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SUMMARY

For two years, two experiments were carried out to compare the performance of Single-Comb White Leghorn layers housed in 1) naturally ventilated, uninsulated cages and floor pens and 2) a mechanically ventilated, insulated cage house.

Layers housed in naturally and mechanically ventilated, uninsulated or insulated cage houses ate significantly less ($P \leq 0.05$) feed per layer in both experiments than birds housed in an uninsulated floor pen house. No statistically significant difference was observed for the other performance data.

Performance of Single-Comb White Leghorn Layers in Three Types of Houses in Oregon

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The trend in poultry housing in recent years has gradually gone from uninsulated, naturally ventilated cage layer houses to mechanically ventilated, insulated cage layer houses. Primary reasons for this shift were to provide better control of the environment in the area housing the birds and to allow for housing more birds. By minimizing seasonal variation of environmental temperature and light, production may be more uniform throughout the year and physiological stress on birds may be less. Mortality also may be reduced during extremely hot weather.

Parker and Rodgers (1954) reported that in Western Oregon, which has mild winters, open-type houses and cages gave comparable results with White Leghorn pullets. In trials during three periods from December 1949 to July 1952, percent egg production ranged from 50.5 to 56.2 for colony-type community cage open houses. Percent mortality ranged from 19.5 to 38.9. During the same trials, pullets housed in inside or outside individual cages and in a conventional floor pen house had percent hen-day egg production ranging from 53.2 to 59.8, and percent mortality ranging from 16.7 to 38.9.

Becker and Davis (1954) reported that Wyoming studies found no advantages in insulated and mechanically ventilated pens over the uninsulated and naturally ventilated pens in any of the production factors.

Several investigators reported slightly higher egg production in layers kept in cages than in floor pens. However, blood spots were higher in eggs produced from layers kept in cages than in floor pens (Temperton and Dudley, 1948; Gowe, 1956; Froning and Funk, 1958; Bailey *et al.*, 1959).

Francis *et al.* (1961) reported that housing pullets in single or colony cages for two years was not as satisfactory for egg production as in floor pens. Feed conversion was better, incidence of blood spots lower, and production higher for layers housed in floor pens than for layers housed in single or colony cages.

In a Florida report (Christmas *et al.*, 1976), 12 strains of layers housed at two or three layers per cage were com-

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pared in four trials in insulated and uninsulated California-type cage laying houses. There was no significant difference in performance of birds housed in both types of houses regardless of bird density. These investigators concluded that under conditions of their trials, insulation was of no practical value in improving the performance of commercial White Leghorn type laying hens.

Comparative trials involving Single-Comb Leghorn layers were carried out over a two-year period as a result of the availability of a recently constructed, mechanically ventilated, fully insulated cage layer house and the presence also of an uninsulated, naturally ventilated cage layer house and a floor pen house on the same research plant.

EXPERIMENTAL PROCEDURES

An uninsulated, naturally ventilated, open-front floor pen house (6.1 meters x 30.5 meters), an uninsulated, naturally ventilated, open-side single-cage house (12.2 meters x 32.9 meters), and an insulated, positive-pressure ventilated, totally closed single- and multiple-layer cage house (13.4 meters x 48.8 meters) were used in two successive experiments.

In the floor pen house, two floor pens (4.3 meters x 3.1 meters per pen) were used with the pens separated by a wooden wall. Floors in each pen were covered with about 5 centimeters of wood shavings. On the west or hall side in each pen, a roosting area (0.91 meters x 1.22 meters) was set with the roost 0.61 meters above the floor. An incandescent 25-watt light bulb was suspended 2.13 meters above the center of each pen. Two rows of five nests each were suspended on the south wall approximately 0.61 meters off the floor. Two metal self-feeding tube feeders (40 centimeters in diameter) and 1.22-meter V-trough waterers were used in each pen. To control cannibalism, the layers were equipped with aluminum specs at the time of housing. Each pen contained 50 Babcock Single-Comb White Leghorn layers.[1] Water was provided for eight 15-minute watering periods of approximately equal intervals from 4:45 a.m. to 6:15 p.m., and artificial light was provided from 4:30 a.m. to 6:30 p.m. when necessary to provide 14 hours of light.

In the uninsulated, naturally ventilated single-cage house, layers were housed in individual cages (20.3 centimeters x 35.6 centimeters x 40.6 centimeters). Forty-watt light bulbs were suspended approximately 2.13 meters above the floor of the house and spaced about 3.0 meters apart from each other. Artificial light was provided from

[1] Babcock B-300 hatching eggs were gratuitously provided by Skylane Farms, Woodburn, Oregon, and Babcock Industries, Ithaca, New York.

5 a.m. to 7 p.m. when necessary to provide 14 hours of light. Water was provided in continuous V-trough-type waterers with eight 15-minute watering periods of approximately equal intervals from 5:15 a.m. to 6:45 p.m. In Experiment 1, duplicate lots of 50 layers each in a single row were used. In Experiment 2, there were four replicates of 25 layers each scattered throughout the house for comparative purposes.

In the positive pressure, mechanically ventilated house, the layers were housed in individual cages (20.3 centimeters x 45.7 centimeters x 45.7 centimeters) with 24 cages in a row. There were four rows arranged in a stair-step manner. Light bulbs (100 watts) were suspended 2.43 meters above the floor and spaced 3.0 meters from each other. These light bulbs were connected to a rheostat to control the light intensity. Approximately 5.4 lux (0.5 foot candle) was provided at bird level. Artificial light was provided from 4 a.m. to 6 p.m. Ventilation rate was approximately 6,000 to 7,000 cubic feet per minute. Water was provided in continuous V-trough-type waterers with eight 15-minute watering periods of approximately equal intervals from 4:15 a.m. to 5:45 p.m. In Experiment 1, because of the number of pullets available, 48 layers were used with 12 layers per row or one layer for every other cage. In Experiment 2, 96 layers were used with 24 layers per row or one bird per cage. There were four replicates in both experiments.

