The Changes in Egg Quality Resulting from Force Molting White Leghorn Yearling Hens*

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(Received for publication February 10, 1947)

THE practice of forcing White Leghorn yearling hens to molt during the late spring or early Summer, for the purpose of securing greater production of higher quality eggs during the period of peak fall egg prices, is quite widely followed by the commercial poultrymen of Washington. That the practice of force molting, as conducted by the poultrymen, can be successful is indicated by the increasing number of poultrymen each year who are following the procedure and are continuing to do so year after year.

The poultrymen who have successfully force molted yearling hens have claimed that flocks which are force molted not only produced more eggs but also produced eggs of improved grades during the fall months, than do flocks which are permitted to lay and molt normally. The authors, who had been studying shell and albumen quality, were interested in these claims of improved egg grades following the forced molt. They were unable to find any published data concerning the relationship of first year egg quality to second year egg quality. The two experiments herein reported were conducted for the purpose of determining the extent of the change in egg quality following the forced molt of birds which had been in lay for periods of approximately ten and twelve months.

EXPERIMENT I

Method of Procedure

In the first experiment, a group of 100 yearling hens was selected to study the changes in egg quality resulting from force molting birds which had been in lay for about ten months. These birds had been laying at an average rate of about 65 percent during the pullet year and were producing at a rate of about 50 percent when the experiment was started. All of the eggs laid by the 100 birds during the four day period from July 2 to July 6, 1945, were observed for: (1) Albumen quality by the index method of Heiman and Carver (1936); (2) Shell smoothness, the degree of smoothness being coded according to the method of Miller and Bearse (1934), in which a smooth egg is scored zero and scores of 1, 2, and 3 indicate increasing numbers of calcareous nodules; and, (3) Shell thickness, calculated from the average of three measurements taken at the equatorial plane of each shell by means of a micrometer having a convex anvil. The data secured from the four days gathering of eggs were used as the values for egg quality prior to the molt.

Immediately following the period dur-

* Published as Scientific Paper No. 702, College of Agriculture and Agricultural Experiment Stations, Institute of Agricultural Sciences, State College of Washington, Pullman, Washington.

ing which eggs were saved for observation, the birds were placed on the forced molt management procedure as outlined by the Poultry Council of the State College of Washington (1945). The procedure caused the birds to cease production almost entirely and to start molting within a period of ten days.

The first birds returned to production about nine weeks after they were placed on the forced molting procedure. When production again reached a rate of 50 percent, which was about 12 weeks after the molt started, the same observations for egg quality as were made before the molt were made on all the eggs laid by the birds during four consecutive days. Similar egg quality observations were made at monthly intervals for three succeeding months.

The birds were similarly managed before and after the molt. They were housed in similar pens and were fed a similar ration consisting of 60 percent laying mash, 30 percent whole wheat, and 10 percent whole oats, with limestone grit being provided ad libitum.

Results

Table 1 presents the average of the egg quality data secured before and after the molt. It may be noted that the average egg weight increased four grams per egg. However, there was no further increase but instead a slight decrease in the three months following the first observation.

There was practically no change in the albumen index resulting from the rest period. A marked decline in albumen index occurred in the second and third months after the molt.

The shells of eggs produced after the molt were considerably smoother and thicker than those produced before the molt. The average shell smoothness score decreased from 1.06 to .68. The eggs of the second observation after the molt were as smooth as those of the first observation. However, the eggs laid one and two months later were progressively rougher, being nearly as rough in the fourth observation as they were before the molt. Average shell thickness before the molt was .324 mm. and in the first observation after the molt was .354 mm. During the next three months the shells continued to be as thick and even slightly thicker than they were in the first observation.

TABLE 1.—*Changes in egg quality following forced molt in Experiment I*

Observation	Average egg weight	Average albumen index	Average shell smooth. score	Average shell thickness
	grams			mm.
Before molt	57.5	85.0	1.06	.324
When returned to 50% lay after molt.	61.6	87.2	.68	.354
One month following 1st observation after molt.	61.5	87.0	.66	.360
Two months following 1st observation after molt.	60.8	79.2	.86	.361
Three months following 1st observation after molt.	60.7	74.9	1.00	.361

EXPERIMENT II

The second experiment was instigated in order to study the response to a forced

molt of individual birds which were known to produce either good or poor quality eggs. It was also desired to compare the quality of eggs produced by birds as pullets entering production with those produced by the same birds as yearlings when returning to lay following a molt.

