



Progress In Poultry

"THROUGH RESEARCH"

THE EFFECTS OF CAGE SHAPE, HOUSING AND STRAIN OF CHICKENS ON VARIOUS PERFORMANCE PARAMETERS (REPORT #2)

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INTRODUCTION

The effects of cage shape for caged layers has been the subject of dozens of scientific papers over the last fifteen years. Differences between treatments have ranged from little or none to very large effects on performance. Obviously, the conditions between experiments varied as researchers used different strains, breeds, cage sizes and designs, housing systems, environments, feeding programs and other related management systems.

The North Carolina Random Sample Test began to study these interrelationships in the early 1980's when new facilities were constructed at the Piedmont Research Station. Three Houses were equipped with conventional 12" wide

by 18" deep (D) cages and the shallow (S) cage which used the exact reverse dimensions--18" wide by 12" deep.

The researchers were interested in determining the effects of various forms of management and housing on performance in various white and brown egg strains of chickens. This research is, without a doubt, the most comprehensive ever attempted to seek answers to this very complex question.

This report has been written to summarize their results over the last five tests and to allow the reader to assess the repeatability of results associated with the factors of strain/breed, housing, and cage shape. An earlier report emphasized the cage density aspects of the tests.

DESCRIPTION OF THE TESTS

The following table describes the five tests included in this review.

Number	I.D.	Hatch Date	Ending Date	Weeks	
23rd	81/82	4/1/81	8/10/82	21-71	
24th	82/83	3/31/82	8/9/83	21-71	46.8
25th	83/84	3/30/83	8/7/84	21-71	Average
26th	84/85	4/14/84	6/23/85	20-62	Weeks
27th	85/86	12/17/85	2/24/87	20-62	Of Lay

All groups were reared in cages. Each test group was replicated four times and randomly located within each housing type. Throughout this discussion, LAC refers to an open-sided flush house.

Tables 1-3 summarize results by chicken type (white vs. brown egg strains). Tables 4-12 summarize results by strain for six major strains of white leghorns. Table 13 is a summary of the other tables.

Interpretation of these data should emphasize the repeatability of results between strains, breeds and housing types. The reader should pay particular attention to the possibility of interactions between factors e.g. do results appear to change direction with various factors? Does cage shape affect

performance in one type of housing differently than in others?

Statistical analyses were not performed on the consistency of results between tests because of the many differences which existed between the tests. We would suggest, though, that the reader should place greatest emphasis on those factors that repeat themselves in at least four of the five tests.

The Babcock results in tables 4-12 have been adjusted to compensate for not being in all five tests in the ratio of the three-test results to the five-test averages.

A brief summary of general conclusions is on page 16.

TABLE 1 EFFECTS OF CAGE SHAPE & HOUSING ON PERFORMANCE

EGGS/HEN-HOUSED	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST (WHITE)	231.2	227.1	4.1	250.8	244.3	6.5
82/83 TEST "	265.6	263.2	2.4	262.4	255.4	7.0
83/84 TEST "	267.2	260.8	6.4	263.3	255.1	8.2
84/85 TEST "	217.2	218.6	-1.4	219.4	215.5	3.9
85/87 TEST "	227.7	225.3	2.4	222.0	212.1	9.9
AVERAGE "	241.8	239.0	2.8	243.6	236.5	7.1
=====						
81/82 TEST (BROWN)	233.1	224.8	8.3	227.9	221.2	6.7
82/83 TEST "	240.5	234.2	6.3	248.5	237.5	11.0
83/84 TEST "	249.8	249.1	0.7	246.2	243.0	3.2
84/85 TEST "	200.8	196.1	4.7	199.3	198.1	1.2
85/87 TEST "	224.7	217.7	7.0	213.4	202.3	11.1
AVERAGE "	229.8	224.4	5.4	227.1	220.4	6.6
=====						
FEEED PER 100 HENS/DAY (LBS.)						

81/82 TEST (WHITE)	21.9	21.5	0.4	23.6	23.3	0.3
82/83 TEST "	22.6	21.9	0.7	22.9	23.2	-0.3
83/84 TEST "	23.5	22.9	0.6	24.2	23.6	0.6
84/85 TEST "	22.4	22.5	-0.1	23.5	22.9	0.6
85/87 TEST "	24.2	24.7	-0.5	24.1	23.2	0.9
AVERAGE "	22.9	22.7	0.2	23.7	23.2	0.4
=====						
81/82 TEST (BROWN)	23.4	23.0	0.4	25.7	24.5	1.2
82/83 TEST "	24.7	24.7	0.0	25.7	24.6	1.1
83/84 TEST "	25.6	24.7	0.9	26.3	26.0	0.3
84/85 TEST "	25.1	25.0	0.1	24.4	24.8	-0.4
85/87 TEST "	27.5	27.1	0.4	27.0	25.6	1.4
AVERAGE "	25.3	24.9	0.4	25.8	25.1	0.7
=====						
FEEED (LBS./DOZ.)						

