ration treatments and, therefore, the hen-day production means were adjusted for this difference by using the analysis of covariance technique.

Using the feed prices given in Table 2, our analyses showed no difference in feed cost per dozen eggs on a hen-housed basis (Table 5). Apparently the loss of 11 eggs per hen offset the advantage of the lower feed price.

Table 4. Body weights[1/]

	CP[2/]	PF[2/]	Significance
Pre-molt (period 1)	1813 g	1803 g	NS
Post-molt (period 2)	1883 g	1885 g	NS
Final (period 10)	1962 g	1915 g	NS
% change Period 1-2	3.7	4.6	NS
% change Period 1-10	9.2	7.0	NS
% change Period 2-10	5.5	2.5	NS

1/ No body weight differences were detected as being statistically significant (P > 0.05).
2/ CP = Constant Protein; PF = Phase Fed.

Table 5. Rate of production, mortality, and feed cost

	Period 2-4		Period 5-7		Period 8-10		Period 2-10	
	CP[1/]	PF[1/]	CP	PF	CP	PF	CP	PF
HD Production [2/]	54.8	53.5	72.4	71.4	66.7	61.7	64.4	62.4
Eggs/HH	45.9	44.8	61.0	57.8	56.3*	49.3	163.2	151.9
Feed cost/HH - $	-	-	-	-	-	-	4.03**	3.78
Feed cost/dozen HH - $	-	-	-	-	-	-	0.30	0.30
Egg income - Feed cost[3/] - $	-	-	-	-	-	-	2.06	1.90
HH mortality %	0.56	1.31	0.00	2.42	0.00	1.11	0.56*	4.85

1/ CP = Constant Protein; PF = Phase Fed.
2/ Analysis of covariance was used to calculate adjusted means for hen-day production.
3/ Egg prices: Large 45¢; Medium 40¢; Small 25¢.
* Means are significantly different ($P \leq 0.05$).
** Means are significantly different ($P \leq 0.01$).

Table 6. Egg size and quality[1/]

	Period 2-4		Period 5-7		Period 8-10		Period 2-10	
	CP[2/]	PF[2/]	CP	PF	CP	PF	CP	PF
Average egg weight - g	65.5	64.8	64.8	65.4	63.7	63.0	64.8	64.8
% Jumbo	-	-	-	-	-	-	13.0	13.0
% X-Large	-	-	-	-	-	-	48.1	47.1
% Large	-	-	-	-	-	-	35.3	37.3
% Medium	-	-	-	-	-	-	3.3	2.6
Albumen height[3/] - mm	-	-	-	-	-	-	6.2	6.7
Average Haugh unit[3/]	-	-	-	-	-	-	77.4	80.6
Total egg wt/HH - kg	-	-	-	-	-	-	10.6	9.8

1/ No egg size or egg quality differences were detected as being statistically significant (P > 0.05)
2/ CP = Constant Protein; PF = Phase Fed.
3/ These data collected at end of experiment only (period 10).

Even when the data are analyzed without consideration of mortality, there appears to be no advantage to the less expensive phase feeding regimen in this experiment. Percent hen-day production was not significantly affected by treatment. However, numerical differences occurred in favor of the control fed group. After applying hen-day rate of production to the hen-day feed intake data, the average feed cost per dozen eggs produced was 30.1¢ for control birds and 30.0¢ for phase fed birds. This slight difference was not statistically significant ($P \geq 0.05$).

CONCLUSION

The purpose of using a phase feeding program such as the one tested is to lower feed costs. If laying hens are overconsuming protein, it would be advantageous to limit the birds' intake of this expensive ingredient. In this experiment, the advantage of a less expensive phase feeding regimen was offset by the slightly lower rate of production. It was difficult to evaluate the results of this experiment, because of the difference between treatment groups during the first phase when groups were treated alike. Based on the inconclusive results of this study, it appears that much more information is needed before any general conclusion can be made regarding phase feeding of recycled hens.

REFERENCES

[1]Harms, Robert H. Phase feeding....fact, fad, or fantasy? Poultry Tribune, June 1967.

[2]Scott, M.L., M.C. Nesheim and R.J. Young, 2nd Edition (1976). Nutrition of the Chicken. M.L. Scott & Assoc.

##

Distribution of Progress in Poultry is made to industry leaders and fellow researchers. Anyone wishing to be placed on the mailing list may send a request to the Editor.

R. A. Ernst

R. A. Ernst, Editor PIP
Dept. of Avian Sciences
University of California
Davis, CA 95616