All layers received the same ration[2], formulated to contain 16 percent crude protein, 3 percent calcium, and 0.45 percent available phosphorus, as well as adequate amounts of other required nutrients. Feed was provided ad libitum throughout the experiments.

Experiment 1 was conducted from September 1975 for ten 28-day periods. The experiment was started when the birds attained 25 percent egg production. Body weight was taken at the end of periods 1, 2, 4, 7, 9, and 10; egg shell quality was measured by specific gravity readings for all eggs laid for three consecutive days at the end of periods 1, 5, and 9, using the procedure described by Arscott and Bernier (1961) which involves using salt solutions of different salt concentrations. Egg grades (jumbo, extra large, large, medium, small, and peewee) were determined on an Egomatic candler and grader for all eggs laid for three consecutive days at the end of each period.

Experiment 2 was conducted from September 1976 for ten 28-day periods. The experiment was started when the layers reached 25 percent egg production. Body weight was recorded at the end of periods 1, 2, 4, 7, and 10. Haugh units were determined on eggs at the end of periods 1, 2, and 10. Egg grades and specific gravity were de-

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[2] Ration No. 1468 available on request.

termined at the end of periods 1, 2, 6, and 10 by the method mentioned earlier.

In both experiments, egg production and mortality were recorded daily, and all dead birds were sent to the Veterinary Diagnostic Laboratory for necropsy.

All data derived from both experiments were submitted to a one-way analysis of variance, and significant treatment means separated by Duncan's multiple-range test (Steel and Torrie, 1960).

RESULTS

The performance data from both experiments were combined since there was no significant interaction with time between the two experiments (Table 1). Average body weight for layers in the naturally ventilated cage house was 1.62 kilograms; the average body weight for layers in the mechanically ventilated cage house and floor pens was 1.75 and 1.71 kilograms, respectively. Layers housed in floor pens laid an average of 73.3 percent; layers housed in the naturally and mechanically ventilated cage houses laid an average of 68.2 and 70.3 percent, respectively. Conversely, feed conversion was better for layers housed in the naturally ventilated house than layers in the mechanically ventilated cage and floor pen houses. Mortality for layers housed in the naturally ventilated cage house was almost twice the mortality in the other two houses. Specific gravity (shell thickness) and Haugh units (interior egg quality) were slightly less for layers housed in the naturally ventilated cage house than either the mechanically ventilated cage or floor pen houses. None of the performance data discussed above was statistically significantly different among the three types of housing, except that layers housed in floor pens ate significantly ($P \leq 0.05$) more feed per bird during both experiments than layers housed in the naturally or mechanically ventilated cage houses. Feed wastage may have occurred but the loss was minimal during the experiments.

Data for each trial showed that layer performance in the naturally ventilated house was significantly lower ($P \leq 0.05$) than that of layers housed either in the floor pen or the mechanically ventilated house during the first experiment. These differences may have been attributed to location effect within the house since these layers were housed in one section of the house.

In the second experiment, when four groups of 25 layers per group were scattered randomly throughout the naturally ventilated cage house, no significant differences in performance of layers housed in the three types of houses were found. However, in this same experiment, numerically better percent average hen-day production, mortality, shell thickness, and interior egg quality (Haugh

Table 1. Comparison of the performance of Single-Comb White Leghorn layers in three types of houses in Oregon for two consecutive years (Experiments 1 and 2)[1,2,3]

Types of Housing	Ave. Body wt.* (kg)	Ave. Hen-Day Egg Prod. (%)	F.C. (kg feed/doz.)	Ave. Daily Feed Consumed (gm/bird/day)	Cum. Mort. (%)	Ave. Egg wt. (gms)	Specific** Gravity	Ave. Egg Grade (%)				
								Jumbo	Ex. Large	Large	Medium	Haugh*** Units
Positive pressure mechanically ventilated cage	1.75[a]	70.3[a]	2.04[a]	111.8[a]	7.3[a]	59.2[a]	1.0829[a]	3.8	27.3	39.1	27.4	76.2[a]
Naturally ventilated single cage	1.62[a]	68.2[a]	1.98[a]	108.7[a]	12.0[a]	58.9[a]	1.0828[a]	2.2	27.1	35.2	30.1	75.4[a]
Naturally ventilated floor pens	1.71[a]	73.3[a]	2.41[a]	131.6[b]	6.5[a]	59.5[a]	1.0836[a]	2.4	34.8	35.9	25.5	78.5[a]

1. Average values for ten 28-day periods except where indicated.
2. Figures in each column with different superscripts are significantly different at $P \leq 0.05$.
3. Babcock - 300 strain layers.

* Average body weight at the end of the 10th period.

** Average of averages at the end of periods 1, 2, 6, and 10.

*** Average of averages at the end of periods 1, 2, and 10. Values from Experiment 2 only.

units) were observed in layers housed in floor pens than in layers housed in naturally and mechanically ventilated cage houses.

From the data shown in Table 1, our results are in agreement with Kurnick *et al.* (1958) and Francis *et al.* (1961) who stated that layers housed in floor pens performed slightly better than layers housed in cage houses. Contrarily, our results do not agree with several investigators who have reported slightly higher egg production for layers housed in cages than in floor pens (Temperton and Dudley, 1948; Gowe, 1956; Froning and Funk, 1958; Bailey *et al.*, 1959).

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