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SINGLE PRODUCTION CYCLE REPORT OF THE THIRTY SIXTH

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 and Consumer Services. The flock is maintained at the Piedmont Research Station, Salisbury, North Carolina. Mr. Joe Hampton is the Piedmont Research Station Superintendent; Mr. Aaron Sellers 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 poultry industry personnel in North Carolina, across the country, and internationally in the evaluation of commercial layer stocks and management systems.

The data presented herein represents the analysis of the first production cycle and molt of the 36th North Carolina Layer Performance and Management Test. Performance summary tables are available for each strain, and molt treatment used as well as for the combined results. You can view this report on our website at http://www.ces.ncsu.edu/depts/poulsci/tech_manuals/layer_reports/36_single_cycle_report.pdf

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36th NORTH CAROLINA LAYER PERFORMANCE AND MANAGEMENT TEST
Protocol Procedures Used

Entries:

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

Dates of Importance:

The eggs for the 36th NCLP&MT were set on March 8, 2005 at the North Carolina Dept. of Agriculture and Consumer Services, Piedmont Research Station, Poultry Unit at Salisbury, NC. The flock was hatched on March 29, 2005 and the pullets were moved to the laying facilities on July 21 to July 26, 2005 during their 17th week of age. The age of the flock at transfer was lowered to reflect current trends in the industry and requests of the breeders to move the flock prior to onset of egg production in the rearing houses.

Single cycle production records commenced on July 27, 2005 (17 weeks of age), through October 25, 2006 (82 weeks of age). This report includes production data summarized from 17 to 82 weeks (574 days).

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 75 % of the house and brown egg strains occupied the other 25 % of the house. All strains were assigned to be represented as equally as possible in each room, row, and cage level.

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. approximately 3 reps/strain) on all levels resulting in a randomized incomplete block. This allows for a total of 3,744 pullets per room. Rooms 2 to 4 were used for the 36th NCLP&MT resulting in a total pullet count in House 8 of 11,232. 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 pullets were brooded and grown in the same cage during the entire 16 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 in^2 (310 cm^2). Even though the room dividers were in place between the rooms for this test, the environmental conditions were maintained the same in each room so that all birds were essentially reared in a contiguous house. Pullet nutrition and husbandry practices are published in the Pullet Rearing Report (Vol. 36, No. 2).

Layer Housing:

The hens were randomly assigned to the replicate cages with white egg and brown egg strains being inter-mingled throughout the houses. The white egg strains occupied 75% of the house and brown egg strains occupied the other 25%. All strains were assigned to be represented as equally as possible in the first 2 rows of cages on all levels.

House 5 is a standard height totally enclosed force ventilated laying house with a scraper pit manure handling system. It has 2 banks of triple deck cages and two banks with 4 levels of cages. The replicates are equipped with feed hoppers to supply and monitor feed consumption for each individual replicate and the feed is distributed by an automatic feeding system. Again, each side of a bank was designated as a row and each row was divided into 9 8-foot replicates/level. There are a total of 72 replicates in rows 1 and 2 in house 5 which can support 1,728 hens. The cage density is dictated by the cage size in each replicate that contain cages that were either 30.5 or 40.6 cm wide and 40.6 cm deep. Thus the cages that were 30.5 and 40.6 cm cages allowed for a constant density of 64 in^2 (413 cm^2), at 3 or 4 hens/cage, respectively. 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.

House 7 is a standard height windowless enclosed force ventilated house with battery cages. The cages consist of 4 rows of a Tri-Deck Stacked Layer Cage System. There is 60' of cage row with each side being designated a row. Each row is divided into six 10' cage row sections consisting of 4 cages /section with a 24" space between cage sections for feed hoppers and feed recovery. The waste collection system consists of manure belt cleaning. This configuration provides 36 replicates for used in this report each consisting of 4 - 24" x 20" cages which held 7 hens at 68 in^2 for a total of 28 hens/replicate and a house total of 1,008 hens. The feeder system was designed to allow for automatic feeding and the collection of individual replicate feed consumption records. 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, and levels.

