



Progress In Poultry

"THROUGH RESEARCH"

RESTRICTED FEEDING OF LAYING HENS

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Several experiments during the past five years by universities and private companies have shown that profits can be maintained or increased by feeding layers quantities of feed less than ad libitum. Researchers have experimented with from 5 to 20 percent restriction and have frequently shown improved feed efficiency over full-fed controls.

Research in California has demonstrated that two 2-hour feedings per day give about 10 percent restriction. The experiment to be discussed here was designed to evaluate this type of feeding program in environmental and conventional open-type housing with two protein levels in the feed.

EXPERIMENTAL

Location: Sunnymead Ranch, Riverside Co.

Duration: Eleven 4-week periods (24 to 68 weeks of age). January to November.

Stock: 960 twenty-four-week-old Shaver strain White Leghorn pullets.

Housing: Evaporatively cooled environmental housing vs. California open-

type with curtain and hot-weather foggers, 3 hens per 12" x 18" cage, back to back. Front feed trough. Swish drinking cups in back of cages.

Feeding: Restricted - wire lid opened between 6 and 8 a.m. and 4 and 6 p.m.
Full-fed - feed available 24 hrs/day.
Ration analysis - see table 1.

Design: 2 feeding regimens x 2 protein levels = 4 treatments.
4 completely randomized blocks per housing type (environmental and open) = 16 groups per house or 32 groups total.
30 birds per group (ten 3-bird cages) x 32 = 960 birds

Measurements: Daily egg production, feed consumption and mortality.
Egg size every 4 weeks.
Body weight and egg weight every eight weeks.

RESULTS

The tables which follow summarize the results for the entire 44-week experiment.

Table 1. Calculated analysis of rations by periods

	4-week periods					
	1 through 6		7		8 through 11	
	High	Low	High	Low	High	Low
Protein (%)	18.7	17.4	17.4	17.4	17.4	16.6
Methionine (%)	.28	.31	.31	.31	.31	.25
Methionine & Cystine (%)	.51	.52	.52	.52	.52	.44
Lysine (%)	.79	.68	.68	.68	.68	.61
Calcium (%)	3.45	3.52	3.52	3.52	3.52	3.54
ME Kcal/lb	1179	1190	1190	1190	1190	1201
Cost/100 lbs	\$5.98	\$5.93	\$5.93	\$5.93	\$5.93	\$5.81

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Hen-day production was significantly reduced by 2.6 percent with restricted feeding. This resulted in a significant reduction in the total mass of eggs produced. The higher protein feeding program resulted in a larger total mass of eggs, greater average weight per dozen, and more large eggs. Egg size was not adversely affected by restricted feeding.

Table 2. Egg production, egg size, and mortality^{1/}

Housing	Feeding	Protein	Egg production		Egg size			Mortality
			Hen-day	Hen-housed	Total egg weight	Avg. egg weight	Large & above	
			%	no.	lbs.	oz/dozen	%	
Environ.	Restricted	High	75.6	224	30.3	25.0	79.9	6.7
		Low	75.3	224	29.9	24.8	71.9	6.7
	Ad lib	High	78.6	230	31.7	25.2	78.1	8.3
		Low	76.3	230	30.2	24.7	74.3	5.0
Open-type	Restricted	High	76.4	225	31.0	25.3	80.7	8.3
		Low	74.1	219	29.3	24.6	71.8	8.3
	Ad lib	High	78.1	223	31.7	25.3	81.3	10.8
		Low	78.5	235	31.6	25.1	78.0	5.0
Housing:	Environmental		76.4	227	30.5	24.9	76.1	6.7
	Open-type		n.s. 76.8	n.s. 225	n.s. 30.9	n.s. 25.1	n.s. 76.0	n.s. 8.1
Feeding:	Restricted		75.3	223	30.1	24.9	76.1	7.5
	Ad lib		** 77.9	n.s. 229	** 31.3	n.s. 25.1	n.s. 77.9	n.s. 7.3
Protein:	High protein		77.2	225	31.2	25.2	80.0	8.5
	Low protein		n.s. 76.1	n.s. 227	* 30.2	** 24.8	* 74.0	n.s. 6.2

^{1/} * Significance at the 5% level.

