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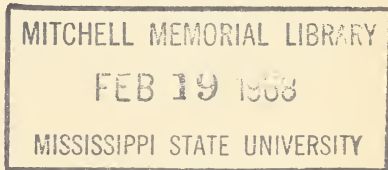
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The Effects of Restricted Feeding On the Performance of Different Strains of Commercial Layers

By CHARLES H. THOMAS and
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Summary

This experiment was designed to study the effects of restricting the feed of pullets from 8 to 26 weeks of age. Six commercial layer strains were used, and they were housed in one cage unit and two floor units. One-half of each strain was full fed and the other half received 8 pounds of mash and 2.5 pounds of oats per 100 birds daily from 8 to 26 weeks of age. All birds were full fed at all other times from day of age to two years of age.

Mortality from 8 to 26 weeks of age was approximately twice as high in the restricted fed group as the full fed group; however, mortality was slightly lower in the restricted fed group in the laying house.

Although there was a highly significant difference in body weight at 20 weeks of age (full fed birds 0.56 pounds heavier), this difference was not significant at 2 years of age.

The full fed birds reached 5% production 39 days and 50% production 20 days before the restricted fed birds.

The mean egg production of the full fed group was 275 eggs and of the restricted fed group 288 eggs. The full fed birds laid over 10 times as many peewee and over three times as many small eggs as the restricted fed birds.

Labor income per bird was approximately \$0.50 more from the restricted fed birds than the full fed birds.

Although the difference between houses for egg production was not significant, the mean egg production of the birds in the cage house was higher than the birds in the floor units.

These results indicate that restricting the feed as done in this series of test will reduce the number of small and peewee eggs and increase the number of large and extra large eggs of birds with different genetic makeup.

THE EFFECT OF RESTRICTED FEEDING ON THE PERFORMANCE OF DIFFERENT STRAINS OF COMMERCIAL LAYERS

By CHARLES H. THOMAS and R. C. ALBRITTON*

Previous research by the Mississippi Station has shown that restricting the feed of pullets between the ages of 8 and 26 weeks delays sexual maturity and reduces the number of small and peewee eggs. The object of the experiment reported here was to determine if six different strains of commercial layers would perform similarly under two different feeding methods.

Six strains of day-old chicks, with approximately 500 birds per strain, were started in each of two successive trials. The same six strains were used in each of the two-year trials. All birds were fed starting mash *ad libitum* to 8 weeks of age. At 8 weeks of age each strain was equally divided into two groups—one for full and one for restricted feeding. Plastic specs were used to prevent cannibalism and all the birds were reared in confinement throughout the experiment.

The full fed groups were given all the growing mash and oats they would eat. The restricted group were limited to 8 pounds of mash and 2.5 pounds of oats per 100 birds daily from 8 to 26 weeks of age in each trial. At 20 weeks of age each group was randomly divided into three housing groups. One group was housed in cages (10 x 18 inches) and two groups were placed in floor units (approximately 2.5 square feet per bird). All were fed an all mash

laying ration from 26 weeks of age to two years in each trial.

All birds were vaccinated for Newcastle and bronchitis at 4 days, 4 weeks, and 4 months of age and for fowl pox at 8 weeks of age.

The birds were weighed at 8 and 20 weeks and 2 years of age. Feed consumption and mortality was recorded for each group, and all eggs were classified daily into the following weight classes: extra large, large, medium, small, and peewee. Egg production for each group was recorded from the first egg to 2 years of age. The birds received approximately 14 hours of light daily in the laying house.

In determining the cost and income the following prices were used: chick cost \$0.35, starting mash \$4.40 per 100 pounds, growing mash \$4.00 per 100 pounds, oats \$2.95 per 100 pounds, laying mash \$3.61 per 100 pounds, brooding and vaccination \$0.04 per bird, extra large and large eggs \$0.42 per dozen, medium \$0.36 per dozen, small \$0.30 per dozen, peewee \$0.24 per dozen, and old hens \$0.10 per pound. The cost to 26 weeks of age was based on the number of birds alive at 26 weeks of age and the feed consumed per 100 birds was based on the number of birds alive at 26 weeks.