Laying House and Molting Lighting Schedules:

Age	Date	House 5	House 7
		(Light Hours)	(Light Hours)
Housing Pullets	July 20-26,2005	10.0	10.0
17 Weeks[1]	July 27, 2005	11.0	11.0
18 Weeks	August 3, 2005	11.5	11.5
19 Weeks	August 9, 2005	12.0	12.0
20 Weeks	August 16, 2005	12.5	12.5
21 Weeks	August 23, 2005	13.0	13.0
22 Weeks	August 30, 2005	13.5	13.5
23 Weeks	September 6, 2005	14.0	14.0
24 Weeks	September 13, 2005	14.25	14.25
25 Weeks	September 20, 2005	14.5	14.5
26 Weeks	September 28, 2005	14.75	14.75
27 Weeks	October 4, 2005	15.0	15.0
28 Weeks	October 11, 2005	15.25	15.25
29 Weeks	October18, 2005	15.5	15.5
30 Weeks	October 25, 2005	15.75	15.75
31 Weeks	November 1, 2005	16.0	16.0
Through 82 Weeks	October 25, 2006	16.0	16.0

Test Design:

The laying test was arranged as a completely randomized factorial design. The main effects within House 5 were strain, and population, however, in House 7 was strain only. Following are general descriptions of the main effects and other housing conditions.

Strain

The samples of fertile hatching eggs were provided directly by the breeders involved. All eggs were set and hatched concurrently at the Piedmont Research Station. A total of nine white egg strains and three brown egg strains were included in the test. See the 36th Hatch Report (Vol. 36, No. 1) for details.

Density

In House 5, all individual cages within each block contained either brown or white egg layers. Thus each replicate included 24 hens in 30.5 x 40.6 cm cages for 8 cages with 3 hens/cage or 40.6 x 40.6 cm cages for 6 cages with 4 hens/cage. Cage densities were held constant at 413 cm^2 (64 in^2) for the two cage dimensions to approximate the poultry welfare guidelines that were developed by the United Egg Producers as closely as possible. The initial population sizes provided for a constant density and feeder space allocation. Thus, all of the birds in this test had the same density and feeder space. Thus, density and feeder space were not factors in this test.

Population and Density Allocations in House 5.

White and Brown Hens per Cage	Cage Size Width Depth	Floor Space per Bird	Feeder Space per Bird	Water Nipples per Cage
3	30.5 cm x 40.7 cm	413 cm^2 (64 in^2)	10.2 cm 4.0 in	1
4	40.7 cm x 40.7 cm	413 cm^2 (64 in^2)	10.2 cm 4.0 in	1

In House 7, all individual cages within each block contained either brown or white egg layers. Each replicate consisted of 28 hens/replicate, with the hens being contained in 4 cages measuring 61 x 50.8 cm (24" x 20"). Each cage held 7 hens at 439 cm^2 (68 in^2). These cage dimensions represent the commercial animal welfare guidelines. The initial population sizes provided for a constant density and feeder space allocation. Therefore, density and feeder space were not factors in this experiment.

Layer Nutrition:

Layer diets were identified as Diets D, E, F, G, H, I, M, N, and O 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. 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 as shown in the Laying House Feeding Program Table.
weight with no egg production.

Minimum Daily Intake of Nutrients Per Bird at Various Stages of Production in the 36th NCLP&MT

Production Stage	Pre-Peak > 87%	87-80%	80-70%	<70%
White Egg Layers				
Protein[1](g/day)	19	18	17	16
Calcium (g/day)	4.0	4.1	4.2	4.3
Lysine (mg/day	820	780	730	690
TSAA (mg)day)	700	670	630	590
Brown Egg Layers				
Protein[1](g/day)	20	19	18	17
Calcium (g/day)	4.0	4.0	4.1	4.2
Lysine (mg/day	830	820	780	730
TSAA (mg)day)	710	700	670	630

[1] If the egg production is higher than predicted values protein intake should be increased by 1%
Note: House temperatures dictate the body maintenance demand of the hen if the house temperature is 75 to 80°F feed protein content should be increased accordingly to compensate for metabolic heat needed to maintain a homeostatic body temperature. If the house temperature is at or above 85°F no adjustment is needed.

