

**HATCH AND SEROLOGY REPORT OF THE FOURTIETH  
NORTH CAROLINA LAYER PERFORMANCE AND MANAGEMENT TEST  
AND  
ALTERNATIVE MANAGEMENT TEST**

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The North Carolina Layer Performance and Management Test is conducted under the auspices of the North Carolina Layer Performance and Management Program, 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-Poultry Unit, Salisbury, North Carolina. Mr. Joe Hampton is Piedmont Research Station Superintendent; Ms. Teresa Herman is Poultry Unit Manager of the flock; Dr. Ramon Malheiros is coordinator of data compilation and statistical analysis; and Dr. Kenneth. Anderson is Project Leader. The purpose of this program is to assist poultry management teams in evaluation of commercial layer stocks and management systems.

Copies of current and past reports are maintained for public access at [http://www.ces.ncsu.edu/depts/poulsci/tech\\_manuals/layer\\_reports/40\\_hatch\\_report.pdf](http://www.ces.ncsu.edu/depts/poulsci/tech_manuals/layer_reports/40_hatch_report.pdf).

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**HATCH AND SEROLOGY REPORT OF THE FOURTIETH  
NORTH CAROLINA LAYER PERFORMANCE AND MANAGEMENT TEST**

**Dates of Importance and Entries:**

Eighteen entries were accepted or acquired in accordance with the rules and regulations of the test. The eggs were placed into trays and set on May 10, 2016 and were pulled from the hatchers on June 1, 2016. Eleven commercial white egg strains and seven commercial brown egg strains are participating in the current test. Table 1 shows the source of the laying stock (Breeder) and the strain which was entered in the test. Table 5 provides the breeder, source of eggs, and entry status of each strain. The egg deliveries to the Research Station occurred from May 5, 2016 through May 9, 2016. All eggs arrived in good condition, however, the age of the eggs were variable between strains. The eggs for each of the strains were shipped directly to the station via delivery truck while some strains entered the U.S. via Air Freight. There were few broken eggs and the numbers of dirty eggs were minimal among all shipments and strains. The eggs were set 90 eggs/tray and allowed to come to room temperature prior to placement in the incubators. At time of transfer, two egg trays were transferred to each hatching tray (180 eggs/tray) and were placed into the hatchers. Only obvious leakers or contaminated eggs were removed at transfer to facilitate the hatch and were noted on the hatching tray labels.

**Table 1. 40th North Carolina Layer Performance and Management Test Strain Code Assignments**

<b>Strain No.</b>	<b>Source of Stock</b>	<b>Source Code</b>	<b>Strain</b>
1	ISA	ISA	Bovans White
2	ISA	ISA	Shaver White
3	ISA	ISA	Dekalb White
4	ISA	ISA	Babcock White
5	ISA	ISA	B 400 White
6	Hy-Line	HL	W-80
7	Hy-Line	HL	W-36
8	Hy-Line	HL	White Exp
9	Lohmann	L	LSL Lite
10	H&N	H&N	H&N Nick Chick
11	Novogen	N	Novowhite
12	ISA	ISA	Bovans Brown
13	ISA	ISA	ISA Brown
14	Hy-Line	HL	Brown
15	Hy-Line	HL	Silver Brown
16	Lohmann	L	LB Lite
17	Novogen	N	Novobrown
18	Tetra Americana	TA	TETRA Brown

## **Data Collection:**

**Serology:** The serum samples were obtained by collecting blood from 10 male chicks in each strain at the time of hatch. The blood was allowed to agglutinate and the serum to separate for collection. The serum samples were then pooled by combining individual samples from ten chicks per strain into 1 ml aliquots. The pooled samples were packaged and refrigerated until delivery and testing at the NC Department of Agriculture & Consumer Services, Rollins Diagnostic Laboratory for Mycoplasma gallisepticum (MG), Mycoplasma synoviae (MS), and Infectious Bursal Disease (IBD). The serological tests were conducted for Infectious Bursal Disease using the Agar Gel Immuno Diffusion (AGID) method and ELISA. Mycoplasma gallisepticum and synoviae serological test used the ELISA test. The serum pool volumes were adequate for each of the 18 strains to be tested. Serology results for MG, MS, and IBD are shown in Table 2. The chicks were MG and MS negative and the IBD antibody levels were positive, indicative of a reasonable breeder vaccination programs in the breeder flocks of all strains. IBD titers were present in all the strains and the titer levels for the individual samples appeared to have a greater variation between strains than seen in previous reports. The distribution of the sample titers across strains is shown in Figure 1.