81/82 TEST (WHITE)	3.62	3.57	0.05	3.73	3.78	-0.05
82/83 TEST "	3.48	3.40	0.08	3.57	3.66	-0.09
83/84 TEST "	3.56	3.54	0.02	3.70	3.72	-0.02
84/85 TEST "	3.49	3.50	-0.01	3.64	3.63	0.01
85/87 TEST "	3.62	3.74	-0.12	3.67	3.69	-0.02
AVERAGE "	3.55	3.55	0.00	3.66	3.70	-0.03
=====						
81/82 TEST (BROWN)	4.01	4.11	-0.10	4.47	4.53	-0.06
82/83 TEST "	4.16	4.26	-0.10	4.10	4.23	-0.13
83/84 TEST "	4.10	4.00	0.10	4.33	4.39	-0.06
84/85 TEST "	4.13	4.27	-0.14	4.18	4.23	-0.05
85/87 TEST "	4.24	4.28	-0.04	4.32	4.28	0.04
AVERAGE "	4.13	4.18	-0.06	4.28	4.33	-0.05
=====						

TABLE 2 EFFECTS OF CAGE SHAPE & HOUSING ON PERFORMANCE

EGG WT. (OZS./DOZ.)	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST (WHITE)	24.3	24.3	0.0	25.2	25.3	-0.1
82/83 TEST "	24.3	24.3	0.0	25.2	25.2	0.0
83/84 TEST "	24.0	24.2	-0.2	25.4	25.3	0.1
84/85 TEST "	23.7	23.6	0.1	24.7	24.5	0.2
85/87 TEST "	22.2	22.2	0.0	22.8	22.8	0.0
AVERAGE "	23.7	23.7	0.0	24.7	24.6	0.0
81/82 TEST (BROWN)	26.1	26.2	-0.1	27.2	26.9	0.3
82/83 TEST "	26.4	26.6	-0.2	27.2	27.1	0.1
83/84 TEST "	26.1	26.0	0.1	27.7	27.6	0.1
84/85 TEST "	25.3	25.5	-0.2	26.9	27.0	-0.1
85/87 TEST "	24.5	24.1	0.4	24.8	25.0	-0.2
AVERAGE "	25.7	25.7	0.0	26.8	26.7	0.0
=====						
% LARGE EGGS						
81/82 TEST (WHITE)	64.9	66.6	-1.7	76.1	76.1	0.0
82/83 TEST "	65.9	66.9	-1.0	78.7	77.8	0.9
83/84 TEST "	62.2	63.0	-0.8	82.4	80.2	2.2
84/85 TEST "	59.5	59.3	0.2	71.5	70.6	0.9
85/87 TEST "	63.8	61.7	2.1	69.7	70.0	-0.3
AVERAGE "	63.3	63.5	-0.2	75.7	74.9	0.7
81/82 TEST (BROWN)	81.1	82.8	-1.7	87.7	86.0	1.7
82/83 TEST "	88.7	89.4	-0.7	90.7	90.6	0.1
83/84 TEST "	83.3	82.4	0.9	94.1	94.0	0.1
84/85 TEST "	77.7	79.6	-1.9	85.9	86.9	-1.0
85/87 TEST "	82.6	80.1	2.5	83.4	85.5	-2.1
AVERAGE "	82.7	82.9	-0.2	88.4	88.6	-0.2
=====						
TOTAL EGG WEIGHT/HEN HOUSED (LBS.)						
81/82 TEST (WHITE)	29.2	28.7	0.5	32.9	32.2	0.7
82/83 TEST "	33.5	33.2	0.3	34.4	33.5	0.9
83/84 TEST "	33.3	32.8	0.5	34.7	33.5	1.2
84/85 TEST "	26.8	26.9	-0.1	28.2	29.5	-1.3
85/87 TEST "	28.6	28.2	0.4	28.4	27.4	1.0
AVERAGE "	30.3	30.0	0.3	31.7	31.2	0.5
81/82 TEST (BROWN)	31.7	30.6	1.1	32.2	31.0	1.2
82/83 TEST "	33.1	32.4	0.7	35.2	33.5	1.7
83/84 TEST "	33.9	33.6	0.3	35.4	34.8	0.6
84/85 TEST "	26.5	26.0	0.5	27.9	27.9	0.0
85/87 TEST "	31.1	29.9	1.2	30.0	28.7	1.3
AVERAGE "	31.3	30.5	0.8	32.1	31.2	1.0

TABLE 3 EFFECTS OF CAGE SHAPE & HOUSING ON PERFORMANCE

% CRACKED EGGS	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST (WHITE)	3.2	2.4	0.8	2.6	4.5	-1.9
82/83 TEST "	2.6	2.6	0.0	2.4	3.1	-0.7
83/84 TEST "	2.9	3.1	-0.2	2.5	3.7	-1.2
84/85 TEST "	3.0	2.1	0.9	2.7	3.8	-1.1
85/87 TEST "	2.9	3.1	-0.2	2.9	3.6	-0.7
AVERAGE "	2.9	2.7	0.3	2.6	3.7	-1.1
=====						
81/82 TEST (BROWN)	3.0	2.3	0.7	3.2	2.9	0.3
82/83 TEST "	3.2	2.9	0.3	3.0	4.7	-1.7
83/84 TEST "	2.7	2.7	0.0	2.8	4.4	-1.6
84/85 TEST "	2.8	3.0	-0.2	4.3	5.5	-1.2
85/87 TEST "	3.1	2.4	0.7	2.6	3.3	-0.7
AVERAGE "	3.0	2.7	0.3	3.2	4.2	-1.0
=====						
% DIED						

81/82 TEST (WHITE)	14.4	15.3	-0.9	12.3	13.9	-1.6
82/83 TEST "	7.7	7.4	0.3	5.4	9.2	-3.8
83/84 TEST "	10.0	15.8	-5.8	9.0	8.9	0.1
84/85 TEST "	7.4	7.1	0.3	6.9	7.5	-0.6
85/87 TEST "	8.2	6.7	1.5	8.5	8.1	0.4
AVERAGE "	9.5	10.5	-0.9	8.4	9.5	-1.1
=====						
81/82 TEST (BROWN)	11.0	8.1	2.9	12.8	6.5	6.3
82/83 TEST "	11.9	8.8	3.1	10.8	8.4	2.4
83/84 TEST "	11.0	14.8	-3.8	9.9	5.6	4.3
84/85 TEST "	13.9	12.6	1.3	7.4	9.7	-2.3
85/87 TEST "	6.0	5.6	0.4	5.6	8.0	-2.4
AVERAGE "	10.8	10.0	0.8	9.3	7.6	1.7
=====						
FEED/EGG RATIO						