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	D	D
	9.57-10.39	F	E
	10.43-11.29	H	G
	11.34-12.20	I	H
	12.25-13.11	M	I
	>13.15	N	M
80-87%	< 9.52	F	E
	9.57-10.39	G	F
	10.43-11.29	I	H
	11.34-12.20	M	I
	12.25-13.11	N	M
	>13.15	O	N
70-80%	< 9.52	H	G
	9.57-10.39	I	H
	10.43-11.29	M	I
	11.34-12.20	N	M
	12.25-13.11	O	N
	>13.15	O	O
< 70%	< 9.52	H	G
	9.57-10.39	I	H
	10.43-11.29	N	M
	11.34-12.20	O	N
	12.25-13.11	O	O
	>13.15	O	O

Note: Low house temperatures and egg production higher than breeder guides for any given hen age will require an adjustment to the dietary phase feeding program to ensure the hens are in a positive nutrient status.

LAYING PERIOD DIETS

Ingredients	D	E	F	G	H
Corn	866.71	925.46	997.91	1068.19	1131.97
Soybean meal	663.18	621.10	552.33	499.80	457.65
Wheat Midds					
Fat (Tallow)	110.88	102.43	87.73	74.61	64.32
Gluten Meal 60%	95.83	88.37	100.00	99.23	90.80
D.L. Methionine	3.08	2.89	2.52	2.26	2.48
Lysine 78.8%					
Soybean Hulls					
Ground Limestone	132.42	133.70	135.07	134.02	132.50
Coarse Limestone	75.00	75.00	75.00	75.00	75.00
Bi-Carbonate	3.00	3.00	3.00	3.00	3.00
Phosphate Mono/D	36.77	34.73	32.84	30.36	28.79
Salt	6.00	5.99	5.95	5.93	5.92
Vit. premix	1.00	1.00	1.00	1.00	1.00
Min. premix	1.00	1.00	1.00	1.00	1.00
Mold Inhibitor	1.00	1.00	1.00	1.00	1.00
T-Premix	1.00	1.00	1.00	1.00	1.00
.06% Selenium Premix	1.00	1.00	1.00	1.00	1.00
Choline Cl 60%	2.14	2.33	2.65	2.59	2.57
Calculated Analysis					
Protein %	22.0	21.0	20.00	19.00	18.0
ME kcal/kg	2926.0	2926.0	2926.0	2926.0	2926.0
Calcium %	4.45	4.45	4.45	4.40	4.35
T. Phos. %	0.71	0.68	0.65	0.61	0.59
Lysine %	1.15	1.09	1.00	0.93	0.87
TSAA %	0.89	0.85	0.81	0.77	0.75

LAYING PERIOD DIETS

Ingredients	I	M	N	O
Corn	1199.47	1258.28	1309.81	1371.93
Soybean meal	406.08	363.91	340.24	333.87
Wheat Midds				
Fat (Tallow)	52.26	43.80	38.85	14.71
Gluten Meal 60%	89.84	82.64	61.54	25.79
D.L. Methionine	2.02	1.62	1.75	1.80
Lysine 78.8%				
Soybean Hulls				
Ground Limestone	158.82	160.10	161.33	167.71
Coarse Limestone	50.00	50.00	50.00	50.00
Bi-Carbonate	3.00	3.00	3.00	3.00
Phosphate Mono/D	26.79	24.75	22.60	20.30
Salt	5.90	5.89	5.89	5.89
Vit. premix	1.00	1.00	1.00	1.00
Min. premix	1.00	1.00	1.00	1.00
Mold Inhibitor	1.00	1.00	1.00	1.00
T-Premix	1.00	1.00	1.00	1.00
.06% Selenium Premix	1.00	1.00	1.00	1.00
Choline Cl 60%	0.83	1.02		
Calculated Analysis				
Protein %	17.00	16.00	15.00	14.00
ME kcal/kg	2926.0	2926.0	2926.0	2860.0
Calcium %	4.35	4.35	4.35	4.45
T. Phos. %	0.56	0.52	0.49	0.47
Lysine %	0.80	0.74	0.70	0.68
TSAA %	0.70	0.65	0.62	0.58

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 in the pilot processing facility and handled as they would be in a commercial off-line facility.

Egg Price--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, 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 ($P < 0.01$) within white and brown egg strains are noted by differing letters among columns of means. All data were subjected to ANOVA utilizing the GLM procedure of SAS, with the main effect of strain. 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

Single cycle performance of white and brown egg strains are shown on Tables 1 to 12.

Breeder (Strain):

Short identification codes of the breeder and strain of the stock were developed. See more complete information following data tables in Table 13.