**Table 2. Determination of MG and MS presence and status of the IBD parental immunity in the participating strains in the 40th NCLP&MT**

<b>Source Code &amp; Strain</b>	<b>MG<sup>1</sup></b>	<b>MS<sup>1</sup></b>	<b>IBD<sup>2</sup></b>	<b>Result</b>	<b>S/P<sup>3</sup></b>
ISA-Bovans White	- Neg	- Neg	+ Pos		4.437
ISA-Shaver White	- Neg	- Neg	+ Pos		1.71
ISA-Dekalb White	- Neg	- Neg	+ Pos		0.751
ISA-Babcock White	- Neg	- Neg	+ Pos		1.016
ISA-B 400 White	- Neg	- Neg	+ Pos		0.755
HL-W-80	- Neg	- Neg	+ Pos		1.547
HL-W-36	- Neg	- Neg	+ Pos		2.845
HL-White Exp	- Neg	- Neg	+ Pos		3.820
L-LSL Lite	- Neg	- Neg	+ Pos		3.192
H&N-Nick Chick	- Neg	- Neg	+ Pos		1.008
N-Novowhite	- Neg	- Neg	+ Pos		2.057
ISA-Bovans Brown	- Neg	- Neg	+ Pos		3.845
ISA-Brown	- Neg	- Neg	+ Pos		0.588
HL-Brown	- Neg	- Neg	+ Pos		1.412
HL-Silver Brown	- Neg	- Neg	+ Pos		0.522
L-LB Lite	- Neg	- Neg	+ Pos		1.502
N-Novobrown	- Neg	- Neg	+ Pos		1.947
TA-TETRA Brown	- Neg	- Neg	+ Pos		3.106

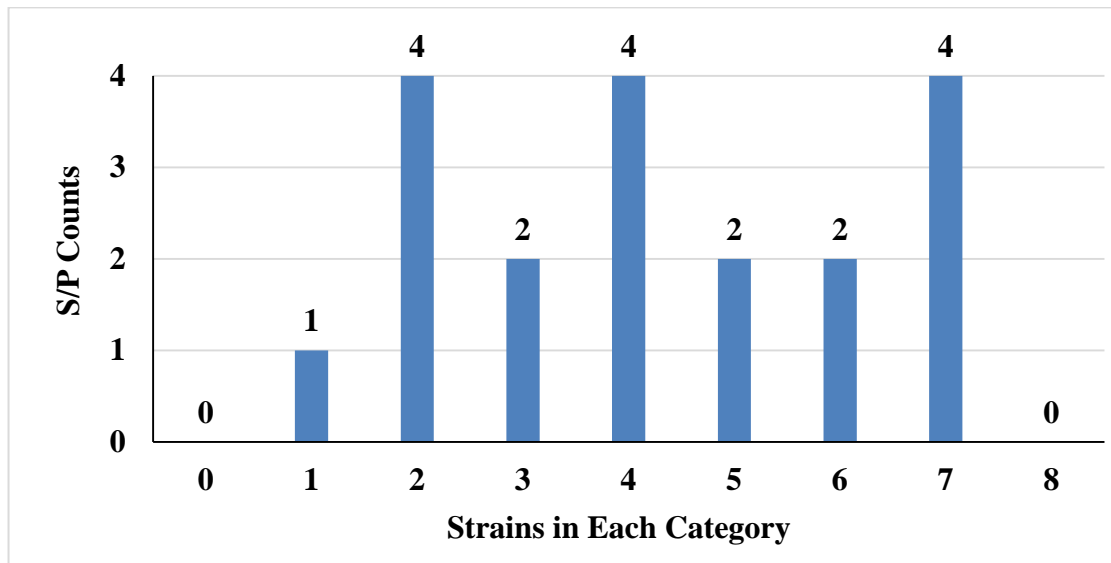
Samples n=10 pooled serum samples/strain representing 20 chicks