81/82 TEST (WHITE)	2.39	2.35	0.04	2.37	2.39	-0.02
82/83 TEST "	2.29	2.24	0.05	2.27	2.32	-0.05
83/84 TEST "	2.37	2.34	0.03	2.33	2.35	-0.02
84/85 TEST "	2.35	2.37	-0.02	2.34	2.35	-0.01
85/87 TEST "	2.39	2.49	-0.10	2.36	2.37	-0.01
AVERAGE "	2.36	2.36	0.00	2.33	2.36	-0.02
=====						
81/82 TEST (BROWN)	2.46	2.50	-0.04	2.63	2.69	-0.06
82/83 TEST "	2.51	2.56	-0.05	2.41	2.50	-0.09
83/84 TEST "	2.52	2.46	0.06	2.51	2.54	-0.03
84/85 TEST "	2.61	2.65	-0.04	2.46	2.49	-0.03
85/87 TEST "	2.55	2.60	-0.05	2.55	2.52	0.03
AVERAGE "	2.53	2.55	-0.02	2.51	2.55	-0.04
=====						

TABLE 4 EFFECTS OF CAGE SHAPE AND HOUSING BY STRAIN
EGGS PER HEN HOUSED

DEKALB XL	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST	241.2	220.1	21.1	255.1	245.3	9.8
82/83 TEST	273.7	272.3	1.4	271.9	250.0	21.9
83/84 TEST	276.0	274.4	1.6	265.6	268.4	-2.8
84/85 TEST	223.3	216.6	6.7	217.5	223.7	-6.2
85/87 TEST	232.4	232.0	0.4	237.5	218.9	18.6
AVERAGE	249.3	243.1	6.2	249.5	241.3	8.3

BABCOCK B300						
81/82 TEST	243.6	245.3	-1.7	259.4	245.2	14.2
82/83 TEST			N/A			
83/84 TEST			N/A			
84/85 TEST	204.7	203.0	1.7	215.9	207.4	8.5
85/87 TEST	232.4	237.7	-5.3	235.2	222.5	12.7
ADJ. AVERAGE	241.8	243.0	-1.2	248.5	235.8	12.7

HISEX WHITE						
81/82 TEST	242.1	239.2	2.9	255.4	254.5	0.9
82/83 TEST	277.1	274.6	2.5	264.9	262.7	2.2
83/84 TEST	267.6	254.6	13.0	264.3	247.9	16.4
84/85 TEST	233.1	232.7	0.4	223.0	222.6	0.4
85/87 TEST	230.7	220.5	10.2	210.3	215.6	-5.3
AVERAGE	250.1	244.3	5.8	243.6	240.7	2.9

H&N						
81/82 TEST	239.1	242.1	-3.0	266.3	247.4	18.9
82/83 TEST	267.3	259.5	7.8	265.3	253.4	11.9
83/84 TEST	263.8	262.0	1.8	261.6	262.8	-1.2
84/85 TEST	211.2	203.2	8.0	228.5	217.5	11.0
85/87 TEST	232.6	228.4	4.2	231.3	211.7	19.6
AVERAGE	242.8	239.0	3.8	250.6	238.6	12.0

HYLINE W36						
81/82 TEST	228.8	242.2	-13.4	260.8	257.0	3.8
82/83 TEST	259.7	250.4	9.3	254.5	255.2	-0.7
83/84 TEST	260.7	254.0	6.7	261.9	254.4	7.5
84/85 TEST	225.9	221.6	4.3	219.4	210.5	8.9
85/87 TEST	229.7	230.8	-1.1	226.5	214.2	12.3
AVERAGE	241.0	239.8	1.2	244.6	238.3	6.4

SHAVER 288A						
81/82 TEST	210.5	216.1	-5.6	249.1	252.9	-3.8
82/83 TEST	250.3	259.0	-8.7	255.3	255.8	-0.5
83/84 TEST	268.0	259.0	9.0	263.1	242.2	20.9
84/85 TEST	216.0	222.5	-6.5	219.7	215.4	4.3
85/87 TEST	237.5	232.6	4.9	210.4	210.7	-0.3
AVERAGE	236.5	237.8	-1.4	239.5	235.4	4.1
=====						
SIX STRAIN AVERAGE	243.6	241.2	2.4	246.1	238.3	7.7
=====						

TABLE 5 EFFECTS OF CAGE SHAPE AND HOUSING BY STRAIN
FEED PER 100 HENS/DAY (LBS.)

DEKALB XL	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST	22.6	21.3	1.3	23.3	22.3	1.0
82/83 TEST	22.2	22.4	-0.2	23.6	22.6	1.0
83/84 TEST	24.0	23.2	0.8	24.4	24.2	0.2
84/85 TEST	23.6	23.8	-0.2	23.9	23.0	0.9
85/87 TEST	24.3	24.8	-0.5	24.7	24.1	0.6
AVERAGE	23.3	23.1	0.2	24.0	23.2	0.7

BABCOCK B300						
81/82 TEST	22.1	21.4	0.7	24.5	23.3	1.2
82/83 TEST			N/A			
83/84 TEST			N/A			
84/85 TEST	23.2	22.7	0.5	23.7	22.8	0.9
85/87 TEST	24.1	25.0	-0.9	24.2	24.0	0.2
ADJ. AVERAGE	23.0	22.7	0.3	24.0	23.4	0.6

