

## Metabolism and Nutrition: Nutrition - Feeds and Manufacturing

**99 Effects of marker selection and mix time on coefficient of variation in the mixing process.** P. M. Clark\* and K. C. Behnke, *Kansas State University, Manhattan.*

An experiment was conducted to evaluate marker selection and mix time on mix uniformity in the feed manufacturing process as determined by percent coefficient of variation (% CV). A corn-soybean meal based diet was formulated for broiler chicks from d 0 to 17. Dietary nutrients or tracers evaluated included: 1) salt (chloride ion); 2) phosphorus; 3) manganese; 4) iron particles (Micro Tracer™ Red #40 by count)(MTC); 5) iron particles (Micro Tracer™ Red #40 by absorbance)(MTA); 6) iron particles (Micro Tracer™ RF Blue Lake)(MTB); 7) roxarsone; 8) semduramicin; 9) DL-Methionine; 10) HCl-Lysine; and 11) crude protein. Diets were mixed with a double ribbon mixer for three different mix times (0.5, 2.5, and 5.0 min). Ingredients were weighed separately and added in the same location for all treatments. Following the mix cycle, feed was conveyed to a sacking bin by a discharge screw and bucket elevator. Samples (5 kg) were collected from 10 sacks (i.e. 1,3,5, etc.) for % CV calculation. Within each sample, all markers were analyzed for that particular batch. With the exception of protein and MTA, all marker data reported a considerable reduction in % CV as a percent, ranging from 17.3% (roxarsone) to 52.9% (phosphorus) from 0.5 to 2.5 minute mix time. From 2.5 to 5.0 minutes, salt, roxarsone, and MTC, % CV increased, while all other markers continued to reduce in % CV. Overall, from 0.5 to 5.0 minutes all markers showed a reduction in % CV however, crude protein should not be considered as a marker due to all major components contribute some level of protein and can be difficult to determine if the batch has been mixed adequately.

**Table 1. Effect of marker selection and mix time on diet uniformity**

Item, % CV	Mix time (minutes)		
	0.5	2.5	5.0
Salt (chloride ion)	20.3	12.8	15.1
Phosphorus	13.7	6.5	6.3
Manganese	36.3	20.8	17.6
Micro Tracer™ Red #40 (count)	21.8	11.7	15.1
Micro Tracer™ Red #40 (absorbance)	21.1	20.5	16.9
Micro Tracer™ RF Blue Lake	32.5	20.1	18.6
Roxarsone	30.4	25.2	25.5
Semduramicin	27.4	16.1	11.2
DL-Methionine	23.9	14.6	9.5
HCl-Lysine	19.8	16.0	8.7
Crude Protein	7.7	7.3	6.9

**Key Words:** mixer analysis, diet uniformity

**100 The effects of cellulose and soy protein isolate on pellet manufacture variables and quality.** N. P. Buchanan\*, J. M. Hott, S. E. Cutlip, and J. S. Moritz, *West Virginia University, Morgantown.*

The majority of broiler feed is in pelleted form. Feeding pelleted diets results in an increase in weight gain and feed efficiency compared to feeding mash diets. Improvements in performance are contingent

upon pellet quality. Past research has focused on methods to improve pellet quality without negatively affecting processing variables and performance. However, data are limited. Pellet quality is measured using the Pellet Durability Index (PDI), Modified Pellet Durability Index (MPDI), and calculating the percentage of fine particles present after pelleting. Improvement in pellet quality may be achieved through thermal alterations of starch, fiber, and protein. The objective of the current study was to evaluate the effects of cellulose and soy protein isolate inclusion on pellet manufacture variables and quality in a corn-soybean based broiler diet. Cellulose or soy protein isolate was included at 5% into a corn-soybean based diet at the expense of corn. A control (CON), a cellulose (CELL), and a soy protein isolate (SPI) diet were manufactured in a Latin Square Design over a three-day period. All feed was conditioned at 82.2°C using a steam pressure of 262kPa. The mean ambient temperature during processing was -0.63°C. Production rate, percentage of fines, and bulk density did not differ between treatment (P=0.5366, 0.1700, and 0.1778, respectively). Relative to the control diet, cellulose or soy protein isolate inclusion improved PDI by 8.19 and 7.50% (P=0.0450) and MDPI by 13.44 and 11.67%, respectively (P=0.0527). Pelleting resulted in the addition of 3.34, 4.11, and 3.70% moisture for CON, CELL, and SPI, respectively (P=0.2834). Pellet moisture loss following three-day storage at 11.7°C averaged 3.48% and did not differ between treatment (P=0.9415). These results demonstrate that the addition of cellulose or soy protein isolate to a corn-soybean based broiler diet may improve pellet quality without negatively affecting processing variables.

**Key Words:** soy protein isolate, cellulose, pellet quality

**101 Effect of steam conditioning practices on pellet quality and growing broiler nutritional value.** S. Cutlip\*, J. Hott, N. Buchanan, and J. Moritz, *West Virginia University, Morgantown.*

