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FIRST CYCLE REPORT OF THE THIRTY THIRD

NORTH CAROLINA LAYER PERFORMANCE

AND MANAGEMENT TEST

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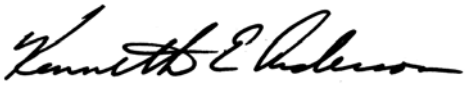
The North Carolina Layer Performance and Management Test is conducted under the auspices of the Cooperative Extension Service at North Carolina State University and the North Carolina Department of Agriculture. The flock is maintained at the Piedmont Research Station, Salisbury, North Carolina. Mr. Raymond Coltrain is Piedmont Research Station Superintendent; Mr. David Joyce is Resident Manager of the flock; Pam Jenkins is the Statistical Research Assistant; and Dr. K. E. Anderson is Project Leader. The purpose of this program is to assist poultrymen in evaluation of commercial layer stocks and management systems.

The data presented herein represents the analysis of the first production cycle and Molt of the 33rd North Carolina Layer Performance and Management Test. Performance summary tables are available examining density individually as well as the combined results. This is due to the remodeling of the production facilities which resulted in the curtain sided house becoming an enclosed force ventilated house.

For further information contact:



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33rd NORTH CAROLINA LAYER PERFORMANCE AND MANAGEMENT TEST

Protocol Procedures Used

Entries:

A total of four white egg and four brown egg strains were accepted in accordance with the rules and regulations of the test.

Dates of Importance:

The eggs for the 33rd NCLP&MT were set on June 10, 1998 at the Piedmont Research Station (NCDA) Poultry Unit. The flock was hatched on July 1, 1998 and the pullets were moved to the laying facilities on October 27-28, 1998 during their 17th week of age. The age of the flock at transfer was lowered to approximately 17 weeks due to current trends in the industry and requests of the breeders to move the flock prior to excessive egg production in the rearing houses.

First cycle production records commenced on November 4, 1998 (18 weeks of age) until molt was induced on October 6, 1999. The molt records commenced on October 6, 1999 (66 weeks of age) and ended on November 3, 1999 (70 weeks of age). This report includes production data summarized from 18 to 66 weeks, and 66 to 70 weeks.

Pullet Housing:

The chicks were randomly assigned to the growing cages with white egg and brown egg replicates being intermingled throughout the house. The white egg strains occupied approximately ½ of the house and brown egg strains occupied the other half of the house. All strains were assigned to be represented as equally as possible in all rooms, row, and levels.

House 8--is an environmentally controlled closed brood-grow facility with 3 banks of quad-deck cages in each room. Each room has been assigned a number, each side of each bank has been assigned a row number, and each cage section within each row and level/row has been assigned a replicate number. For statistical analysis, pairs of rows have been designated as blocks. Thus, each block consists of two rows containing 24 replicates (i.e. 3 reps/strain) on all levels. This allows for a total of 3,744 pullets per room resulting in a total pullet count in House 8 of 14,976. The white and brown-egg strains were randomly assigned to three replicates within each block in the house. Entrant strains were assigned to the blocks in a restricted randomized manner with the restrictions being that all strains were approximately equally represented in all rows, levels, and rooms. All chicks were brooded in the same cage during the entire 17 wk rearing period. Paper was placed on the cage floor for the first 7 days within each of the replicate series within each row. Each cage within the replicate was filled with 13 white-egg or brown-egg (13 per 24" x 26" cage) pullets on the day of hatch for a rearing allowance of 48 sq in for the white-egg layers. The same number of pullets were grown in each replicate for both white and brown-egg strains. The room dividers were removed for this test so that all birds were essentially reared in a contiguous house. Pullet nutrition and husbandry practices are published in the Pullet Rearing Report (Vol. 33, No. 2).

Test Design:

The arrangement for the laying test involved a completely randomized design and the main effects were set up in a factorial arrangement. The main effects were strain and density. Following are general descriptions of the main effects:

Strain

The samples of fertile eggs were provided directly by the breeders involved. All eggs were set and hatched concurrently. A total of four white egg strains and four brown egg strains participated in the test. See the 33rd Hatch

Report (Vol. 33, No. 1) for details.