HISEX WHITE						
81/82 TEST	21.2	23.3	-2.1	23.3	23.6	-0.3
82/83 TEST	22.0	21.8	0.2	22.7	23.8	-1.1
83/84 TEST	23.2	23.4	-0.2	24.4	23.4	1.0
84/85 TEST	22.7	22.4	0.3	24.3	24.1	0.2
85/87 TEST	24.9	24.9	0.0	24.2	23.3	0.9
AVERAGE	22.8	23.2	-0.4	23.8	23.6	0.1

H&N						
81/82 TEST	23.9	21.8	2.1	24.3	24.4	-0.1
82/83 TEST	23.7	23.0	0.7	23.7	24.0	-0.3
83/84 TEST	23.9	22.9	1.0	24.6	24.1	0.5
84/85 TEST	22.4	23.0	-0.6	24.2	24.5	-0.3
85/87 TEST	25.1	27.1	-2.0	25.3	24.4	0.9
AVERAGE	23.8	23.6	0.2	24.4	24.3	0.1

HYLINE W36						
81/82 TEST	20.5	20.0	0.5	23.0	22.7	0.3
82/83 TEST	22.4	20.4	2.0	21.6	22.5	-0.9
83/84 TEST	23.9	22.2	1.7	23.4	22.7	0.7
84/85 TEST	21.8	21.6	0.2	23.7	21.8	1.9
85/87 TEST	24.9	23.9	1.0	22.9	22.1	0.8
AVERAGE	22.7	21.6	1.1	22.9	22.4	0.6

SHAVER 288A						
81/82 TEST	23.7	21.5	2.2	24.2	23.7	0.5
82/83 TEST	22.6	21.8	0.8	22.8	23.3	-0.5
83/84 TEST	22.7	23.0	-0.3	24.1	23.5	0.6
84/85 TEST	21.8	22.7	-0.9	22.8	22.9	-0.1
85/87 TEST	24.2	24.8	-0.6	23.4	23.5	-0.1
AVERAGE	23.0	22.8	0.2	23.5	23.4	0.1
=====						
SIX STRAIN AVERAGE	23.1	22.8	0.3	23.8	23.4	0.4
=====						

TABLE 6 EFFECTS OF CAGE SHAPE AND HOUSING BY STRAIN
FEED (LBS./DOZ.)

DEKALB XL	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST	3.47	3.52	-0.05	3.78	3.66	0.12
82/83 TEST	3.39	3.37	0.02	3.55	3.59	-0.04
83/84 TEST	3.55	3.39	0.16	3.71	3.74	-0.03
84/85 TEST	3.54	3.57	-0.03	3.71	3.54	0.17
85/87 TEST	3.51	3.60	-0.09	3.63	3.64	-0.01
AVERAGE	3.49	3.49	0.00	3.68	3.63	0.04

BABCOCK B300						
81/82 TEST	3.69	3.65	0.04	3.86	3.78	0.08
82/83 TEST			N/A			
83/84 TEST			N/A			
84/85 TEST	3.80	3.73	0.07	3.85	3.79	0.06
85/87 TEST	3.63	3.71	-0.08	3.63	3.73	-0.10
ADJ. AVERAGE	3.70	3.66	0.04	3.77	3.77	0.00

HISEX WHITE						
81/82 TEST	3.22	3.61	-0.39	3.54	3.72	-0.18
82/83 TEST	3.27	3.25	0.02	3.53	3.65	-0.12
83/84 TEST	3.46	3.64	-0.18	3.78	3.74	0.04
84/85 TEST	3.37	3.36	0.01	3.67	3.65	0.02
85/87 TEST	3.65	3.84	-0.19	3.87	3.76	0.11
AVERAGE	3.39	3.54	-0.15	3.68	3.70	-0.03

H&N						
81/82 TEST	3.86	3.46	0.40	3.70	3.92	-0.22
82/83 TEST	3.67	3.64	0.03	3.68	3.79	-0.11
83/84 TEST	3.65	3.63	0.02	3.72	3.73	-0.01
84/85 TEST	3.45	3.69	-0.24	3.56	3.75	-0.19
85/87 TEST	3.54	3.94	-0.40	3.84	3.87	-0.03
AVERAGE	3.63	3.67	-0.04	3.70	3.81	-0.11

HYLINE W36						
81/82 TEST	3.50	3.40	0.10	3.62	3.61	0.01
82/83 TEST	3.46	3.34	0.12	3.45	3.55	-0.10
83/84 TEST	3.67	3.46	0.21	3.65	3.67	-0.02
84/85 TEST	3.34	3.34	0.00	3.68	3.49	0.19
85/87 TEST	3.73	3.62	0.11	3.48	3.57	-0.09
AVERAGE	3.54	3.43	0.11	3.58	3.58	0.00

SHAVER 288A						
81/82 TEST	3.94	3.47	0.47	3.76	3.65	0.11
82/83 TEST	3.60	3.41	0.19	3.65	3.72	-0.07
83/84 TEST	3.47	3.58	-0.11	3.65	3.73	-0.08
84/85 TEST	3.46	3.51	-0.05	3.54	3.61	-0.07
85/87 TEST	3.51	3.65	-0.14	3.51	3.71	-0.20
AVERAGE	3.60	3.52	0.07	3.62	3.68	-0.06
=====						
SIX STRAIN AVERAGE	3.56	3.55	0.01	3.67	3.70	-0.03
=====						

TABLE 7 EFFECTS OF CAGE SHAPE AND HOUSING BY STRAIN
EGG WEIGHT (OZS./DOZ.)