Method of Procedure

Twenty White Leghorn yearling hens, which had finished a full laying year and for which egg quality data had been secured on the first four eggs laid and on four eggs laid at monthly intervals during their laying year, were used as experimental birds. Just prior to beginning the forced molt procedure four consecutively laid eggs were secured from each bird and observations for egg quality, similar to those made in the first experiment, were made.

The birds were forced to molt in the same manner as the birds in the first experiment. Prior to the molt and until a time just prior to the commencement of production the birds were maintained on the floor. Just before the birds resumed production they were transferred to individual cages. The first four eggs laid by each bird and the first four eggs laid at monthly intervals thereafter for three months were observed for egg quality.

Results

Table 2 presents the average egg weight and albumen index for the fifteen individual birds for which complete data were secured before and after the molt. By the end of the first month, or at the second observation after the molt, egg weight had increased to the same extent as it did in the first experiment or an average of four grams per egg. Average egg weight did not increase further during the second and third months. Considerable variation in the degree of change in weight occurred among the various birds.

The average albumen index value for the birds as pullets entering production was 145, before the molt it was 71 and after the molt, 91. Only three of the fifteen birds failed to produce eggs with better albumen quality after the molt than before the molt. However, in none of

TABLE 2.—*Changes in egg weight and albumen index following a forced molt. Experiment II*

Bird no.	Egg weight observations					Albumen index observations					
	Before molt	After molt				Av. 1st 4 pullet eggs	Before molt	After molt			
		1	2	3	4			1	2	3	4
	grams	grams	grams	grams	grams						
865	61	64	65	66	64	147	66	88	103	90	85
875	70	71	76	74	74	157	98	104	85	78	72
896	71	74	75	72	70	121	53	71	70	69	84
937	58	68	69	69	69	157	55	88	88	81	80
941	61	63	63	62	62	118	105	93	78	63	64
963	59	60	61	58	56	165	77	84	97	97	99
980	56	59	63	60	62	174	119	108	120	112	110
982	67	67	68	69	69	145	42	60	71	53	57
987	67	65	70	68	66	132	83	78	66	72	71
988	66	66	67	67	66	156	55	97	86	76	75
989	61	69	69	67	67	150	63	78	77	92	93
1006	59	60	64	65	61	162	69	124	97	93	92
1010	68	68	70	72	70	136	38	82	89	74	97
1016	61	62	64	65	63	131	76	101	81	67	91
1023	61	55	67	65	64	129	68	111	97	68	106
Av.	63	65	67	67	66	145	71	91	87	79	85

the birds did the average albumen index after the molt approach the corresponding pullet index.

Table 3 presents the data on shell smoothness and shell thickness. The average shell smoothness score before the molt was 1.49 and after the molt .83. At the end of the first month the average score had decreased to .70 after which time the shells again started to become rougher. The average score of these birds as pullets was .18. Although only one bird failed to produce a smoother shell following the molt, only five of the fifteen birds laid as smooth eggs after the molt as they did as pullets.

Before the molt the shells average .310 mm. in thickness whereas after the molt it rose to .337 mm. The average thickness of the shells formed by these birds as pullets was .354 mm. Only one bird failed to produce thicker shells after the molt than it did before the molt. Only five of the birds formed as thick or thicker shells after the molt than they did as pullets.