Layer Housing

Two lay houses (4 and 5) were utilized. House 4 is a high rise, environmentally controlled facility with three banks of four-deck high cages. Each side of each bank was designated as a row, and each row was divided into nine eight-foot replicate blocks/level. The replicate blocks contain cages that are either 30.5 or 40.5 cm wide. House 5 is a standard height totally enclosed force ventilated open-sided laying house with a flush manure handling system. It has 2 banks of triple deck cages and two banks with 4 levels of cages. Again, each side of a bank was designated as a row and each row was divided into 9 8-foot replicates/level. The replicates contained cages that were either 30.5 or 40.5 cm wide. In both houses the cages were 40.5 cm deep therefore, when the bird population was held constant at 4 hens per cage, densities for the 30.5 and 40.4 cm cages were 310 and 413 cm^2, respectively. House 4 contained 6,048 hens and House 5 7,056. Both houses contain feeder systems which allow feed consumption to be determined per replicate block. The white-egg and brown-egg strains were assigned to the replicates in a restricted randomized manner, with the restrictions being that all strains were approximately equally represented in all rows, levels and cage sizes.

Density

All individual cages within each block contained 4 hens for both the brown and the white egg layers. Thus the replicate blocks contained either 32 or 24 hens per replicate, for the block with 30.5 cm or 40.5 cm lengths, respectively. Cage densities for each 4 hen cage group were 310 cm^2 (48 in^2) and 413 cm^2 (64 in^2) for these two types of cages. Initial population size was constant throughout the test, so population size was not a factor in this test.

Layer Management (Molting):

The molt experiment was conducted utilizing the hens which are participating in the layer test. Participating strains were randomly divided into two groups such that all strains, densities, and levels were approximately equally represented in both houses. Two molting procedures were compared commencing at 66 wks of age. The first molting program consisted of a 14 day fasting period with a goal of hen body weight loss of approximately 30 %. Following the fasting phase the hens were provided a single diet containing 16% crude protein resting diet for 2 wks. The second program consisted of a short fasting period of 5-6 days followed by the feeding of a 10% crude protein diet containing 1400 KcalME/kg for the remainder of the molting program. This was to allow the hen's body weight loss to be approximately 25%. The hens were returned to the laying diet and light stimulated 4 wks after the molt was initiated.

Layer Nutrition:

Layer diets are identified as Diets D, E, F, G, H, I, M, N, O, P, and Q which consist of a pre-lay diet and a series of layer diets formulated to assure a daily protein, mineral and amino acid intake as shown below. The diets are provided to the birds in a crumblized form to reduce feed wastage. Dietary formulations are presented in the following section. Feed was offered ad libitum in accordance with the guidelines that all birds should receive acceptable nutrient intake at all times depending on the bird's age and production rate (see Table). The diet being fed at any given time provides the nutrient intake and is determined based upon bird age, production stage, and average daily feed intake.

MINIMUM DAILY INTAKE OF NUTRIENTS PER BIRD AT VARIOUS STAGES OF PRODUCTION

Production Stage>	87% and	87-80%	80-70%	<70%

White-Egg Layers

Protein (g/day)	19	18	17	16
Calcium (g/day)	3.8	3.8	4.0	4.0
Lysine (mg/day)	820	780	730	690
TSAA (mg/day)	700	670	630	590

Brown Egg Layers

Protein (g/day)	20	19	18	17
Calcium (g/day)	3.8	3.8	3.8	4.0
Lysine (mg/day)	830	820	780	730
TSAA (mg/day)	710	700	670	630

LAYING HOUSE FEEDING PROGRAM

Rate of Production	Consumption Per 100 Birds/Day (kg)	Diet Fed: White Egg Strains	Diet Fed: Brown Egg Strains
Weeks 17-26	< 9.52	D	D
Pre-Peak and > 87%	< 9.52	F	E
	9.57-10.39	G	F
	10.43-11.29	I	H
	11.34-12.20	N	M
	12.25-13.11	P	O
	>13.15	Q	Q
80-87%	< 9.52	G	F
	9.57-10.39	H	G
	10.43-11.29	M	I
	11.34-12.20	O	N
	12.25-13.11	Q	P
	>13.15	Q	Q
70-80%	< 9.52	H	G
	9.57-10.39	I	H
	10.43-11.29	N	M
	11.34-12.20	P	O
	12.25-13.11	Q	Q
	>13.15	Q	Q
< 70%	< 9.52	I	H
	9.57-10.39	M	I
	10.43-11.29	O	N
	11.34-12.20	Q	O
	12.25-13.11	Q	Q
	>13.15	Q	Q
Post-Molt < 70%	< 9.52	G	F
	9.57-10.39	H	G
	10.43-11.29	M	I
	11.34-12.20	O	N
	12.25-13.11	Q	P
	>13.15	Q	Q