DEKALB XL	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST	24.9	24.8	0.1	25.5	25.4	0.1
82/83 TEST	24.3	24.3	0.0	25.4	24.9	0.5
83/84 TEST	23.9	24.2	-0.3	25.3	25.2	0.1
84/85 TEST	23.6	23.7	-0.1	25.1	24.2	0.9
85/87 TEST	22.2	21.9	0.3	22.6	22.9	-0.3
AVERAGE	23.8	23.8	0.0	24.8	24.5	0.3

BABCOCK B300						
81/82 TEST	24.2	24.2	0.0	25.5	25.5	0.0
82/83 TEST			N/A			
83/84 TEST			N/A			
84/85 TEST	24.1	24.0	0.1	25.2	24.4	0.8
85/87 TEST	22.4	22.3	0.1	23.0	22.7	0.3
ADJ. AVERAGE	23.9	23.8	0.1	25.0	24.6	0.4

HISEX WHITE						
81/82 TEST	24.2	23.9	0.3	24.5	25.1	-0.6
82/83 TEST	24.3	24.1	0.2	25.0	25.5	-0.5
83/84 TEST	24.0	24.6	-0.6	25.9	25.6	0.3
84/85 TEST	24.0	23.7	0.3	24.5	24.9	-0.4
85/87 TEST	22.5	22.1	0.4	23.7	23.2	0.5
AVERAGE	23.8	23.7	0.1	24.7	24.9	-0.1

H&N						
81/82 TEST	24.5	24.5	0.0	25.4	25.6	-0.2
82/83 TEST	24.6	24.9	-0.3	25.6	25.6	0.0
83/84 TEST	24.3	24.1	0.2	25.4	25.2	0.2
84/85 TEST	23.6	23.7	-0.1	24.3	25.0	-0.7
85/87 TEST	22.7	22.8	-0.1	23.0	23.4	-0.4
AVERAGE	23.9	24.0	-0.1	24.7	25.0	-0.2

HYLINE W36						
81/82 TEST	24.1	23.8	0.3	25.1	25.3	-0.2
82/83 TEST	24.1	24.0	0.1	25.0	25.1	-0.1
83/84 TEST	24.0	23.9	0.1	25.4	25.5	-0.1
84/85 TEST	23.6	23.4	0.2	24.6	24.3	0.3
85/87 TEST	22.0	21.7	0.3	22.5	22.7	-0.2
AVERAGE	23.6	23.4	0.2	24.5	24.6	-0.1

SHAVER 288A						
81/82 TEST	24.0	24.7	-0.7	25.2	25.4	-0.2
82/83 TEST	24.0	24.1	-0.1	25.0	25.1	-0.1
83/84 TEST	24.0	24.0	0.0	25.0	25.0	0.0
84/85 TEST	23.5	23.4	0.1	24.4	24.4	0.0
85/87 TEST	22.5	22.6	-0.1	22.9	22.9	0.0
AVERAGE	23.6	23.8	-0.2	24.5	24.6	-0.1
=====						
SIX STRAIN AVERAGE	23.8	23.7	0.0	24.7	24.7	0.0
=====						

TABLE 8 EFFECTS OF CAGE SHAPE AND HOUSING BY STRAIN
% LARGE EGGS

DEKALB XL	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST	71.0	71.2	-0.2	78.6	78.7	-0.1
82/83 TEST	65.7	69.0	-3.3	81.8	73.2	8.6
83/84 TEST	60.8	62.9	-2.1	82.1	82.6	-0.5
84/85 TEST	56.6	59.8	-3.2	76.6	67.0	9.6
85/87 TEST	64.0	60.5	3.5	71.0	72.4	-1.4
AVERAGE	63.6	64.7	-1.1	78.0	74.8	3.2
BABCOCK B300						
81/82 TEST	68.6	65.0	3.6	79.2	80.4	-1.2
82/83 TEST			N/A			
83/84 TEST			N/A			
84/85 TEST	68.6	65.6	3.0	76.1	70.7	5.4
85/87 TEST	67.1	63.8	3.3	72.1	69.9	2.2
ADJ. AVERAGE	68.8	66.0	2.8	79.4	76.3	3.1
HISEX WHITE						
81/82 TEST	64.7	62.8	1.9	70.6	73.6	-3.0
82/83 TEST	69.7	65.6	4.1	78.3	80.8	-2.5
83/84 TEST	62.2	71.1	-8.9	87.4	82.6	4.8
84/85 TEST	64.6	61.9	2.7	71.2	75.9	-4.7
85/87 TEST	66.1	59.3	6.8	77.2	72.0	5.2
AVERAGE	65.5	64.1	1.3	76.9	77.0	0.0
H&N						
81/82 TEST	68.4	69.1	-0.7	77.1	79.2	-2.1
82/83 TEST	70.4	73.3	-2.9	82.2	81.6	0.6
83/84 TEST	65.2	59.3	5.9	82.3	79.1	3.2
84/85 TEST	59.7	59.5	0.2	70.7	76.6	-5.9
85/87 TEST	61.0	55.7	5.3	66.9	68.9	-2.0
AVERAGE	64.9	63.4	1.6	75.8	77.1	-1.2
HYLINE W36						
81/82 TEST	58.8	69.7	-10.9	76.5	75.8	0.7
82/83 TEST	62.1	62.5	-0.4	73.2	75.2	-2.0
83/84 TEST	62.7	58.5	4.2	80.4	79.5	0.9
84/85 TEST	56.8	57.8	-1.0	69.0	69.0	0.0
85/87 TEST	61.0	55.7	5.3	66.9	68.9	-2.0
AVERAGE	60.1	62.1	-2.0	74.8	74.9	-0.1
SHAVER 288A						
81/82 TEST	61.6	73.2	-11.6	75.7	78.3	-2.6
82/83 TEST	61.4	64.0	-2.6	78.1	78.3	-0.2
83/84 TEST	60.2	63.2	-3.0	79.7	79.4	0.3
84/85 TEST	52.7	56.8	-4.1	68.4	71.5	-3.1
85/87 TEST	67.0	66.1	0.9	73.7	72.5	1.2
AVERAGE	60.6	64.7	-4.1	75.1	76.0	-0.9
SIX STRAIN AVERAGE	63.9	64.2	-0.2	76.7	76.0	0.7

TABLE 9 EFFECTS OF CAGE SHAPE AND HOUSING BY STRAIN
TOTAL EGG WEIGHT/HEN HOUSED (LBS.)