TABLE 3.—*Changes in shell smoothness score and shell thickness following a forced molt. Experiment II*

Bird No.	Shell smoothness score observations						Shell thickness observations					
	Pullet year	Before molt	After molt				Av. 1st 4 pullet eggs	Before molt	After molt			
			1	2	3	4			1	2	3	4
							mm.	mm.	mm.	mm.	mm.	mm.
865	.00	2.00	.50	.75	.50	.75	.349	.287	.278	.311	.292	.285
875	.00	2.50	2.37	2.00	1.67	2.00	.383	.283	.344	.356	.346	.326
896	.63	1.87	1.50	1.63	1.50	1.50	.358	.310	.344	.309	.323	.323
937	.13	1.37	1.00	.67	1.00	1.00	.338	.291	.337	.342	.324	.325
941	.13	.38	1.00	.50	.88	.75	.375	.348	.337	.334	.328	.299
963	.13	1.37	.00	.00	.25	.13	.323	.265	.305	.309	.311	.272
980	.50	1.50	.87	.38	.50	.63	.335	.331	.357	.341	.359	.348
982	.13	1.12	.25	.25	.13	.63	.369	.353	.350	.370	.356	.347
987	.00	.25	.62	.12	.00	.50	.351	.340	.345	.353	.318	.331
988	.38	2.17	1.12	1.00	.88	1.00	.339	.312	.308	.323	.302	.306
989	.38	2.50	2.32	1.38	2.00	2.50	.351	.274	.348	.338	.326	.311
1006	.00	1.12	.75	.50	.75	.67	.347	.323	.317	.319	.333	.308
1010	.13	2.25	.75	1.00	1.50	1.50	.376	.322	.353	.373	.372	.357
1016	.00	.12	.00	.00	.00	.00	.363	.310	.315	.325	.321	.333
1023	.13	1.87	.33	.38	.50	1.25	.350	.308	.311	.358	.342	.358
Av.	.18	1.49	.83	.70	.80	.99	.354	.310	.330	.337	.330	.322

Discussion

The data presented above show that egg shells become smoother and thicker following a forced molt. Since the data of Conrad (1939) and of Warren and Schnepel (1940) respectively, show that high constant temperatures will cause decreases in blood calcium and shell thickness it might be questioned whether the improvement in shell quality was due to the rest provided by the molt or to decreased temperatures following the molt. In the first experiment the average maximum atmospheric temperature during the pre-molt observation period in July was 80°F. and during the first post-molt observation period in October was 66°F. During the same periods the average between the maximum and minimum temperatures were 61°F. and 56°F., respectively. Neither the maximum nor average of maximum and minimum temperatures during the present experiment approached the constant temperature of 90°F. shown by Conrad (1939) and Warren and Schnepel (1940) to effect blood calcium and shell thickness. It would seem therefore, that decreasing temperature was not a factor in the improved shell quality observed following the molt. That

temperature was not a factor is further emphasized in the second experiment where the birds were molted in October and returned to lay in January when the mean maximum atmospheric temperatures were 62° and 47°F., respectively.

An increase in egg size, which may have been due to the rest or to a natural phenomenon associated with increased age of the birds, was observed. It was further noted that egg size did not increase during three months following the molt. Since no data was available to indicate the trend in egg size for a period of time prior to the molt, and since no data was available with birds which had been permitted to lay and molt under natural circumstances, it is difficult to ascertain whether the increase in egg size was due to the rest provided by the molt or to increased age. Any possible effect of temperature change on egg size must be questioned because of the comparatively low temperatures and small differences in temperatures which existed before and after the molt.

The fact that the albumen index did not show a definite increase with both groups of birds leaves the picture of the effect of the molt on albumen quality somewhat confused. Undoubtedly at least part of the difference in the response of the two groups can be attributed to the variation in length of time the groups had been in production before the molt, and to the variance in actual index values before the molt. Although the second group of birds showed a definite increase in albumen index the average value of this group after the molt was practically the same as for the first group which started with a higher value and showed no improvement.

The comparison of the pullet year egg quality of the second group of birds with the egg quality after the molt indicates that an approximate ten weeks' rest is not sufficient to restore the physiological functions of the bird to their maximum ability to produce quality eggs. It is highly improbable, however, that a further rest would be of value in promoting additional improvement.

SUMMARY

A forced molt of White Leghorn yearling hens which had been in lay for 10 and 12 months resulted in:

1. An increase in egg weight.
2. A marked improvement in the smoothness of egg shells.
3. An increase in shell thickness.
4. No changes in albumen quality of birds after being in lay for ten months.
5. An improvement in albumen quality with birds which had been in lay for twelve months before being forced to molt.
6. Failure to produce eggs with as high albumen index or shells as thick or smooth as were produced by the same birds when pullets.

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