Mortality

From 0 to 8 weeks mortality was approximately the same for both trials (5.36 and 5.90%) with some variation between strains in each trial. From 8 to 20 weeks, mortality was approximately three times as high in Trial 2 as Trial 1; however, the mor-

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¹Thomas and Albritton 1959, 1960, 1963.

tality was approximately twice as high in the restricted fed group as the full fed group in both trials (Table 1). From 20 to 26 weeks mortality was 0.70% for the full fed group and 4.02% for restricted fed group in Trial 1 and approximately 1.3% in Trial 2 for both groups. Although the mortality from 26 weeks to 2 years of age was slightly less in the restricted fed group in both trials, the difference was only 1.27%. The cage house had the lowest average mortality for the two trials; however, most of the difference in mortality between houses was in Trial 2.

Feed Consumption

Although the average number of pounds of feed consumed per bird from 8 to 26 weeks of age is shown as 19.03 and 19.14 in Trials 1 and 2, respectively, for the full fed groups and 13.59 and 13.87 for Trials 1 and 2, respectively for the restricted fed group, the actual consumption per bird was slightly less because the mean feed consumption was based on the number of birds alive at 26 weeks of age (Table 2). The actual amount of feed fed per bird from 8 to 26 weeks of age was 13.23 pounds of feed for the restricted fed group. Since the restricted fed group consumed approximately 5.5 pounds of feed less than the full fed group, a savings of approximately \$0.22 in feed cost per bird was

realized. This savings in feed cost would more than offset the higher chick cost resulting from higher mortality in the restricted fed group.

Body Weight

The mean 8 week body weight was 1.22 pounds (Table 3). The difference in body weight at 20 weeks of age was 0.56 pounds which was highly significant (Table 4). The difference between strains and trials was not significant at 20 weeks. Although the full fed birds were still heavier in both trials at 2 years of age (0.07 pounds), the difference was not significant (Table 3). The birds in cages had an average weight of approximately 0.3 of a pound more than the birds in the two floor units.

Age At Sexual Maturity

Although the full fed birds reached 5% production 39 days before the restricted fed birds, there was a difference of only 20 days between the ages at 50% production because the full fed birds did not reach 50% production for approximately 30 days after 5% production. The restricted birds reach 50% production approximately 10 days after 5% production (Table 5). The difference between treatments was highly significant at 5% and 50% production; however, the other sources of variation were not significant (Table 7).

Table 1. Percent Mortality.

Weeks	Trial	Strain						Treatment		House		Mean	
		1	2	3	4	5	6	F	R	Cage	Floor		
0-8	1	4.96	3.67	3.92	4.22	8.04	7.32	.....	.....	.....	.....	5.36
	2	9.85	3.66	4.43	7.03	5.36	5.19	.....	.....	.....	.....	5.96
	Mean	7.40	3.66	4.18	5.62	6.65	6.26	.....	.....	.....	.....	5.63
8-20	1	5.24	2.00	2.65	2.63	1.49	3.80	1.71	4.24	.....	.....	2.97
	2	12.21	4.60	12.30	11.34	7.00	9.94	6.10	12.96	.....	.....	9.53
	Mean	8.72	3.30	7.48	6.98	4.24	6.87	3.90	8.60	.....	.....	6.25
20-26	1	3.21	1.23	1.26	3.31	1.94	3.08	0.70	5.02	.....	.....	2.32
	2	1.22	2.94	0.02	0.07	1.33	1.35	1.31	1.34	.....	.....	1.33
	Mean	2.22	2.08	0.64	1.69	1.64	2.22	1.01	2.68	.....	.....	1.84
26-2 yrs.	1	15.17	12.63	9.77	12.64	22.64	16.56	15.78	13.78	15.69	14.70	14.58	14.83
	2	24.94	9.50	47.47	15.99	22.42	35.39	26.09	25.55	17.40	22.91	32.79	25.84
	Mean	20.06	11.06	29.63	14.33	22.53	25.98	30.94	19.67	16.54	18.80	23.68	20.34

¹F full fed, R restricted.