DEKALB XL	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST	31.3	28.4	2.9	33.9	32.5	1.4
82/83 TEST	34.6	35.1	-0.5	36.0	32.4	3.6
83/84 TEST	34.4	34.6	-0.2	35.0	35.2	-0.2
84/85 TEST	27.4	26.7	0.7	28.4	28.2	0.2
85/87 TEST	29.1	28.8	0.3	30.6	28.4	2.2
AVERAGE	31.4	30.7	0.6	32.8	31.3	1.4

BABCOCK B300						
81/82 TEST	30.7	30.9	-0.2	34.5	32.6	1.9
82/83 TEST			N/A			
83/84 TEST			N/A			
84/85 TEST	25.7	25.4	0.3	28.3	26.4	1.9
85/87 TEST	29.3	29.9	-0.6	30.6	28.5	2.1
ADJ. AVERAGE	30.5	30.6	-0.1	32.9	30.7	2.2

HISEX WHITE						
81/82 TEST	30.5	29.8	0.7	32.6	33.3	-0.7
82/83 TEST	35.1	34.5	0.6	34.5	34.9	-0.4
83/84 TEST	33.5	32.6	0.9	35.7	33.1	2.6
84/85 TEST	29.1	28.7	0.4	28.5	28.9	-0.4
85/87 TEST	29.4	27.4	2.0	28.3	28.6	-0.3
AVERAGE	31.5	30.6	0.9	31.9	31.8	0.2

H&N						
81/82 TEST	30.5	30.9	-0.4	35.2	33.0	2.2
82/83 TEST	34.2	33.7	0.5	35.4	33.8	1.6
83/84 TEST	33.4	32.9	0.5	34.6	34.5	0.1
84/85 TEST	26.0	25.1	0.9	28.9	28.3	0.6
85/87 TEST	30.0	29.2	0.8	30.1	28.0	2.1
AVERAGE	30.8	30.4	0.5	32.8	31.5	1.3

HYLINE W36						
81/82 TEST	28.7	30.0	-1.3	34.1	33.9	0.2
82/83 TEST	32.6	31.3	1.3	33.1	33.4	-0.3
83/84 TEST	32.6	31.6	1.0	34.6	33.8	0.8
84/85 TEST	27.8	27.0	0.8	28.1	26.6	1.5
85/87 TEST	28.6	28.3	0.3	28.9	27.7	1.2
AVERAGE	30.1	29.6	0.4	31.8	31.1	0.7

SHAVER 288A						
81/82 TEST	26.3	27.8	-1.5	32.7	33.5	-0.8
82/83 TEST	31.3	32.5	-1.2	33.2	33.4	-0.2
83/84 TEST	33.5	32.4	1.1	34.3	31.5	2.8
84/85 TEST	26.4	27.1	-0.7	27.9	27.4	0.5
85/87 TEST	30.2	29.7	0.5	27.3	27.5	-0.2
AVERAGE	29.5	29.9	-0.4	31.1	30.7	0.4
=====						
SIX STRAIN AVERAGE	30.6	30.3	0.3	32.2	31.2	1.0
=====						

TABLE 10 EFFECTS OF CAGE SHAPE AND HOUSING BY STRAIN
% CRACKED EGGS

DEKALB XL	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST	1.8	3.4	-1.6	2.6	6.2	-3.6
82/83 TEST	3.4	3.0	0.4	2.5	3.2	-0.7
83/84 TEST	4.1	3.6	0.5	2.9	4.1	-1.2
84/85 TEST	2.7	2.8	-0.1	2.9	3.7	-0.8
85/87 TEST	2.8	2.5	0.3	3.3	4.6	-1.3
AVERAGE	3.0	3.1	-0.1	2.8	4.4	-1.5
BABCOCK B300						
81/82 TEST	1.7	1.8	-0.1	2.6	3.3	-0.7
82/83 TEST			N/A			
83/84 TEST			N/A			
84/85 TEST	2.8	1.7	1.1	1.5	1.9	-0.4
85/87 TEST	2.3	2.3	0.0	2.6	2.7	-0.1
ADJ. AVERAGE	2.3	1.9	0.4	2.2	2.4	-0.2
HISEX WHITE						
81/82 TEST	3.4	3.8	-0.4	3.9	4.6	-0.7
82/83 TEST	3.1	3.1	0.0	1.9	5.2	-3.3
83/84 TEST	2.7	5.1	-2.4	2.9	3.8	-0.9
84/85 TEST	4.2	5.6	-1.4	4.8	6.8	-2.0
85/87 TEST	2.8	2.7	0.1	2.3	5.0	-2.7
AVERAGE	3.2	4.1	-0.8	3.2	5.1	-1.9
H&N						
81/82 TEST	3.4	2.3	1.1	1.1	4.8	-3.7
82/83 TEST	2.8	2.6	0.2	2.4	2.6	-0.2
83/84 TEST	3.4	2.0	1.4	2.3	3.6	-1.3
84/85 TEST	2.6	1.1	1.5	2.1	1.6	0.5
85/87 TEST	4.4	2.3	2.1	2.9	2.0	0.9
AVERAGE	3.3	2.1	1.3	2.2	2.9	-0.8
HYLINE W36						
81/82 TEST	3.1	1.8	1.3	2.2	2.6	-0.4
82/83 TEST	2.3	1.9	0.4	3.5	1.9	1.6
83/84 TEST	1.6	2.5	-0.9	2.4	4.5	-2.1
84/85 TEST	2.9	1.0	1.9	3.1	5.5	-2.4
85/87 TEST	0.9	4.2	-3.3	2.4	5.2	-2.8
AVERAGE	2.5	1.8	0.7	2.8	3.6	-0.8
SHAVER 288A						
81/82 TEST	2.6	1.0	1.6	1.5	4.5	-3.0
82/83 TEST	1.6	2.3	-0.7	1.8	2.4	-0.6
83/84 TEST	2.5	2.5	0.0	1.8	2.6	-0.8
84/85 TEST	2.7	2.0	0.7	1.7	3.9	-2.2
85/87 TEST	2.6	3.6	-1.0	2.3	2.0	0.3
AVERAGE	2.4	2.3	0.1	1.8	3.1	-1.3
SIX STRAIN AVERAGE	2.8	2.5	0.3	2.5	3.6	-1.1