LAYING PERIOD DIETS

	Diet Identification[1]				
	Layer Diets				
Ingredient	D	E	F	G	H
	Pounds Per Ton				
Corn	772.07	819.01	934.81	1000.11	1068.72
Corn Gluten Meal	100.0	75.00	85.00	90.00	90.00
Soybean Meal	603.43	581.58	530.80	466.26	412.42
Wheat Midds	145.62	150.00	100.14	109.38	110.93
Calcium Carb	200.49	194.30	188.83	184.03	178.56
DiCalcium Phos	21.20	23.15	24.36	24.02	24.91
Sodium Bi-Carb	16.74	16.66	17.72	17.54	17.52
Salt	5.00	5.00	5.00	5.00	5.00
Methionine	3.54	4.50	4.82	5.45	5.06
Lysine		1.31		1.90	2.66
Choline Chloride	5.49	5.35	5.27	5.20	5.10
Vitamin premix	2.00	2.00	2.00	2.00	2.00
Min. premix	1.00	1.00	1.00	1.00	1.00
Fat	120.42	118.14	97.25	85.11	73.12
Mold Inhibitor	2.00	2.00	2.00	2.00	2.00
Tracer	1.00	1.00	1.00	1.00	1.00
Total	2000	2000	2000	2000	2000
Protein %	22	21	20	19	18
ME kcal/kg	2925	2925	2925	2925	2925
Calcium %	4.10	4.00	3.90	3.80	3.70
T. Phos %	.59	.60	.59	.58	.58
Lysine %	1.14	1.15	1.02	1.00	.95
TSAA %	.90	.90	.90	.90	.85

LAYING PERIOD DIETS

	Diet Identification[1]					
	Layer Diet					
Ingredient	I	M	N	O	P	Q
	Pounds Per Ton					
Corn	1136.49	1211.94	1233.32	1215.69	1318.20	1390.16
Corn Gluten Meal	100.00	85.00	50.00	50.00	25.00	25.00
Soybean Meal	346.86	314.14	300.80	223.71	216.04	162.24
Wheat Midds	109.19	103.88	147.81	256.18	200.00	200.00
Calcium Carb	178.31	168.03	158.33	155.44	150.20	145.85
DiCalcium Phos	26.00	25.88	24.14	19.60	20.30	18.78
Sodium Bi-Carb	17.56	17.69	16.77	14.52	15.70	15.71
Salt	5.00	5.00	5.00	5.00	5.00	5.00
Methionine	4.56	4.32	3.36	2.20	1.97	1.58
Lysine	3.80	3.91	1.97	1.80	2.61	3.37
Choline Chloride	5.04	4.91	4.71	4.60	4.46	4.37
Vet premix	2.00	2.00	2.00	2.00	2.00	2.00
Min. premix	1.00	1.00	1.00	1.00	1.00	1.00
Fat	61.19	49.30	47.79	45.26	34.79	21.94
Mold Inhibitor	2.00	2.00	2.00	2.00	2.00	2.00
Tracer	1.00	1.00	1.00	1.00	1.00	1.00
Total	2000	2000	2000	2000	2000	2000
Protein %	17	16	15	14	13	12
Me kcal/kg	2925	2925	2925	2925	2925	2925
Calcium %	3.7	3.5	3.3	3.2	3.1	3.0
T. Phos %	.58	.57	.56	.54	.52	.50
Lysine %	.90	.85	.75	.65	.65	.60
TSAA %	.80	.75	.65	.55	.50	.45

Data Collection Schedule and Procedures:

Egg Production--All eggs that had the potential of being marketed were credited toward the test unit's (replicate) egg production, regardless of the shell condition at the time of collection. All eggs were collected and recorded daily. Egg production was summarized at twenty-eight day intervals, and was calculated and reported on a hen-day basis.

Egg Weight--At twenty-eight day intervals, all eggs produced in the previous 24-hour period were weighed and sorted by size (See egg size distribution). Percentages of eggs within each size category, average egg weight (g), and egg mass (g) were calculated and reported.

Egg Quality--At twenty-eight day intervals, all eggs produced within the previous 24 hours were examined by candling light and graded according to current USDA standards for egg quality. Eggs were graded at the point of production with no handling prior to examination. Egg income was calculated using three-year regional average prices for farm value of eggs based on egg production and quality evaluation.