Egg Production

The mean egg production was higher for the restricted fed birds than for the all fed birds in both trials, and was higher for the birds in the cages than

for either floor unit in both trials. The mean egg production ranged from 268 to 299 for the six strains (Table 6). The difference between strains was highly significant for extra large and large and

Table 2. Pounds of feed consumed per 100 birds (based on number alive at 26 weeks of age).

Weeks	Treatment	Trial	Strain						Mean
			1	2	3	4	5	6	
1-8 Mash		1	522	521	523	527	555	558	534
		2	370	370	370	370	370	370	370
1-20 Mash	F	1	1086	1056	1120	1068	1109	1104	1090
	R	1	743	685	683	682	683	697	696
	F	2	1040	930	989	1036	969	970	989
	R	2	722	689	733	727	713	727	719
Oats	F	1	-----	-----	-----	-----	-----	-----	-----
	R	1	231	214	212	212	213	217	216
	F	2	162	142	153	159	148	149	152
	R	2	226	215	228	227	222	227	224
3-20 Total	F	1	1086	1056	1120	1068	1109	1104	1090
	R	1	974	899	895	894	896	915	912
	F	2	1202	1072	1142	1195	1117	1119	1141
	R	2	948	904	961	954	935	954	943
20-26 Mash	F	1	799	815	804	795	811	852	813
	R	1	347	340	340	345	342	343	343
	F	2	723	696	675	699	738	658	698
	R	2	337	340	337	338	345	343	340
Oats	F	1	-----	-----	-----	-----	-----	-----	-----
	R	1	108	107	106	108	107	107	107
	F	2	83	56	89	86	50	85	75
	R	2	102	105	101	103	105	106	104
20-26 Total	F	1	799	815	804	795	811	852	813
	R	1	455	447	446	453	449	450	443
	F	2	806	752	764	785	788	743	773
	R	2	439	445	438	441	450	449	444
0-26 Total	F	1	2407	2392	2447	2390	2475	2514	2437
	R	1	1951	1867	1864	1874	1900	1922	1893
	F	2	2378	2194	2276	2350	2275	2232	2284
	R	2	1757	1719	1769	1765	1755	1773	1757
8-26 Total	F	1	1875	1871	1924	1863	1920	1956	1903
	R	1	1429	1346	1341	1367	1345	1364	1359
	F	2	2008	1824	1906	1980	1905	1862	1914
	R	2	1387	1329	1399	1395	1335	1403	1387

¹F full fed, R restricted.

Table 3. Mean body weight (Pounds).

	Trial	Strain						Treatment		House			Mean	
		1	2	3	4	5	6	F	R	A	B	C		
8 wks.	1	1.20	1.20	1.21	1.19	1.37	1.31	-----	-----	-----	-----	-----	-----	1.25
	2	1.20	1.20	1.26	1.08	1.26	1.20	-----	-----	-----	-----	-----	-----	1.20
	Mean	1.20	1.20	1.24	1.14	1.32	1.26	-----	-----	-----	-----	-----	-----	1.22
20 wks.	1	2.49	2.49	2.79	2.43	2.66	2.38	2.89	2.19	-----	-----	-----	-----	2.54
	2	2.53	2.51	2.54	2.52	2.54	2.46	2.72	2.30	-----	-----	-----	-----	2.52
	Mean	2.51	2.50	2.66	2.48	2.50	2.42	2.80	2.24	-----	-----	-----	-----	2.51
2 yrs.	1	4.02	3.89	3.76	4.01	4.14	4.12	4.03	3.93	4.20	3.96	3.91	3.98	3.98
	2	4.48	3.96	4.12	4.18	3.91	4.00	4.12	4.05	4.42	4.04	3.96	4.09	4.09
	Mean	4.25	3.93	3.94	4.10	4.02	4.06	4.08	3.99	4.31	4.00	3.94	4.04	4.04

Table 4. Analysis of variance for 20 week body weight.