<sup>1</sup>MG and MS status was determined using the ELISA method

<sup>2</sup>IBD status was determined using Agar Gel Immune Diffusion (AGID) by Synbiotics Corp

<sup>3</sup>S/P =Titer for IBD

**Figure 1. Graphical representation to Compare Case Report with Table 2: 40<sup>th</sup> NCLP&MT Distribution of strain serum samples across titer groups (20540-IBD-XR)**



**Table 3. Eggs delivered and set for the 40<sup>th</sup> NCLP&MT**

Strain Code	Eggs Delivered	Eggs Set	Transport	Egg Pull
			Damage	Transfer
			(% of Delivered)	(% of Set)
ISA-Bovans White	2160	2152	0.37	0.0
ISA-Shaver White	2520	2514	0.24	0.0
ISA-Dekalb White	2880	2873	0.24	0.0
ISA-Babcock White	2520	2513	0.28	0.0
ISA-B 400 White	2520	2518	0.08	0.0
HL-W-80	2880	2849	1.08	0.0
HL-W-36	2880	2870	0.35	0.0
HL-White Exp	1080	1075	0.46	0.09
L-LSL Lite	2880	2869	0.38	0.07
H&N-Nick Chick	2880	2849	1.08	0.0
N-Novowhite	2520	2494	1.03	0.0
ISA-Bovans Brown	2520	2515	0.20	0.0
ISA-Brown	2520	2519	0.04	0.0
HL-Brown	3600	3588	0.33	0.0
HL-Silver Brown	3240	3215	0.77	0.28
L-LB Lite	3600	3586	0.39	0.0
N-Novobrown	2520	2507	0.52	0.0
TA-TETRA Brown	2520	2514	0.24	0.0

Pre-Incubation Handling and Storage: The eggs for the 40<sup>th</sup> NCLP&MT were delivered by company representatives from May 5, 2016 through May 9, 2016 in either vans or other delivery vehicles; one strain arrived in US via Air Freight overnight (Table 3). Upon arrival, eggs were inspected and placed in incubation trays and stored in the holding area. The holding area was

maintained at 65 ° F ± 3 °F and a 75-80% relative humidity. At 2:00 am on Tuesday, May 10, 2016, approximately 5 hours prior to set, all eggs were tempered to 80 °F in the hatchery work room. Beginning at 7:00 am, the eggs were transferred to the incubators; this process was completed by 11:30 am when the incubator doors were closed. The incubators were fumigated at set with formaldehyde to minimize potential microbial population variations from the different sources of eggs.

Incubator and Hatcher: The incubators are set up with an automatic dialing alarm to notify the managers of electrical, temperature or humidity problems. The temperature and humidity were recorded three times each day with the temperature range and humidity shown in Table 4. The incubation temperatures ranged in all incubators from 99.3 to 99.6 °F with a set point of 99.5 °F and the relative humidity was steady at 55 to 56% which were the same as those used in our weekly hatches. The incubator temperature was lowered to 98.5 °F on May 26, 2016 (day 16) due to the increased metabolic heat generated by the embryos. The eggs were transferred from the incubators to the hatchers on May 28, 2016 (day 18). The hatchers were set at 98.0 °F. There was a direct 1 to 1 egg transfer from incubation trays into the hatching trays.