Hen Housed Eggs per Bird:

The total number of eggs produced divided by the number of birds housed at 119 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 119 through 462 days of age and 462 through 490 which occurred during the molt period are 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. Weight of all eggs collected from previous 24 hours divided by the number of eggs collected.

Egg Income:

The calculated income per hen housed at 119 days, from egg production using three-year regional average egg prices 2003 to 2006.

Three Year Regional Average Egg Prices

Grade	Size	$$/Dozen
A	Extra Large	0.872
A	Large	0.839
A	Medium	0.669
A	Small	0.519
A	Pee Wee	0.260
B	All	0.445
Checks	All	0.445

Grade Information:

The average grade of all eggs sampled according to USDA grading standards over all sampling periods. Grades are established by personnel trained in USDA grading standards.

Egg Size Distribution:

The following size classifications were used for establishing the USDA egg size grading. There has been blending of egg size in this test with the weight cutoff between medium and large being 23.5 ounces/doz. 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.

USDA Egg Weights Used To Establish The Egg Size Distribution Weighted for Large Eggs.

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

Feed Cost:

The calculated feed cost per hen housed at 119 days, using the pounds/diet consumed and the average price of each diet per ton.

The Average Contract Feed Price For Feed Purchases.

Diets	Price Per Ton
D	198.4
E	195.0
F	190.4
G	186.4
H	182.0
I	175.4
M	170.4
N	165.0
O	158.6

Metric Conversions:

1 lb = 453.6 g
1 lb = .4536 kg
1 oz = 28.35 g

1 g = .03527 oz
1 kg = 2.204 lb
1 g = 1000 mg
1 kg = 1000 g

TABLE 1. EFFECT OF WHITE EGG STRAIN AND POPULATION ON PERFORMANCE OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN STAIR-STEP CAGES (HOUSE 5)

Breeder (Strain)	Population[1]	Feed Consumption (kg/100/hen/d)	Feed Conversion (g egg/g feed)	Eggs Per Bird Housed	Egg Production (HD%)	Egg Mass (g/HD)	Mortality (%)
LSL-Lite	3	11.7	0.46	366.9	85.9	55.6	14.6
White	4	10.8	0.47	374.3	82.6	53.2	4.9
	Average	11.3^{AB}	0.46	370.6	84.2	54.4^{ABC}	9.8
Bovans	3	10.5	0.49	369.8	82.8	54.3	7.6
White Exp.	4	10.8	0.48	360.3	81.6	54.6	8.3
	Average	10.7^{BC}	0.49	365.0	82.2	54.4^{AB}	8.0
Bovans	3	11.9	0.45	365.3	88.0	56.3	19.7
White	4	11.8	0.45	354.1	85.2	54.3	20.5
	Average	11.8^{A}	0.45	359.7	86.6	55.3^{A}	20.1
DeKalb	3	10.7	0.47	375.0	83.5	52.5	4.7
White Exp.	4	10.7	0.48	368.6	83.9	53.6	10.4
	Average	10.7^{BC}	0.48	371.8	83.7	53.0^{ABC}	7.5
DeKalb	3	11.0	0.47	346.7	83.6	54.2	17.7
White	4	10.6	0.49	363.7	83.2	54.3	14.9
	Average	10.8^{B}	0.48	355.2	83.4	54.3^{ABC}	16.3
Hy-Line	3	10.0	0.49	369.0	81.3	51.3	2.1
(W-36)	4	10.0	0.49	361.1	80.0	50.7	7.0
	Average	10.0^{C}	0.49	365.0	80.7	51.0^{C}	4.5
Hy-Line	3	11.6	0.46	371.9	82.6	55.4	8.3
(W-98)	4	10.9	0.48	359.7	81.3	53.9	7.0
	Average	11.3^{AB}	0.47	365.8	82.0	54.7^{AB}	7.6
CV-20	3	10.2	0.48	362.8	81.6	51.6	6.3
	4	9.5	0.51	370.1	82.1	51.4	4.4
	Average	9.9^{C}	0.50	366.5	81.8	51.5^{BC}	5.3
ISA	3	10.1	0.49	365.2	83.3	52.6	14.3
White Exp.	4	10.1	0.49	363.8	82.3	52.2	10.0
	Average	10.1^{C}	0.49	364.5	82.8	52.4^{BC}	12.1
All Strains	3	10.9	0.47	365.8	83.6	53.7	10.6
	4	10.6	0.48	364.0	82.5	53.1	9.7

[1]All strains were housed at a constant density of: 413 cm^2 equals 64 in^2.