Source	d. f.	M.S.
Total	23	.....
Strains	5	3.28
Treatments	1	187.60
Strain X Treatments	5	0.88
Trials	1	0.57
Error	11	2.63

Table 5. Age at 5% and 50% Production.

Age	Prod.	Trial	Strain						Treatment			House			Mean
			1	2	3	4	5	6	F	R	A	B	C		
Age 5%	Prod. 1	1	187	177	180	182	180	177	163	197	177	182	182	18	
		2	182	177	183	183	176	183	159	202	183	179	180	18	
		Mean	185	177	182	182	178	180	161	200	180	180	181	18	
Age 50%	Prod. 1	1	208	204	195	198	199	202	192	210	197	203	203	20	
		2	201	200	204	205	197	210	191	213	203	201	203	20	
		Mean	204	202	200	202	198	206	192	212	200	202	203	20	

Table 6. Mean egg production, pounds of feed per dozen eggs and percent of each size of egg

Strain	Trial	Mean egg prod.	Lbs. of feed per doz. eggs	Extra large	Large	Medium	Small	Peewee	Treatment
1	1	273	5.56	80.25	15.47	3.33	0.34	0.0	Full Fed
	2	270	6.17	47.05	45.12	6.94	0.74	0.1	
	Mean	271	.....	63.65	30.30	5.37	0.54	0.1
2	1	301	4.47	75.12	18.83	5.20	0.65	0.2	Restricted
	2	297	5.00	44.57	46.40	7.96	0.91	0.1	
	Mean	299	.....	59.84	32.62	6.54	0.77	0.1
3	1	298	4.65	71.62	21.33	6.17	0.77	0.1	House Cage
	2	235	5.81	51.80	41.37	6.26	0.49	0.0	
	Mean	268	.....	61.71	31.35	6.21	0.65	0.0
4	1	298	4.69	72.50	21.24	5.63	0.54	0.0	Floor
	2	275	5.97	43.55	48.30	7.50	0.55	0.1	
	Mean	287	.....	58.02	34.77	6.48	0.55	0.0
5	1	285	4.96	75.77	17.77	5.55	0.74	0.1	Floor
	2	281	5.54	52.47	41.14	5.43	0.79	0.1	
	Mean	283	.....	64.12	29.46	5.52	0.76	0.1
6	1	305	4.82	77.85	17.53	4.01	0.45	0.1	Floor
	2	246	5.00	44.27	48.02	6.92	0.69	0.1	
	Mean	276	.....	61.06	32.78	5.30	0.56	0.1
Full Fed	1	291	4.74	73.50	19.31	6.03	0.187	0.24	Full Fed
	2	258	5.71	45.31	44.86	8.48	1.14	0.21	
	Mean	275	.....	59.40	32.09	7.17	0.99	0.22
Restricted	1	297	4.94	77.32	18.28	4.09	0.29	0.01	Restricted
	2	278	5.72	49.14	45.30	5.26	0.27	0.02	
	Mean	288	.....	63.23	31.79	4.46	0.28	0.02
House Cage	1	315	4.54	75.28	18.84	5.10	0.63	0.15	House Cage
	2	304	5.36	50.98	43.50	4.98	0.45	0.08	
	Mean	3.0	.....	63.13	31.17	5.04	0.54	0.12
Floor	1	290	4.95	74.86	19.15	5.22	0.66	0.12	Floor
	2	272	5.68	45.98	45.78	7.34	0.76	0.14	
	Mean	281	.....	60.42	32.47	6.22	0.71	0.13
Floor	1	288	4.86	75.88	18.48	5.02	0.50	0.12	Floor
	2	246	5.95	46.40	45.25	7.45	0.79	0.11	
	Mean	267	.....	61.14	31.87	6.09	0.63	0.12
Floor	1	294	4.84	75.35	18.81	5.11	0.59	0.13	Floor
	2	268	5.72	47.22	45.08	6.87	0.71	0.12	
	Mean	281	.....	61.29	31.94	5.93	0.64	0.12

Table 7. Analysis of variance for age at 5 and 50% production, egg production, egg production, percent of each size, and 2 year body weight.