Feed Consumption--All feed offered for consumption was recorded for each replicate. At twenty-eight day intervals, feed not consumed was weighed back and feed consumption was calculated. Daily feed intake (kg/100 hens/day) was calculated and reported for each strain. Feed costs were based on the actual feed prices for each feed delivery which were calculated and summarized for the complete production cycle.

Mortality--All mortalities were recorded daily, categorized as to the cause, and obvious accidents were not included in reported mortalities.

Statistical Analyses and Separation of Means:

Analyses of variance were performed on all data. Separate analyses were conducted for white and brown egg strains. Significant differences ($P < .01$) within white and brown egg strains are noted by differing letters among columns of means. The blocking effect for the layer house was not significant, therefore, data for houses 4 and 5 were pooled in this analysis. All data were subjected to ANOVA utilizing the GLM procedure of SAS, with main effects of strain and density. First and second order interactions were tested for significance. Mean differences were separated via the PDIFF option of the GLM procedure.

DESCRIPTION OF DATA TABLE STATISTICS

First cycle performance of white and brown egg strains are shown on Tables 1-6. The molt period performance of the white and brown egg strains are shown on Tables 7 to 10.

Breeder (Strain):

Short identification codes of the breeder and strain of the stock were developed. See more complete information following data tables.

Population and Density Allocations:

White and Brown Hens per Cage	Cage Size Width Depth	Floor Space per Bird	Feeder Space per Bird	Water Nipples per Cage
4	30.5 cm x 40.7 cm	310 cm^2 (48 in^2)	7.6 cm 3.0 in	1
4	40.7 cm x 40.7 cm	413 cm^2 (64 in^2)	10.2 cm 4.0 in	1

Hen Housed Eggs per Bird:

The total number of eggs produced divided by the number of birds housed at 126 days.

Hen Day Egg Production:

The average daily number of eggs produced per 100 hens per day.

Egg Mass:

The average daily production of egg mass in grams per hen day.

Mortality:

The percentage of birds which died between 126 and 462 days of age. Mortality which occurred during the molt period were reported separately.

Feed Consumption:

The kilograms of feed consumed daily per 100 hens (housed or hen days).

Feed Conversion:

The grams of egg produced per gram of feed consumed.

Egg Weight:

The average egg weight (gms) for each period sampled.

Egg Income:

The calculated income per hen housed at 126 days, from egg production using three-year regional average egg prices as follows:

Grade	Size	Cents/Dozen
A	Extra Large	80.2
A	Large	80.2
A	Medium	64.8
A	Small	49.1
A	Pee Wee	24.6
B	All	24.6
Cracks	All	42.5

Feed Cost:

The calculated feed cost per hen housed at 126 days, using the pounds/diet consumed and the average price of each diet per ton.

Diets	Price Per Ton
D	164.72
E	155.60
F	158.71
G	160.29
H	160.81

Grade Information:

The average grade of all eggs sampled according to USDA grading standards over all sampling periods.

Egg Size Distribution:

Following are the USDA size classifications used for the egg size grading. There has been blending of egg size in this test with the weight cutoff between medium and large being 23.5. This maximizes the number of USDA large eggs just as would occur in a commercial plant. The proportion of the eggs falling into the following size categories are reported in the tables.

Size Category	Ounces/Dozen
Pee Wee	< 18
Small	18 - 21
Medium	21 - 23.5
Large	23.5 - 27
Extra Large	> 27

Metric Conversions:

1 lb = 453.6 g1 g = .03527 oz
1 lb = .4536 kg1 kg = 2.204 lb

1 oz = 28.35 g1 g = 1000 mg
1 kg = 1000 g

TABLE 1.EFFECT OF WHITE EGG STRAIN AND DENSITY ON PERFORMANCE OF HENS IN THE 33rd NCLP&MT (126-462 DAYS)