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

TABLE 2. EFFECT OF WHITE EGG STRAIN AND POPULATION ON EGG WEIGHT AND EGG SIZE DISTRIBUTION OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN STAIR-STEP CAGES (HOUSE 5)

Breeder	Population[1]	Egg Weight	Pee Wee	Small	Medium	Large	Extra Large
(Strain)		(g egg/hen/d)	(%)	(%)	(%)	(%)	(%)
LSL-Lite	3	61.6	0.0	3.4	4.5	21.0	71.1
White	4	61.2	0.0	2.7	5.0	21.9	70.4
	Average	61.4^{BCD}	0.0	3.0	4.7	21.5^{BCD}	70.7^{ABCD}
Bovans	3	62.7	0.1	1.5	3.8	23.8	70.5
White Exp.	4	63.7	0.0	1.8	3.6	13.9	80.7
	Average	63.2^{AB}	0.0	1.6	3.7	18.8^{CD}	75.6^{AB}
Bovans	3	61.0	0.0	1.1	6.0	27.9	64.4
White	4	60.8	0.0	3.2	6.1	29.8	60.7
	Average	60.9^{CD}	0.0	2.1	6.0	28.8^{ABC}	62.6^{BCD}
DeKalb	3	60.0	0.0	2.8	6.9	30.0	60.1
White Exp.	4	61.0	0.1	2.1	5.2	25.1	67.3
	Average	60.5^{D}	0.0	2.4	6.0	27.5^{ABC}	63.7^{BCD}
DeKalb	3	61.7	0.0	3.9	6.7	17.8	71.5
White	4	62.2	0.3	1.8	6.0	19.4	72.1
	Average	62.0^{BC}	0.1	2.8	6.4	18.6^{D}	71.8^{ABC}
Hy-Line	3	60.2	0.0	4.0	5.7	28.4	61.9
(W-36)	4	60.4	0.7	3.9	6.3	28.3	60.4
	Average	60.3^{D}	0.4	3.9	6.0	28.4^{ABC}	61.1^{CD}
Hy-Line	3	64.6	0.0	1.7	4.7	14.1	79.3
(W-98)	4	64.0	0.0	1.4	6.3	12.7	79.2
	Average	64.3^{A}	0.0	1.6	5.5	13.4^{D}	79.2^{A}
CV-20	3	60.1	0.6	3.8	4.6	29.7	61.2
	4	59.6	0.1	3.1	6.0	35.3	55.3
	Average	59.9^{D}	0.4	3.4	5.3	32.5^{A}	58.2^{D}
ISA	3	59.7	0.1	3.0	8.0	29.5	59.2
White Exp.	4	60.1	0.1	2.8	6.3	28.9	61.5
	Average	59.9^{D}	0.1	2.9	7.1	29.2^{AB}	60.3^{D}
All	3	61.3	0.1	2.8	5.6	24.7	66.6
Strains	4	61.4	0.1	2.5	5.6	23.9	67.5

[1]All strains were housed at a constant density of: 413 cm^2 equals 64 in^2.

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

TABLE 3. EFFECT OF WHITE EGG STRAIN AND POPULATION ON EGG QUALITY, INCOME AND FEED COSTS OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN STAIR-STEP CAGES (HOUSE 5)