**Table 4. Hatchery: Incubator and hatcher temperature range, average relative humidity, and average egg shell temperatures**

Day-Date	Temperature <sup>1</sup> Range (°F)	Humidity (%)	Egg Shell Temperature (°F)	Comment
Set-5-10-16	99.5	55		Reached temp at 4:00 pm
1-5/11/16	99.3 to 99.6	55		
2-5/12/16	99.5	55		
3-5/13/16	99.4 to 99.5	55		
4-5/14/16	99.4 to 99.5	55		
5-5/15/16	99.5	55		
6-5/16/16	99.4 to 99.5	55		
7-5/17/16	99.4 to 99.5	55		
8-5/18/16	99.4 to 99.5	55		
9-5/19/16	99.5	55	98.8 - 100.0	
10-5/20/16	99.4 to 99.5	55		
11-5/21/16	99.4 to 99.5	55		
12-5/22/16	99.5	55		
13-5/23/16	99.5	55	100.5 - 100.8	
14-5/24/16	99.4 to 99.5	55		
15-5/25/16	99.0 to 99.4	55	101.5 - 102.1	Dropped temperature set point to accommodate embryonic metabolic heat
16-5/26/16	98.5	55	100.8 - 101	Shell surface temperature dropped
17-5/27/16	98.5	55		Eggs transferred to hatchers
18-5/28/16	98	56		
19-5/29/16	98	56		
20-5/30/16	98	56		
21-5/31/16	98	56		Started pulling chicks at 9:00 pm

<sup>1</sup>Temperatures in machines recorded at 8:00 am, 12:00 pm, and 4:00 pm.

**Hatch:** Hatch residues were examined to evaluate potential hatch problems, including fertility and embryonic mortality at specific points during the incubation period. The evaluation was conducted on a random sample of approximately 1080 eggs for all eggs set in each strain. The residues remaining in the hatching trays on the hatch day were examined from 6 trays. Table 5 shows the percent usable chicks, cull chicks, and residue of the total eggs set for each strain. Table 6 shows the distribution of the residue by each embryonic category and is based upon the percentages of the total egg residue.

**Table 5. Analysis of hatch by evaluating chicks pulled, female, male, and cull chicks as a percentage of the total eggs set for the 40<sup>th</sup> NCLP&MT**

Strain Code	Chicks Pulled	Female Chicks <sup>1</sup>	Male Chicks	Cull Chicks	Total Egg Residue
	-----%-----				
ISA-Bovans White	82.2	41.2	41.0	0.1	17.7
ISA-Shaver White	80.0	37.4	42.7	0.0	20.0
ISA-Dekalb White	48.0	25.9	22.1	0.7	51.3
ISA-Babcock White	71.5	37.2	34.4	0.8	27.6
ISA-B 400 White	62.6	32.6	30.0	1.4	36.0
HL-W-80	70.0	37.4	32.6	1.1	28.9
HL-W-36	82.4	42.1	40.3	1.5	16.1
HL-White Exp	76.3	40.6	35.7	1.5	22.2
L-LSL Lite	89.2	46.0	43.2	0.4	10.4
H&N-Nick Chick	83.9	43.4	40.5	0.6	15.5
N-Novowhite	69.0	37.6	31.4	0.8	30.2
ISA-Bovans Brown	84.4	38.5	45.8	0.3	15.3
ISA-Brown	86.1	39.5	46.6	0.1	13.8
HL-Brown	73.0	36.5	36.5	0.4	26.7
HL-Silver Brown	83.7	38.7	45.0	0.1	16.2
L-LB Lite	71.8	44.0	27.8	0.1	28.1
N-Novobrown	79.5	44.1	35.4	0.2	20.3
TA-TETRA Brown	84.4	39.3	45.2	0.2	15.4

<sup>1</sup>Calculated as a percentage of total eggs set.

**Table 6. Analysis of breakout to determine cause of embryo mortality as percent of residue sample (n=1080/strain) for the 40<sup>th</sup> NCLP&MT**