Breeder (Strain)	Density[1] (cm^2)	Feed Cons (kg/100 hens/d)	Feed Conversion (g egg/ g feed)	Eggs Per Bird Housed	Egg Production (HD%)	Egg Mass (g/HD)	Mortality (%)	Age at 50% Production (Days)
Bovans	310	9.8	.46	258.0	82.3	45.4	15.0	137.9
(White)	413	10.9	.45	279.9	87.7	49.0	12.3	137.9
	Average	10.3	.46	268.9^{AB}	85.0^{A}	47.2^{A}	13.7^{A}	137.9^{B}
Bovans	310	9.7	.48	264.1	82.7	46.4	10.7	139.0
(Experiment)	413	10.4	.47	280.2	86.3	48.7	7.5	138.2
	Average	10.0	.47	272.1^{A}	84.5^{A}	47.5^{A}	9.1^{B}	138.6^{B}
Hy-Line	310	9.9	.46	248.9	77.5	45.8	10.3	134.1
(W-98)	413	10.4	.46	258.9	80.7	47.7	7.4	135.2
	Average	10.2	.46	253.9^{C}	79.1^{B}	46.7^{A}	8.9^{BC}	134.7^{C}
Hy-Line	310	9.3	.47	257.5	78.5	44.5	6.3	144.4
(W-36)	413	10.2	.45	265.2	80.3	45.8	4.4	143.7
	Average	9.7	.46	261.4^{BC}	79.4^{B}	45.1^{B}	5.4^{C}	144.0^{A}
All Strains	310	9.7^{Z}	.47	257.1^{Z}	80.2^{Z}	45.5^{Z}	10.6^{Y}	138.8
	413	10.5^{Y}	.46	271.1^{Y}	83.8^{Y}	47.8^{Y}	7.9^{Z}	138.7
	Average	10.1	.46	264.1	82.0	46.6	9.3	138.8

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.

A,B,C - Different letters denote significant differences (P<.01), comparisons made among strain average values.

Y,Z - Different letters denote significant differences (P<.01), comparisons made among density average values.

TABLE 2.EFFECT OF WHITE EGG STRAIN AND DENSITY ON EGG WEIGHT AND EGG SIZE DISTRIBUTION OF HENS IN THE 33rd NCLP&MT (126-462 DAYS)

Breeder (Strain)	Density[1] (cm^2)	Egg Weight (g/egg)	Pee Wee (%)	Small (%)	Medium (%)	Large (%)	Extra Large (%)
Bovans	310	54.9	4.9	10.0	32.7	38.3	14.0
(White)	413	55.6	4.6	9.3	28.4	42.0	15.4
	Average	55.2^{C}	4.7^{A}	9.6	30.5^{A}	40.1^{A}	14.7^{C}
Bovans	310	55.9	3.6	8.6	29.4	41.1	17.1
(Experiment)	413	56.2	3.6	7.6	28.2	42.1	18.2
	Average	56.0^{B}	3.6^{B}	8.1	28.8^{A}	41.6^{A}	17.7^{C}
Hy-Line	310	59.0	1.6	8.3	18.3	35.2	36.5
(W-98)	413	59.0	2.1	7.5	17.1	36.2	36.8
	Average	59.0^{A}	1.9^{C}	7.9	17.7^{C}	35.7^{B}	36.7^{A}
Hy-Line	310	56.1	5.0	7.6	27.4	38.8	21.1
(W-36)	413	56.6	5.0	8.4	22.8	40.5	23.1
	Average	56.4^{B}	5.0^{A}	8.0	25.1^{B}	39.6^{A}	22.1^{B}
All Strains	310	56.5	3.8	8.6	26.9^{Y}	38.3	22.2
	413	56.8	3.8	8.2	24.2^{Z}	40.2	23.4
	Average	56.7	3.8	8.4	25.5	39.3	22.8

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.

A,B,C - Different letters denote significant differences (P<.01), comparisons made among strain average values.

Y,Z - Different letters denote significant differences (P<.01), comparisons made among density average values.

TABLE 3.EFFECT OF WHITE EGG STRAIN AND DENSITY ON EGG QUALITY, INCOME AND FEED COSTS OF HENS IN THE 33rd NCLP&MT (126-462 DAYS)

Breeder (Strain)	Density[1] (cm^2)	Grade A (%)	Grade B (%)	Cracks (%)	Loss (%)	Egg Income ($/hen)	Feed Costs ($/hen)
Bovans	310	97.4	0.4	2.1	0.2	14.71	5.54
(White)	413	98.3	0.4	1.2	0.2	16.21	6.25
	Average	97.9	0.4	1.6	0.2	15.46^{AB}	5.90
Bovans	310	97.9	0.2	1.8	0.1	15.43	5.60
(Experiment)	413	98.4	0.2	1.3	0.2	16.52	6.07
	Average	98.1	0.2	1.5	0.1	15.98^{A}	5.83
Hy-Line	310	97.7	0.6	1.6	0.1	15.12	5.76
(W-98)	413	98.1	0.1	1.7	0.1	15.79	6.02
	Average	97.9	0.3	1.7	0.1	15.46^{AB}	5.89
Hy-Line	310	98.1	0.2	1.5	0.2	15.05	5.51
(W-36)	413	98.4	0.2	1.3	0.1	15.62	6.07
	Average	98.2	0.2	1.4	0.2	15.33^{B}	5.79
All Strains	310	97.8^{Z}	0.3	1.7	0.1	15.08^{Z}	5.60^{Z}
	413	98.3^{Y}	0.2	1.4	0.1	16.03^{Y}	6.10^{Y}
	Average	98.0	0.3	1.6	0.1	15.56	5.85

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.