TABLE 11 EFFECTS OF CAGE SHAPE AND HOUSING BY STRAIN
% DIED

DEKALB XL	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST	16.2	20.2	-4.0	12.1	12.1	0.0
82/83 TEST	4.2	3.6	0.6	4.7	10.8	-6.1
83/84 TEST	6.9	16.5	-9.6	7.2	3.3	3.9
84/85 TEST	6.2	15.0	-8.8	8.7	4.2	4.5
85/87 TEST	13.3	7.9	5.4	4.2	12.9	-8.7
AVERAGE	9.4	12.6	-3.3	7.4	8.7	-1.3

BABCOCK B300						
81/82 TEST	6.1	3.2	2.9	6.8	14.6	-7.8
82/83 TEST			N/A			
83/84 TEST			N/A			
84/85 TEST	10.8	12.5	-1.7	2.5	7.1	-4.6
85/87 TEST	4.2	0.0	4.2	1.3	4.6	-3.3
ADJ. AVERAGE	6.6	5.7	0.9	3.9	8.8	-5.4

HISEX WHITE						
81/82 TEST	15.6	19.8	-4.2	12.9	18.3	-5.4
82/83 TEST	5.6	6.4	-0.8	4.2	8.3	-4.1
83/84 TEST	14.7	21.1	-6.4	7.5	8.6	-1.1
84/85 TEST	6.7	3.7	3.0	7.1	6.7	0.4
85/87 TEST	8.4	7.5	0.9	7.5	2.5	5.0
AVERAGE	10.2	11.7	-1.5	7.8	8.9	-1.0

H&N						
81/82 TEST	15.5	13.6	1.9	6.7	10.8	-4.1
82/83 TEST	5.6	8.6	-3.0	4.2	11.9	-7.7
83/84 TEST	12.5	5.3	7.2	14.2	10.6	3.6
84/85 TEST	11.6	10.4	1.2	8.8	12.6	-3.8
85/87 TEST	11.8	11.8	0.0	2.8	7.9	-5.1
AVERAGE	11.4	9.9	1.5	7.3	10.8	-3.4

HYLINE W36						
81/82 TEST	10.4	2.5	7.9	3.8	8.3	-4.5
82/83 TEST	12.6	9.2	3.4	8.1	8.3	-0.2
83/84 TEST	9.2	20.4	-11.2	5.3	8.6	-3.3
84/85 TEST	2.9	3.7	-0.8	9.6	12.1	-2.5
85/87 TEST	7.1	5.8	1.3	7.1	2.5	4.6
AVERAGE	8.4	8.3	0.1	6.8	8.0	-1.2

SHAVER 288A						
81/82 TEST	21.2	19.6	1.6	13.1	14.8	-1.7
82/83 TEST	10.3	9.4	0.9	5.8	6.9	-1.1
83/84 TEST	6.9	15.5	-8.6	10.6	13.6	-3.0
84/85 TEST	5.8	3.7	2.1	7.1	7.9	-0.8
85/87 TEST	5.0	5.0	0.0	12.1	10.8	1.3
AVERAGE	9.8	10.6	-0.8	9.7	10.8	-1.1
=====						
SIX STRAIN AVERAGE	9.3	9.8	-0.5	7.2	9.3	-2.2
=====						

TABLE 12 EFFECTS OF CAGE SHAPE AND HOUSING BY STRAIN
FEED/EGG RATIO

DEKALB XL	LAC HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
81/82 TEST	2.23	2.27	-0.04	2.37	2.30	0.07
82/83 TEST	2.23	2.22	0.01	2.24	2.30	-0.06
83/84 TEST	2.38	2.24	0.14	2.35	2.36	-0.01
84/85 TEST	2.40	2.40	0.00	2.36	2.33	0.03
85/87 TEST	2.32	2.41	-0.09	2.35	2.32	0.03
AVERAGE	2.31	2.31	0.00	2.33	2.32	0.01

BABCOCK B300						
81/82 TEST	2.44	2.41	0.03	2.42	2.37	0.05
82/83 TEST			N/A			
83/84 TEST			N/A			
84/85 TEST	2.52	2.48	0.04	2.42	2.46	-0.04
85/87 TEST	2.40	2.46	-0.06	2.32	2.42	-0.10
ADJ. AVERAGE	2.44	2.42	0.02	2.37	2.41	-0.04