** Significance at the 1% level.

*** Significance at the .1% level.

n.s. = Not significant.

The restricted-fed hens consumed 6.2 percent less feed than their full-fed sisters. Individual periods ranged from 3.4 percent to 9.6 percent restriction. Unfortunately, we had to terminate our experiment two months prematurely due to mechanical problems and, thus, our data do not include the two coldest months of the year--December and January.

There was a highly significant two-way interaction between housing and feeding program. Feed restriction indoors resulted in a 4.7 percent reduction in feed consumption, while outdoors the reduction was 7.6 percent. The restricted birds in both types of housing ate exactly the same quantity of feed. Feed efficiency was significantly improved with feed restriction, even when expressed on a lbs-of-feed-per-lb-of-egg basis.

Table 3. Feed consumption and conversion^{1/}

Housing	Feeding	Protein	Feed per hen day	Feed per dozen	Feed per 24-oz dozen	Feed per lb of eggs
			<u>pounds</u>			
Environ.	Restricted	High	.230	3.65	3.50	2.34
		Low	.227	3.61	3.50	2.33
	Ad lib	High	.242	3.70	3.53	2.35
		Low	.237	3.73	3.63	2.42
Open-type	Restricted	High	.230	3.61	3.42	2.28
		Low	.225	3.65	3.56	2.37
	Ad lib	High	.247	3.80	3.60	2.40
		Low	.245	3.75	3.58	2.39
Housing:	Environmental		.234 _{n.s.}	3.67 _{n.s.}	3.54 _{n.s.}	2.36 _{n.s.}
	Open-type		.237	3.70	3.54	2.36
Feeding:	Restricted		.228 _{***}	3.63 _{**}	3.49 _*	2.33 _*
	Ad lib		.243	3.74	3.58	2.39
Protein:	High protein		.237 _{**}	3.69 _{n.s.}	3.51 _{n.s.}	2.34 _{n.s.}
	Low protein		.234	3.68	3.57	2.38

^{1/} * Significance at the 5% level.
 ** Significance at the 1% level.
 *** Significance at the .1% level.
 n.s. = Not significant.

Obviously, all nutrient intake levels associated with feed restriction were significantly reduced since intake itself was reduced. Methionine intake appears to be less than optimum, but period 11 egg production averaged 73 percent, indicating no major effect of this lower level.

Table 4. Nutrient intake^{1/}

Housing	Feeding	Protein	Protein per hen day	Kcal ME per hen day	Methionine per hen day	Methionine & cystine/ hen day	Lysine per hen day	Calcium per hen day
			<u>grams</u>		<u>mg</u>	<u>mg</u>	<u>mg</u>	<u>grams</u>
Environ.	Restricted	High	18.2	274	261	459	637	3.7
		Low	17.1	272	257	452	627	3.6
	Ad lib	High	19.1	288	275	483	670	3.9
		Low	17.8	284	269	473	655	3.8
Open-type	Restricted	High	18.1	274	261	459	636	3.7
		Low	17.0	271	256	450	624	3.6
	Ad lib	High	19.5	294	280	493	684	4.0
		Low	18.5	295	278	499	679	3.9
Housing:	Environmental		18.0 _{n.s.}	280 _{n.s.}	265 _{n.s.}	467 _{n.s.}	647 _{n.s.}	3.8 _{n.s.}
	Open-type		18.3	283	269	473	656	3.8
Feeding:	Restricted		17.6 _{***}	272 _{***}	258 _{***}	455 _{***}	631 _{***}	3.7 _{***}
	Ad lib		18.7	290	275	485	672	3.9
Protein:	High protein		18.7 _{***}	282 _{n.s.}	269 _{**}	474 _{**}	657 _{**}	3.8 _{**}
	Low protein		17.6	280	265	466	646	3.7

^{1/} * Significance at the 5% level.
 ** Significance at the 1% level.
 *** Significance at the .1% level.
 n.s. = Not significant.

None of the egg quality measurements were significantly affected by the treatments of this experiment, with the exception of shell score--a measure of shell roughness. This supports the author's earlier finding that intermittent restricted feeding (80 percent of ad lib) also gave smoother shells.