Source	d.f.	Mean Squares							Pee-wee ¹	
		5% Prod.	50% Prod.	Egg Prod.	2 Yr. Wt.	Extra Large	Large	Medium		Small
Total	71									
Houses	2	3.88	50	11,705	0.95	.00414	.00084	.00108	.00001	.000740
Trials	1	0.50	57	9,823	0.21	1.38570	1.23320	.00413	.00001	.004981
Error a	2	132.12	124	1,532	0.06	.00595	.00096	.00117	.00004	.009734
Strains	5	99.10	111	1,664	0.19	.00664*	.00442**	.00046*	.00002	.013624
Treatments	1	26,526.72**	8,800**	2,850	0.21	.02204*	.00005	.01064**	.00086**	.728073**
Strains X Houses	10	12.18	8	553	0.05	.00123	.00083	.00007	.000002	.001606
Treatments House X	5	93.76	86	1,258	0.03	.00080	.00022	.00012	.00003	.017028*
Treatments Strain X	2	2.26	20	68	0.06	.00179	.00027	.00052	.00001	.003009
Treatments House X	10	12.60	20	185	0.02	.00065	.00037	.00009	.000003	.001933
Error b	33	38.55	46	862	0.06	.00171	.00091	.00018	.00007	.006424

*Significant at 0.05% level of probability.

**Significant at 0.01% level of probability.

¹Mean squares for pee-wee multiplied by 1000.

significant for medium; whereas, the difference between treatments was highly significant for extra large, large, small and peewee. The only significant interaction was between strains and treatments for peewee eggs; however, none of the six strains that were restricted laid more than 37 peewee eggs while the six full fed strains laid from 186 to 484 peewee eggs.

The significant interaction between strains and treatments resulted from the fact that the full fed strain that laid the smallest number of peewee (186) was the restricted strain that laid the most peewee (37). The full fed birds laid approximately 20 times as many peewee in Trial 1 and 10 times as many in Trial 2 as the restricted fed group and the full fed laid almost 4 times as many small eggs as the restricted fed group.

Cost and Feed-Egg Ratio

The pounds of feed required to produce a dozen eggs was slightly less for the full fed group in both trials. Strain 2, Trial 1 had the lowest requirement (4.47) while Strain 1, Trial 2 had the highest requirement (6.17). The birds in the cages required less feed to produce a dozen eggs than either floor unit (Table 6).

The higher mortality in the restricted fed group is reflected in the higher chick cost; however, this higher chick cost is offset by the lower feed cost to 26 weeks of age.

The cost for chick, feed, brooding and

vaccination to 26 weeks of age was \$1.3 per bird for the full fed group and \$1.1 per bird for the restricted fed group.

The labor income was higher for the restricted fed birds in both trials. The mean labor income per bird was \$4.1 for the full fed group and \$4.65 for the restricted fed group (Table 8).

Table 8. Cost and income per 100 birds (based on number alive at 26 weeks of age).

	Trial	Full fed	Restricted fed
Chick Cost	1	\$ 37.89	\$ 37.99
	2	37.63	40.40
	Mean	37.76	39.20
Feed cost to 26 weeks of age	1	99.63	74.59
	2	90.45	68.32
	Mean	95.04	71.45
Cost to 26 weeks of age*	1	141.51	116.58
	2	132.08	112.72
	Mean	136.80	114.65
Cost of laying mash	1	414.93	441.36
	2	443.96	460.28
	Mean	429.44	450.82
Total Cost	1	556.44	557.94
	2	576.04	573.00
	Mean	566.24	565.47
Income from eggs	1	1006.00	1032.50
	2	884.00	964.00
	Mean	945.00	998.25
Income from sale of old hens	1	33.94	33.88
	3	30.45	30.15
	Mean	32.20	32.01
Total Income	1	1039.94	1066.38
	2	914.45	994.15
	Mean	977.20	1030.26
Labor Income	1	483.50	508.44
	2	338.41	421.15
	Mean	410.96	464.79

*\$0.04 per bird added for brooding and vaccination.