A,B,C - Different letters denote significant differences (P<.01), comparisons made among strain average values.

Y,Z - Different letters denote significant differences (P<.01), comparisons made among density average values.

TABLE 4.EFFECT OF BROWN EGG STRAIN AND DENSITY ON PERFORMANCE OF HENS IN THE 33rd NCLP&MT (126-462 DAYS)

Breeder (Strain)	Density[1] (cm^2)	Feed Cons (kg/100 hens/d)	Feed Conversion (g egg/ g feed)	Eggs Per Bird Housed	Egg Production (HD%)	Egg Mass (g/HD)	Mortality (%)	Age at 50% Production (Days)
Bovans (Brown)	310	10.3	.48	263.1	84.0	49.2	13.4	136.7
	413	11.2	.47	289.7	88.7	52.4	7.4	134.6
	Average	10.7	.47^{B}	276.4	86.3^{A}	50.8	10.4^{A}	135.7^{B}
Bovans (Goldline)	310	10.2	.48	258.0	82.2	48.9	12.4	137.6
	413	10.9	.48	282.7	87.4	52.7	7.3	136.4
	Average	10.6	.48^{B}	270.3	84.8^{AB}	50.8	9.8^{A}	137.0^{AB}
Hy-Line (CV-21 Exp.)	310	9.8	.50	257.7	83.2	48.8	13.3	138.5
	413	10.8	.49	291.3	89.2	53.2	5.8	136.3
	Average	10.3	.50^{A}	274.5	86.2^{A}	51.0	9.5^{AB}	137.4^{AB}
Hy-Line (Brown)	310	10.0	.48	256.0	81.0	48.4	9.6	138.9
	413	10.9	.48	288.4	86.9	52.3	2.9	137.0
	Average	10.4	.48^{AB}	272.2	84.0^{B}	50.3	6.2^{B}	137.9^{A}
All Strains	310	10.1^{Z}	.48	258.7^{Z}	82.6^{Z}	48.8^{Z}	12.2^{Y}	137.9^{Y}
	413	10.9^{Y}	.48	288.0^{Y}	88.0^{Y}	52.6^{Y}	5.8^{Z}	136.1^{Z}
	Average	10.5	.48	273.4	85.3	50.7	9.0	137.0

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.

A,B,C - Different letters denote significant differences (P<.01), comparisons made among strain average values.

Y,Z - Different letters denote significant differences (P<.01), comparisons made among density average values.

TABLE 5.EFFECT OF BROWN EGG STRAIN AND DENSITY ON EGG WEIGHT AND EGG SIZE DISTRIBUTION OF HENS IN THE 33rd NCLP&MT (126-462 DAYS)

Breeder (Strain)	Density[1] (cm^2)	Egg Weight (g/egg)	Pee Wee (%)	Small (%)	Medium (%)	Large (%)	Extra Large (%)
Bovans	310	58.3	2.0	6.4	22.5	39.7	29.3
(Brown)	413	58.9	1.2	6.1	19.6	38.8	34.1
	Average	58.6^{B}	1.6	6.2	21.0^{A}	39.2	31.7^{B}
Bovans	310	59.3	1.2	6.8	19.6	36.6	35.5
(Goldline)	413	60.0	1.0	5.6	17.3	36.1	39.8
	Average	59.6^{A}	1.1	6.2	18.5^{AB}	36.4	37.6^{A}
Hy-Line	310	58.5	1.9	6.0	21.3	37.9	32.4
(CV-21 Exp.)	413	59.4	1.3	5.8	17.3	37.5	37.9
	Average	59.0^{AB}	1.6	5.9	19.3^{AB}	37.7	35.2^{AB}
Hy-Line	310	59.4	1.9	5.8	18.4	36.0	37.6
(Brown)	413	59.9	1.2	4.8	16.4	38.3	39.0
	Average	59.7^{A}	1.5	5.3	17.4^{B}	37.2	38.3^{A}
All Strains	310	58.9^{Z}	1.7^{Y}	6.3	20.4^{Y}	37.6	33.7^{Z}
	413	59.6^{Y}	1.2^{Z}	5.6	17.6^{Z}	37.7	37.7^{Y}
	Average	59.2	1.5	5.9	19.1	37.6	35.7

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.