Strain Code	Infertile	Early Dead		Dead		Air Cell		Pipped		Contam <sup>1</sup>	Abnormal		Upside	Crack
		Mem	Blood	Mid	Late	Pre-pip	Post-pip	Live	Dead		Shell <sup>2</sup>	Embryo	Down <sup>3</sup>	
-----%-----														
ISA-Bovans White	15.09	18.87	1.89	6.60	10.38	14.15	0.94	20.75	1.89	0.00	0.00	5.66	3.77	0.00
ISA-Shaver White	15.57	10.66	9.02	15.57	4.10	15.57	9.02	18.03	0.82	0.00	0.00	0.82	0.82	0.00
ISA-Dekalb White	73.50	6.58	6.02	2.07	2.07	3.20	1.69	3.76	0.00	0.00	0.00	0.94	0.00	0.19
ISA-Babcock White	48.70	14.29	8.12	4.55	3.25	5.19	4.55	9.09	0.65	0.00	0.00	0.65	0.97	0.00
ISA-B 400 White	42.16	10.13	8.17	4.90	2.29	6.21	7.84	10.46	0.98	1.31	0.00	2.61	2.94	0.00
HL-W-80	8.15	11.59	5.15	15.88	0.86	25.75	6.87	9.01	6.87	2.58	0.00	3.00	3.86	0.43
HL-W-36	10.62	17.70	8.85	20.80	3.54	18.58	3.54	7.52	3.54	0.88	0.00	2.65	1.33	0.44
HL-White Exp	14.67	14.67	10.22	14.22	10.67	18.67	4.00	6.67	1.33	1.78	0.44	1.33	0.89	0.44
L-LSL Lite	18.39	21.84	10.34	13.79	4.60	8.05	4.60	14.94	0.00	1.15	0.00	1.15	1.15	0.00
H&N-Nick Chick	25.40	16.67	7.94	7.14	3.97	6.35	5.56	19.84	0.79	1.59	0.00	0.79	3.17	0.79
N-Novowhite	9.27	22.93	8.78	13.17	5.85	8.29	5.85	14.63	2.44	1.95	0.00	2.44	0.49	3.90
ISA-Bovans Brown	43.72	10.05	6.03	7.04	8.04	12.56	3.52	1.01	1.51	2.01	0.00	3.02	1.01	0.50
ISA-Brown	22.22	16.99	6.54	7.19	15.03	15.03	7.84	5.23	0.65	0.65	0.00	1.96	0.65	0.00
HL-Brown	10.45	16.79	10.82	8.58	6.72	20.15	6.34	10.45	2.24	0.00	0.00	2.24	5.22	0.00
HL-Silver Brown	15.93	9.34	7.14	8.24	9.89	13.74	9.34	14.29	4.40	4.40	0.00	2.20	1.10	0.00
L-LB Lite	12.80	16.80	9.60	13.60	4.80	9.60	12.00	5.60	4.80	0.00	0.00	10.40	0.00	0.00
N-Novobrown	42.35	18.82	2.35	12.94	4.71	4.71	4.71	0.59	1.76	0.59	0.00	1.76	2.35	2.35
TA-TETRA Brown	25.60	9.52	7.41	4.76	5.36	32.14	2.98	5.95	1.19	0.00	0.00	2.98	1.79	0.60

<sup>1</sup>Contaminated eggs.

<sup>2</sup>Abnormal shell structure.

<sup>3</sup>Eggs set with the small end up.

## **Pullet Housing and Management:**

Housing: The chicks were weighed and randomly assigned to the growing replicates with white egg and brown egg replicates being intermingled throughout the rooms within House 8, 4, and range houses. Strain assignment codes indicate the cage/pen arrangement, replicate identification numbers, and the strain assignments for brood-grow House 4 and 8. Strain codes are maintained by the PI and Unit Manager for identification of birds and record keeping. Individual birds are identified by a permanent identification tag with a four-digit replicate number. Each replicate number indicates room, row, level and replicate within the house

House 8: House 8 is an environmentally controlled windowless brood-grow facility with 3 banks of quad-deck cages in each room. Each room has been assigned a number and each bank has been assigned a row number. 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 on all levels. This allows for a total of 3,744 pullets per room resulting in a total pullet count of 12,220 birds. Strains will be assigned to the replicates in a restricted randomized manner with the restrictions being that all strains are approximately equally represented in all rooms, rows, and levels, as described earlier under the experimental design. All chicks will be brooded in the same cage during the entire 16 week rearing period. Paper will be placed on the cage floor for the first seven days. . Each cage within the replicate will be 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.