Breeder	Population[1]	Grade A	Grade B	Cracks	Loss	Egg Income	Feed Costs
(Strain)		(%)	(%)	(%)	(%)	($/hen)	($/hen)
LSL-Lite	3	96.0	2.4	1.1	0.0	25.07	10.25
White	4	92.5	4.6	2.2	0.0	25.06	10.11
	Average	94.2	3.5	1.7	0.0	25.07	10.18^{AB}
Bovans	3	94.7	2.1	3.1	0.2	25.32	9.71
White Exp.	4	94.9	0.7	4.1	0.3	24.93	9.83
	Average	94.8	1.4	3.6	0.2	25.12	9.77^{ABC}
Bovans	3	93.8	4.0	2.1	0.5	24.60	10.15
White	4	95.9	1.9	1.9	0.0	24.05	10.02
	Average	94.8	3.0	2.0	0.3	24.33	10.08^{AB}
DeKalb	3	94.9	2.6	2.2	0.2	25.31	9.91
White Exp.	4	93.9	2.8	3.0	0.3	24.93	9.68
	Average	94.4	2.7	2.6	0.3	25.12	9.80^{AB}
DeKalb	3	94.3	2.6	2.9	0.2	23.41	9.46
White	4	94.1	2.5	3.0	0.4	24.62	9.58
	Average	94.2	2.6	2.9	0.3	24.01	9.52^{BC}
Hy-Line	3	95.7	2.2	2.2	0.2	25.09	9.41
(W-36)	4	96.7	1.4	1.7	0.1	24.45	9.29
	Average	96.2	1.8	1.9	0.1	24.77	9.35^{BC}
Hy-Line	3	92.3	3.7	4.0	0.0	25.14	10.74
(W-98)	4	94.0	2.7	3.4	0.2	24.51	9.96
	Average	93.2	3.2	3.7	0.1	24.83	10.35^{A}
CV-20	3	94.7	1.7	3.2	0.2	24.47	9.35
	4	96.0	1.6	2.1	0.1	25.10	8.89
	Average	95.3	1.7	2.7	0.1	24.79	9.12^{C}
ISA	3	96.0	1.7	2.6	0.1	24.81	9.17
White Exp.	4	95.0	2.2	2.7	0.1	24.61	9.19
	Average	95.5	1.9	2.6	0.1	24.71	9.18^{C}
All	3	94.7	2.6	2.6	0.2	24.80	9.79
Strains	4	94.8	2.3	2.7	0.2	24.70	9.62

[1]All strains were housed at a constant density of: 413 cm^2 equals 64 in^2.

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

TABLE 4. EFFECT OF BROWN EGG STRAIN AND POPULATION ON PERFORMANCE OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN STAIR-STEP CAGES (HOUSE 5)

Breeder (Strain)	Population[1]	Feed Consumption (kg/100/hen/d)	Feed Conversion (g egg/g feed)	Eggs Per Bird Housed	Egg Production (HD%)	Egg Mass (g/HD)	Mortality (%)
Bovans	3	11.0	0.49	378.6	85.2	55.7	8.8[b]
Brown	4	11.0	0.48	373.9	84.4	55.3	7.3[b]
	Average	11.0[A]	0.49	376.3	84.8	55.5[AB]	8.0
Bovans	3	12.2	0.47	358.1	86.0	59.1	22.9[a]
Goldline	4	10.9	0.50	384.0	84.5	56.6	1.6[b]
	Average	11.5[A]	0.48	371.1	85.2	57.8[A]	12.3
Hy-Line	3	10.2	0.5	370.2	82.4	53.2	2.8[b]
Brown	4	10.1	0.51	365.1	82.8	53.7	7.5[b]
	Average	10.1[B]	0.51	367.6	82.6	53.4[B]	5.2
All	3	11.1	0.49	369.0	84.5	56.0	11.5
Strains	4	10.7	0.50	374.3	83.9	55.2	5.5

[1]All strains were housed at a constant density of: 413 cm^2 equals 64 in^2.

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

a,b - Different letters denote significant differences (P<.01), comparisons made among strain by population interactions.

TABLE 5. EFFECT OF BROWN EGG STRAIN AND POPULATION ON EGG WEIGHT AND EGG SIZE DISTRIBUTION OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN STAIR-STEP CAGES (HOUSE 5)

Breeder (Strain)	Population[1]	Egg Weight (g egg/hen/d)	Pee Wee (%)	Small (%)	Medium (%)	Large (%)	Extra Large (%)
Bovans	3	62.8	0.2	1.6	5.8	21.4	70.9
Brown	4	63.0	0.0	1.1	4.9	19.9	73.7
	Average	62.9[AB]	0.1	1.3	5.3	20.6	72.3
Bovans	3	65.6	0.0	1.4	2.4	14.5	81.4
Goldline	4	64.0	0.0	0.2	5.5	19.6	74.4
	Average	64.8[A]	0.0	0.8	3.9	17.0	77.9
Hy-Line	3	61.8	0.0	1.0	5.6	24.0	69.1
Brown	4	61.9	0.0	1.2	5.3	22.6	70.9
	Average	61.8[B]	0.0	1.1	5.5	23.3	70.0
All	3	63.4	0.1	1.3	4.6	19.9	73.8
Strains	4	63.0	0.0	0.8	5.2	20.7	73.0

[1]All strains were housed at a constant density of: 413 cm^2 equals 64 in^2.