A,B - Different letters denote significant differences (P<.01), comparisons made among strain average values.

Y,Z - Different letters denote significant differences (P<.01), comparisons made among density average values.

TABLE 6.EFFECT OF BROWN EGG STRAIN AND DENSITY ON EGG QUALITY, INCOME AND FEED COSTS OF HENS IN THE 33rd NCLP&MT (126-462 DAYS)

Breeder (Strain)	Density[1] (cm^2)	Grade A (%)	Grade B (%)	Cracks (%)	Loss (%)	Egg Income ($/hen)	Feed Costs ($/hen)
Bovans	310	98.4	0.4	1.2	0.1	15.99	5.79
(Brown)	413	98.5	0.3	1.2	0.0	17.85	6.52
	Average	98.4	0.3	1.2	0.1	16.92	6.16
Bovans	310	98.4	0.3	1.3	0.1	15.83	5.75
(Goldline)	413	98.5	0.3	1.2	0.1	17.57	6.38
	Average	98.4	0.3	1.3	0.1	16.70	6.07
Hy-Line	310	98.1	0.4	1.4	0.1	15.66	5.46
(CV-21 Exp.)	413	98.8	0.1	1.1	0.0	18.06	6.32
	Average	98.4	0.3	1.3	0.0	16.86	5.89
Hy-Line	310	98.1	0.3	1.6	0.1	15.70	5.67
(Brown)	413	98.3	0.2	1.5	0.1	17.93	6.49
	Average	98.2	0.2	1.5	0.1	16.81	6.08
All Strains	310	98.2	0.3	1.4	0.1	15.79[Z]	5.67[Z]
	413	98.5	0.2	1.2	0.0	17.85[Y]	6.43[Y]
	Average	98.4	0.3	1.3	0.1	16.82	6.05

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.

Y,Z - Different letters denote significant differences (P<.01), comparisons made among density average values.

TABLE 7.EFFECT OF WHITE EGG STRAIN AND DENSITY ON SYNCHRONIZED MOLT OF HENS IN THE 33rd NCLP&MT (462-490 DAYS), FORCE MOLTED

Breeder (Strain)	Density[1] (cm^2)	Beginning Body Weight (kg)	Ending Body Weight (kg)	Weight Loss/Day (g)	Weight Loss (%)	Mortality (%)
Bovans	310	1.64	1.17	33	28.6	5.07
(White)	413	1.70	1.25	32	26.4	2.42
	Average	1.67[B]	1.21[B]	33	27.5	3.75[A]
Bovans	310	1.65	1.21	32	27.0	1.53
(Experiment)	413	1.73	1.31	30	24.3	1.04
	Average	1.69[B]	1.26[B]	31	25.6	1.29[B]
Hy-Line	310	1.96	1.55	29	20.5	2.68
(W-98)	413	1.90	1.51	28	21.0	0.86
	Average	1.93[A]	1.53[A]	28	20.8	1.77[AB]
Hy-Line	310	1.72	1.31	30	24.0	1.29
(W-36)	413	1.77	1.39	27	21.6	0.91
	Average	1.75[B]	1.35[AB]	28	22.8	1.10[B]
All Strains	310	1.74	1.31	31	25.1	2.65
	413	1.77	1.36	29	23.3	1.31
	Average	1.76	1.34	30	24.2	1.98

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.

A,B - Different letters denote significant differences (P<.01), comparisons made among strain average values.

TABLE 8.EFFECT OF BROWN EGG STRAIN AND DENSITY ON SYNCHRONIZED MOLT OF HENS IN THE 33rd NCLP&MT (462-490 DAYS), FORCE MOLTED

Breeder (Strain)	Density[1] (cm^2)	Beginning Body Weight (kg)	Ending Body Weight (kg)	Weight Loss/Day (g)	Weight Loss (%)	Mortality (%)
Bovans	310	2.11	1.53	41	27.5	2.39
(Brown)	413	2.02	1.53	36	24.8	2.11
	Average	2.06	1.53	38	26.1	2.25
Bovans	310	1.97	1.47	36	25.7	3.69
(Goldline)	413	2.10	1.61	35	22.9	1.97
	Average	2.03	1.54	35	24.3	2.83
Hy-Line	310	2.29	1.84	32	20.1	2.81
(CV-21 Exp.)	413	2.16	1.65	36	23.8	1.41
	Average	2.22	1.74	34	22.0	2.11
Hy-Line	310	2.04	1.64	29	19.5	2.06
(Brown)	413	2.12	1.68	32	20.7	1.40
	Average	2.08	1.66	30	20.1	1.73
All Strains	310	2.10	1.62	34	23.2	2.74
	413	2.10	1.62	35	23.0	1.72
	Average	2.10	1.62	34	23.1	2.23

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.
There are no significant differences among these means.