Both restricted feeding and the lower protein feed reduced body weight significantly.

Table 5. Egg quality and body weight^{1/}

Housing	Feeding	Protein	Egg quality (simple average)				Body weight at 64 weeks
			Albumen height	Haugh units	Shell ^{2/} score	Shell thickness	
			<u>mm</u>			<u>inches</u>	<u>pounds</u>
Environ.	Restricted	High	7.35	85.5	.34	.0150	3.98
		Low	7.13	84.3	.28	.0146	3.60
	Ad lib	High	7.20	84.5	.46	.0148	4.05
		Low	7.35	86.0	.33	.0146	4.05
Open-type	Restricted	High	7.05	83.0	.24	.0149	3.75
		Low	7.42	86.1	.35	.0149	3.66
	Ad lib	High	7.19	84.4	.47	.0147	4.13
		Low	7.15	84.1	.43	.0149	3.94
Housing:	Environmental		7.26	85.1	.35	.0147	3.92
	Open-type		n.s.	n.s.	n.s.	n.s.	n.s.
Feeding:	Restricted		7.24	84.7	.30	.0149	3.75
	Ad lib		n.s.	n.s.	*	n.s.	***
Protein	High protein		7.20	84.3	.38	.0149	3.98
	Low protein		n.s.	n.s.	n.s.	n.s.	*
			7.26	85.1	.35	.0148	3.81

^{1/} * Significance at the 5% level.
 ** Significance at the 1% level.
 *** Significance at the .1% level.
 n.s. = Not significant.

^{2/} 0 = Smooth shell; 3 = Very rough.

Feed cost per day and per dozen eggs was significantly less in the restricted-fed hens, and yet egg income over feed cost per hen housed was not significantly affected. Apparently the 2.6 percent reduction in eggs produced was enough to offset the 6.2 percent savings in feed.

Table 6. Economic results^{1/}

Housing	Feeding	Protein	Feed cost		Average value ^{2/} of eggs ^{2/}	Egg income over feed cost per hen housed
			Per hen day	Per dozen		
			<u>cents</u>	<u>cents</u>	<u>cents</u>	<u>dollars</u>
Environ.	Restricted	High	1.36	21.7	48.9	5.16
		Low	1.32	21.0	48.2	5.08
	Ad lib	High	1.44	21.9	48.7	5.21
		Low	1.38	21.6	48.4	5.12
Open-type	Restricted	High	1.36	21.4	48.9	5.23
		Low	1.31	21.2	48.4	4.96
	Ad lib	High	1.47	22.5	48.9	5.00
		Low	1.43	21.8	48.8	5.31
Housing:	Environmental		1.37	21.6	48.5	5.14
	Open-type		n.s. 1.39	n.s. 21.7	n.s. 48.8	n.s. 5.13
Feeding:	Restricted		1.34	21.3	48.6	5.11
	Ad lib		*** 1.43	** 22.0	n.s. 48.7	n.s. 5.16
Protein:	High protein		1.41	21.9	48.9	5.15
	Low protein		*** 1.36	* 21.4	* 48.5	n.s. 5.12

^{1/} * Significance at the 5% level.
 ** Significance at the 1% level.
 *** Significance at the .1% level.
 n.s. = Not significant.

^{2/} Large eggs, 50¢/dozen; Medium eggs, 45¢/dozen; Small eggs 35¢/dozen.

DISCUSSION

Limited feeding consistently improves the conversion of feed to eggs. This has been demonstrated in almost every experiment we have seen. Whether or not this is an economic improvement will depend upon the values assigned to eggs and feed. Obviously, under the conditions of this experiment, a 6.2 percent reduction in the consumption of certain critical nutrients below the control flock was excessive for normal performance. Adjustments in feed formulas during the course of production might have avoided these production problems and still have given the reduced feed consumption desired.

This experience reinforces our recommendation that if a poultryman plans to restrict feed to layers, he should maintain some birds on full feed in order to establish normal performance. One must be able to measure the total effect of the program, and for this one must have a comparison flock.

SELECTED REFERENCES

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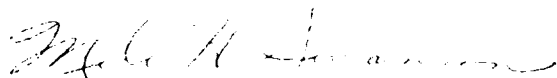
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