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

TABLE 6. EFFECT OF BROWN EGG STRAIN AND POPULATION ON EGG QUALITY, INCOME AND FEED COSTS OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN STAIR-STEP CAGES (HOUSE 5)

Breeder (Strain)	Population[1]	Grade A (%)	Grade B (%)	Cracks (%)	Loss (%)	Egg Income ($/hen)	Feed Costs ($/hen)
Bovans	3	95.6	1.9	2.4	0.1	25.96	10.24
Brown	4	94.3	2.0	3.4	0.3	25.54	10.20
	Average	95.0	2.0	2.9	0.2	25.75	10.22[A]
Bovans	3	94.2	2.9	2.9	0.2	24.58	10.52
Goldline	4	95.3	2.1	2.3	0.3	26.43	10.35
	Average	94.7	2.5	2.6	0.3	25.50	10.43[A]
Hy-Line	3	95.8	2.1	1.9	0.2	25.44	9.59
Brown	4	95.8	2.5	1.5	0.1	25.17	9.38
	Average	95.8	2.3	1.7	0.2	25.31	9.49[B]
All	3	95.2	2.3	2.4	0.2	25.32	10.12
Strains	4	95.2	2.2	2.4	0.3	25.71	9.97

[1]All strains were housed at a constant density of: 413 cm^2 equals 64 in^2.

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

TABLE 7. EFFECT OF WHITE EGG STRAIN ON PERFORMANCE OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN BATTERY CAGES (HOUSE 7)

Breeder (Strain)	Feed Consumption (kg/100/hen/d)	Feed Conversion (g egg/g feed)	Eggs Per Bird Housed	Egg Production (HD%)	Egg Mass (g/HD)	Mortality (%)
LSL-Lite White	9.9^{AB}	0.54	390.8	86.9^{A}	55.2^{A}	3.0
Bovans White Exp.	9.9^{AB}	0.52	373.5	83.9^{AB}	53.7^{AB}	8.6
Bovans White	10.0^{AB}	0.52	364.4	86.8^{A}	54.4^{A}	16.9
DeKalb White Exp.	10.0^{AB}	0.52	377.4	84.4^{AB}	53.4^{AB}	3.6
DeKalb White	10.0^{AB}	0.52	361.2	84.3^{AB}	54.9^{A}	15.8
Hy-Line (W-36)	9.4^{BC}	0.51	356.7	80.3^{C}	50.6^{C}	5.1
Hy-Line (W-98)	10.4^{A}	0.50	372.3	82.2^{BC}	53.9^{A}	1.2
CV-20	9.1^{C}	0.53	371.1	82.7^{BC}	51.0^{BC}	4.6
ISA White Exp.	9.6^{BC}	0.53	367.1	83.9^{AB}	53.1^{ABC}	9.6

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

TABLE 8. EFFECT OF WHITE EGG STRAIN AND POPULATION ON EGG WEIGHT AND EGG SIZE DISTRIBUTION OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN BATTERY CAGES (HOUSE 7)

Breeder (Strain)	Egg Weight (g egg/hen/d)	Pee Wee (%)	Small (%)	Medium (%)	Large (%)	Extra Large (%)
LSL-Lite White	60.8^{BCD}	0.1	0.8	6.8	26.5	65.7^{ABC}
Bovans White Exp.	61.4^{BC}	0.0	1.0	6.7	25.1	67.1^{ABC}
Bovans White	60.1^{CD}	0.1	2.0	6.8	29.9	60.8^{BC}
DeKalb White Exp.	60.7^{BCD}	0.1	0.9	5.1	28.6	64.7^{ABC}
DeKalb White	62.2^{AB}	0.1	0.5	4.6	21.0	73.5^{AB}
Hy-Line (W-36)	60.0^{CD}	0.2	1.9	7.1	28.5	61.8^{BC}
Hy-Line (W-98)	63.4^{A}	0.0	0.5	4.2	17.2	77.6^{A}
CV-20	58.9^{D}	0.2	2.6	7.3	32.8	57.0^{C}
ISA White Exp.	59.9^{CD}	0.2	1.4	6.6	31.6	60.0^{C}