TABLE 9.EFFECT OF WHITE EGG STRAIN AND DENSITY ON SYNCHRONIZED MOLT OF HENS IN THE 33rd NCLP&MT (462-490 DAYS), FEED RESTRICTION MOLTED

Breeder (Strain)	Density[1] (cm^2)	Beginning Body Wt. (kg)	Ending Body Wt. (kg)	Weight Loss/day (g)	Weight Loss (%)	Mortality (%)
Bovans	310	1.59	1.14	32	28.3	3.56
(White)	413	1.67	1.28	28	23.6	3.54
	Average	1.63[B]	1.21[B]	30	25.9	3.55
Bovans	310	1.67	1.31	26	21.6	1.17
(Experiment)	413	1.83	1.52	22	16.7	1.25
	Average	1.75[AB]	1.42[A]	24	19.2	1.21
Hy-Line	310	1.87	1.49	27	20.4	2.47
(W-98)	413	1.86	1.48	27	20.3	0.86
	Average	1.86[A]	1.48[A]	27	20.4	1.66
Hy-Line	310	1.67	1.41	19	15.7	0.06
(W-36)	413	1.78	1.46	23	18.2	1.41
	Average	1.73[AB]	1.43[A]	21	16.9	0.74
All Strains	310	1.70	1.34	26	21.5	1.82
	413	1.78	1.43	25	19.7	1.76
	Average	1.74	1.39	26	20.6	1.79

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.

A,B - Different letters denote significant differences (P<.01), comparisons made among strain average values.

TABLE 10.EFFECT OF BROWN EGG STRAIN AND DENSITY ON SYNCHRONIZED MOLT OF HENS IN THE 33rd NCLP&MT (462-490 DAYS), FEED RESTRICTION MOLTED

Breeder (Strain)	Density[1] (cm^2)	Beginning Body Wt. (kg)	Ending Body Wt. (kg)	Weight Loss/day (g)	Weight Loss (%)	Mortality (%)
Bovans	310	1.92	1.56	26	18.7	1.48
(Brown)	413	2.05	1.55	36	24.6	1.64
	Average	1.99	1.56	31	21.6	1.56
Bovans	310	2.02	1.62	28	19.7	2.70
(Goldline)	413	2.03	1.69	25	17.0	3.85
	Average	2.02	1.65	27	18.4	3.28
Hy-Line	310	2.18	1.77	29	18.8	2.43
(CV-21 Exp.)	413	2.09	1.71	27	18.1	1.11
	Average	2.13	1.74	28	18.5	1.77
Hy-Line	310	2.20	1.82	28	17.5	1.29
(Brown)	413	2.18	1.83	25	16.3	1.06
	Average	2.19	1.82	26	16.9	1.17
All Strains	310	2.08	1.69	28	18.7	1.97
	413	2.09	1.69	28	19.0	1.91
	Average	2.08	1.69	28	18.9	1.95

[1]The following is the conversion from square centimeters to square inches: 310 equals 48 square inches; 413 equals 64 square inches.
There are no significant differences among these means.

Entries 33rd NCLP&MT
Stock Suppliers and Categories

Breeder	Stock	Category[1]	Source
Hy-Line International P.O. Box 310 Dallas Center, IA 50063	W-36	I-A	Hy-Line International 4432 Highway 213, Box 309 Mansfield, GA 30255
	W-98	I-A	(Same)
	Hy-Line Brown	I-A	Hy-Line International 1915 Sugar Grove Dallas Center, IA 50063
	Hy-Line CV-21 Experimental	III-A	(Same)
Centurion Poultry 1471 Lane Creek Road Bogart, GA 30622	Bovans White	I-A	Centurion Poultry Inc. 1471 Lane Creek Road Bogart, GA 30622
	Bovans White Experimental	III-A	(Same)
	Bovans Brown	I-A	(Same)
	Bovans Goldline	I-A	(Same)

[1] I = Extensive distribution in southeast United States
II = Little or no distribution in southeast United States
III = Unavailable for commercial distribution in United States
A = Entry requested
C = Entry not requested