House 4: House 4 is a windowless, environmentally controlled slat-litter cage-free facility that is set up to include whole house heat capabilities. It will serve dual purpose for brooding/rearing and production of the cage-free birds. House 4 is divided into 36 pens which are 2.43 m x 3.05 m (8.0 ft x 10 ft). Sixty-five chicks per pen are provided a minimum of 929 cm<sup>2</sup>/pullet. The rearing protocol is as identical to the cage reared hens as possible. Roosts will be included in the rearing pen to allow the pullets to learn to utilize vertical space, improving the use of nests as hens enter production.

Range Huts: The range houses are set up to include whole house heat capabilities allowing for both brooding/rearing and production of the range birds. The slats will be covered with landscape cloth and a layer of wood shavings. Sixty-five chicks will be started in each 4 m x 2 m (12.1 ft x 6.6 ft) pen providing a minimum of 929 cm<sup>2</sup>/pullet. The rearing protocol will be as identical to the cage reared hens as possible. The litter will be removed after brooding so the pullets can become accustomed to slats.. Pullets will be provided 13 cm of roosting space/bird. The range hut has a timer and light, supplemental propane heater for brooding and cool conditions to maintain an interior temperature within the Thermal Neutral Zone (TNZ) where body temperature will be maintained.

At 12 weeks of age the pullets will be allowed access to their respective range paddocks where the completion of the rearing will be done. They will have free access to the outdoors throughout the day and night but will be trained to return during the dark for roosting and protection.



**Table 6. Entries in the 40th NCLP&MT by Breeder, Stock Suppliers, and Categories**

Breeder	Stock	Category <sup>1</sup>	Source	
Hy-Line International 2583 240 <sup>th</sup> Street Dallas Center, IA 50063	W-36	I-A	Hy-Line North America 4432 Highway 213, Box 309 Mansfield, GA 30255	
	W-80	I-A	(Mansfield, PA)	
	Hy-Line Brown	I-A	HyLine North America 79 Industrial Rd Elizabethtown, PA 17022	
	Hy-Line Silver Brown	I-A	(Elizabethtown, PA)	
Lohmann Tierzucht GmbH Am Seedeich 9-11 . P.O.Box 460 D-27454 Cuxhaven, Germany	Hy-Line White Exp.	II-A	(Mansfield, PA)	
	Lohmann LSL-Lite	I-A	Hy-Line North America 79 Industrial Rd Elizabethtown, PA 17022	
Lohmann Tierzucht GmbH Am Seedeich 9-11 . P.O.Box 460 D-27454 Cuxhaven, Germany	Lohmann LB-Lite	I-A	(Same)	
	H&N International 321 Burnett Ave South, Suite 300 Renton, Washington 98055	H&N "Nick Chick"	I-A	Feather Land Farms 32832 E. Peral Road Coberg, OR 97408
Instiut de Selection Animale (A Hendrix Genetic Company) ISA North America 650 Riverbend Drive, Suite C Kitchener, Ontario N2K 3S2 Canada	Bovans White	I-A	Hendrix-ISA LLC 621 Stevens Rd Ephrata, PA 17522	
	Dekalb White	I-A	(Ephrata, PA)	
	Bovans Brown	I-A	(Ephrata, PA)	
	Babcock White	I-A	Institute de Sélection Animale 50 Franklin Road Cambridge, Ontario N1R 8G6 Canada	
	B 400	I-A	(Cambridge, Ontario)	
	Shaver White	I-A	(Ephrata, PA)	
Tetra Americana, LLC 1105 Washington Road Lexington, GA 30648	ISA Brown	I-A	(Ephrata, PA)	
	Tetra Americana, LLC 1105 Washington Road Lexington, GA 30648	TETRA Brown	II-A	BABOLNA TETRA KFT Babolna TETRA Korisvolgy1 Uraiujfalu, Hungary-EU
	NOVOGEN S.A.S. Mauguérand – Le Foeil BP 265 22 800 QUINTIN - FRANCE	NOVOgen BROWN	I-A	Morris Hatchery 4090 Campbell Road Gillsville, GA
	NOVOgen WHITE	I-A	(Gillsville, GA)	

<sup>1</sup> I = Extensive distribution in southeast United States  
II = Little or no distribution in southeast United States

A = Entry requested