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

TABLE 9. EFFECT OF WHITE EGG STRAIN AND POPULATION ON EGG QUALITY, INCOME AND FEED COSTS OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN BATTERY CAGES (HOUSE 7)

Breeder (Strain)	Grade A (%)	Grade B (%)	Cracks (%)	Loss (%)	Egg Income ($/hen)	Feed Costs ($/hen)
LSL-Lite White	95.8	1.7	2.4	0.1	26.86	9.34
Bovans White Exp.	95.5	1.7	2.4	0.4	25.61	9.19
Bovans White	95.6	2.0	2.2	0.2	24.78	8.85
DeKalb White Exp.	94.7	1.9	3.0	0.3	25.68	9.33
DeKalb White	94.0	3.6	2.3	0.1	24.69	8.99
Hy-Line (W-36)	95.1	2.0	2.1	0.8	24.06	8.75
Hy-Line (W-98)	94.0	2.3	3.3	0.3	25.49	9.83
CV-20	95.7	1.7	2.5	0.0	25.20	8.66
ISA White Exp.	94.3	2.1	3.1	0.5	24.82	8.80

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

TABLE 10. EFFECT OF BROWN EGG STRAIN ON PERFORMANCE OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN BATTERY CAGES (HOUSE 7)

Breeder (Strain)	Feed Consumption (kg/100/hen/d)	Feed Conversion (g egg/g feed)	Eggs Per Bird Housed	Egg Production (HD%)	Egg Mass (g/HD)	Mortality (%)
Bovans Brown	10.4	0.52	382.1	86.8	55.7	7.1
Bovans Goldline	10.1	0.52	373.5	83.7	54.7	7.1
Hy-Line Brown	9.5	0.54	375.7	83.2	53.1	3.6

TABLE 11. EFFECT OF BROWN EGG STRAIN AND POPULATION ON EGG WEIGHT AND EGG SIZE DISTRIBUTION OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN BATTERY CAGES (HOUSE 7)

Breeder (Strain)	Egg Weight (g egg/hen/d)	Pee Wee (%)	Small (%)	Medium (%)	Large (%)	Extra Large (%)
Bovans Brown	61.5	0.2	0.7	4.5	25.7	68.4
Bovans Goldline	62.4	0.0	0.5	5.2	19.6	74.4
Hy-Line Brown	61.2	0.1	0.7	7.9	26.1	65.0

TABLE 12. EFFECT OF BROWN EGG STRAIN AND POPULATION ON EGG QUALITY, INCOME AND FEED COSTS OF HENS IN THE 36th NCLP&MT (119-574 DAYS) IN BATTERY CAGES (HOUSE 7)

Breeder (Strain)	Grade A (%)	Grade B (%)	Cracks (%)	Loss (%)	Egg Income ($/hen)	Feed Costs ($/hen)
Bovans Brown	95.3	1.7	2.8	0.2	26.21	9.77
Bovans Goldline	94.6	2.0	3.2	0.2	25.66	9.67
Hy-Line Brown	96.2	2.0	1.6	0.2	25.78	9.09

TABLE 13. ENTRIES IN THE 36TH NCLP&MT BY BREEDER, 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
	Hy-Line Brown	I-A	(Same)
	W-98	I-A	Hy-Line North America 79 Industrial Rd E-town, PA 17022
	CV-20	I-A	(Same)
Lohmann Tierzucht Inc., N.A. 2433 Bethany Rd Sycamore, IL 60178	Lohmann LSL-Lite	I-A	Hy-Line North America 79 Industrial Rd E-town, PA 17022
Centurion Poultry 1471 Lane Creek Road Bogart, GA 30622	Bovans White	I-A	Centurion Poultry Inc. P.O. Box 591 86 O'Neal Road Lexington, GA 3064822
	Bovans White Experimental	III-A	(Same)
	Bovans Brown	I-A	(Same)
	Bovans Goldline	I-A	(Same)
Centurion Poultry 1471 Lane Creek Road Bogart, GA 30622	Dekalb White	I-A	Centurion Poultry Inc. P.O. Box 591 86 O'Neal Road Lexington, GA 3064822
	Dekalb White Experimental	III-A	(Same)
ISA North America Box 400 Cambridge, Ontario N1R 5V9 Canada	ISA White Experimental	III-A	Cox Brothers Poultry Farm R.R. #1 Maitland, Nova Scotia B0N 1T0 Canada

[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