HISEX WHITE						
81/82 TEST	2.13	2.41	-0.28	2.30	2.36	-0.06
82/83 TEST	2.15	2.15	0.00	2.25	2.29	-0.04
83/84 TEST	2.30	2.37	-0.07	2.33	2.33	0.00
84/85 TEST	2.25	2.27	-0.02	2.36	2.33	0.03
85/87 TEST	2.38	2.58	-0.20	2.40	2.37	0.03
AVERAGE	2.24	2.36	-0.11	2.33	2.34	-0.01

H&N						
81/82 TEST	2.52	2.25	0.27	2.33	2.45	-0.12
82/83 TEST	2.39	2.34	0.05	2.30	2.37	-0.07
83/84 TEST	2.40	2.41	-0.01	2.35	2.37	-0.02
84/85 TEST	2.34	2.51	-0.17	2.33	2.39	-0.06
85/87 TEST	2.30	2.55	-0.25	2.45	2.44	0.01
AVERAGE	2.39	2.41	-0.02	2.35	2.40	-0.05

HYLINE W36						
81/82 TEST	2.33	2.28	0.05	2.31	2.28	0.03
82/83 TEST	2.30	2.23	0.07	2.21	2.27	-0.06
83/84 TEST	2.44	2.32	0.12	2.30	2.30	0.00
84/85 TEST	2.27	2.29	-0.02	2.37	2.31	0.06
85/87 TEST	2.48	2.43	0.05	2.26	2.31	-0.05
AVERAGE	2.36	2.31	0.05	2.29	2.29	0.00

SHAVER 288A						
81/82 TEST	2.62	2.24	0.38	2.38	2.30	0.08
82/83 TEST	2.40	2.26	0.14	2.33	2.37	-0.04
83/84 TEST	2.32	2.38	-0.06	2.34	2.38	-0.04
84/85 TEST	2.37	2.40	-0.03	2.32	2.36	-0.04
85/87 TEST	2.29	2.37	-0.08	2.25	2.34	-0.09
AVERAGE	2.40	2.33	0.07	2.32	2.35	-0.03
=====						
SIX STRAIN AVERAGE	2.36	2.36	0.00	2.33	2.35	-0.02
=====						

Table 13.

Summary of Effects of Cage Shape & Housing*

White Egg Layers	LAS HOUSING			CURTAIN HOUSING		
	S	D	S-D	S	D	S-D
Eggs/Hen-Housed	241.8	239.0	2.8	243.6	236.5	7.1
Feed/100 Hens (lbs)	22.9	22.7	0.2	23.7	23.2	0.5
Feed (lbs./doz.)	3.55	3.55	0	3.66	3.70	-0.04
Egg Wt. (oz/doz)	23.7	23.7	0	24.7	24.6	0.1
Large Eggs (%)	63.3	63.5	-0.2	75.7	74.9	0.8
Egg Mass/H.H. (lbs)	30.3	30.0	0.3	31.7	31.2	0.5
Cracked Eggs (%)	2.9	2.7	0.2	2.6	3.7	-1.1
Mortality (%)	9.5	10.5	-1.0	8.4	9.5	-1.1
Feed: Egg Ratio	2.36	2.36	0	2.33	2.36	-0.03
Brown Egg Layers						
Eggs/Hen-Housed	229.8	224.4	5.4	227.1	220.4	6.7
Feed/100 Hens (lbs)	25.3	24.9	0.4	25.8	25.1	0.7
Feed (lbs./doz.)	4.13	4.18	-0.05	4.28	4.33	-0.05
Egg Wt. (oz/doz)	25.7	25.7	0	26.8	26.7	0.1
Large Eggs (%)	82.7	82.9	-0.2	88.4	88.6	-0.2
Egg Mass/H.H. (lbs)	31.3	30.5	0.8	32.1	31.2	0.9
Cracked Eggs (%)	3.0	2.7	0.3	3.2	4.2	-1.0
Mortality (%)	10.8	10.0	0.8	9.3	7.6	1.7
Feed: Egg Ratio	2.53	2.55	-0.02	2.51	2.55	-0.04

* Other strains are included besides those listed in Tables 4-12.

General Conclusions

Hen-housed egg production favored the shallow cages by 2.8 to 7.1 eggs. Differences seemed to be smaller in the LAC house, especially with the white egg strains. The two types of housing performed almost the same. Most White Leghorn strains laid more eggs in the shallow cage with the possible exception of the shaver 288A and Babcock B300's in the LAC houses.

Feed consumption in the shallow cages was about 2 percent higher than in the conventional cages. The curtain sided houses also consumed about 2 percent more feed. Strains followed a similar pattern.

Feed conversion (pounds per dozen) favored the LAC house, but the Shaver and H&N strains showed significantly better feed conversion in shallow cages when they were located in the curtain house.

Egg size favored the curtain sided house by about 4 percent. Differences due to cage shape were not observed.

Total egg mass was 2 percent higher in the shallow cages and 3 percent

higher in the curtain sided house. The Hisex produced significantly more egg mass in the shallow cage in the LAC house, but a comparable mass in the curtain sided house.

The production of cracked eggs was significantly lower in the shallow cages in the curtain house but appeared to be slightly higher in the LAC house. Egg breakage, in general, was higher in the curtain sided house.

Mortality was higher in conventional cages in the white egg strains, but lower in the brown egg strains. Overall mortality was slightly higher in the LAC house. Several strains demonstrated different mortality patterns relative to cage shape when placed in two housing types. The H&N, for example, showed a marked reduction of mortality in shallow cages when housed in curtain sided housing, but higher mortality when housed in the LAC house.

In conclusion, there does appear to be certain interactions between strain, cage shape and housing. This would suggest that strains and cage shapes may not perform similarly in different types of housing.

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