Feed incurs 60-65% of broiler production cost. Research demonstrates that feeding pellets opposed to mash improves broiler performance. However, pellet quality and subsequent beneficial effects vary based on means of feed processing. Optimization of pellet quality through precision thermo-mechanical processing may decrease broiler production cost. This study evaluates the effect of steam conditioning practice on pellet quality and growing broiler nutritional value. A Latin Square Design was implemented to measure interactions among conditioning temperature and steam pressure. Corn-soybean meal based diets were processed with one of four temperature x steam pressure combinations: 82.2°C at 138 kPa, 93.3°C at 138 kPa, 82.2°C at 552 kPa or 93.3°C at 552 kPa. Three additional diets were prepared: unprocessed mash, the 93.3°C/552 kPa diet reground to mash, and a 50:50 combination of pellets and reground mash produced from the 93.3°C/552 kPa treatment to simulate a high fines percentage diet. Pelleted diets were tested for quality through calculations of pellet durability index (PDI), modified pellet durability index (MPDI) and percentage of fines. Each of the seven treatments was fed to eight replicate pens of 16 straight-run Cobb X Cobb broilers during the 21-to-39 day growing period. Pellet durability index and MPDI improved as temperature was increased (P=0.0001 and 0.0001 respectively). Higher processing temperatures also reduced percentage of fines (P=0.0397). Feed conversion ratio and live weight gain (LWG) improved with increasing processing temperature (P=0.0321 and 0.0001 respectively). Higher steam pressure improved MPDI (P=0.0299); however, higher steam pressure did not improve broiler

performance. Broilers fed the additional three diets had lower feed intake and lower LWG ( $P \leq 0.05$ ). Elevated thermo-mechanical processing produced better quality pellets subsequently leading to improved broiler performance. These effects may be attributed to the physiochemical changes induced by pelleting at the above normal conditions of 93.3°C and 552 kPa.

**Key Words:** steam conditioning, pelleting, broilers

**102 Effect of moisture addition with a mold inhibitor on feed manufacture, pellet quality and broiler performance.** J. M. Hott\*, N. P. Buchanan, S. E. Cutlip, and J. S. Moritz, *West Virginia University, Morgantown.*

Pelleting broiler diets improves feed efficiency and increases live weight gain. The addition of moisture at the mixer to corn-soybean based diets has been shown to improve pellet durability, increase pellet throughput and decrease pellet mill energy consumption. However, moisture addition may dilute feed nutrients and negatively impact broiler performance. In addition, feeds with high moisture levels may be susceptible to mold spore germination and growth. To prevent mold proliferation, commercial inhibitors are available for diet inclusion. The objective of this study was to evaluate the effects of top-dress moisture addition plus a mold inhibitor on feed manufacture, pellet quality, and broiler performance. Two experiments were conducted. In experiment one, the following three diets were manufactured at the WVU pilot feed mill: control (CON), control + 1% addition of water: Mold inhibitor (95:5), and control + 2% addition of water: Mold inhibitor (95:5). Manufacturing was replicated three times using a Latin Square Design. Bulk density, production rate, pellet durability index (PDI), fines percentage, electrical energy usage, and starch gelatinization were measured. In experiment two, day-old, straight-run, Cobb 500 broiler chicks were divided into 30 pens of 16 each. Dietary treatments of experiment one were randomly assigned to 10 replicate pens. Performance variables included live weight gain, feed intake and feed conversion.

**Key Words:** mold inhibitor, moisture, feed manufacture

**103 The effects of whole grains on growth performance, nutrient digestibilities, and cecal short-chain fatty acid production in young chicks.** P. Biggs\*, P. Utterback, E. Kim, C. King, R. Dilger, C. Scherer, and C. Parsons, *University of Illinois, Urbana.*

Five experiments were conducted to evaluate whole wheat, whole sorghum, or whole barley in ground corn-soybean meal diets fed to young chicks. The first four studies utilized New Hampshire x Columbian male chicks and the fifth study used Ross X Ross commercial male chicks. In the first experiment, feeding 5, 10, 15, or 20% whole wheat had no effect on growth at 21 days when compared with chicks fed the control diet. In the second experiment, feeding 10 or 20% whole wheat from 0 to 21 days or from 8 to 21 days had no significant effect on growth performance. The third experiment tested 20, 35, and 50% whole wheat fed from 0 to 21 days of age and showed that a 50% whole wheat diet decreased ( $P < 0.05$ ) 21-day growth and feed efficiency when compared to chicks fed the control diet. In Experiment 4, 10 and 20% whole sorghum caused a reduction ( $P < 0.05$ ) in growth at 21 days while chicks fed 10 and 20% whole barley had similar weight gains to chicks fed a corn-soybean meal diet. The fifth

study with commercial broiler chicks evaluated 10 and 20% whole sorghum or whole barley and 20 and 35% whole wheat. Growth at 21 days was unaffected by any dietary treatment. Feed efficiency was decreased ( $P < 0.05$ ) at 21 days with 20% whole wheat and improved ( $P < 0.05$ ) with 10% whole barley. Feeding whole grains to chicks caused an increase in relative gizzard weight, even as early as 7 days, in all experiments. The greatest increase in relative gizzard weights occurred with 20% whole barley and 20 and 35% whole wheat. Chicks fed diets containing 10 to 20% whole wheat generally had increased MEN values at 3-4, 7, 14, and 21 days and also had slight increases in amino acid digestibility at 21 days in one experiment. At 21 days, cecal pH and short-chain fatty acid concentrations in all experiments were unaffected by feeding whole grains to chicks. The results of this study indicated the feeding whole wheat, sorghum, or barley increases gizzard weight and feeding 10 to 20% whole wheat may increase MEN and amino acid digestibility.

**Key Words:** whole wheat, whole sorghum, whole barley

**104 Increasing the number of phases fed to broiler chickens by blending diets.** R. Currie\*<sup>1</sup>, J. MacIsaac<sup>2</sup>, and B. Rathgeber<sup>3</sup>, <sup>1</sup>*Nova Scotia Agricultural College, Truro, NS, Canada*, <sup>2</sup>*Atlantic Poultry Research Institute, Truro, NS, Canada*, <sup>3</sup>*Agriculture & Agri-Food Canada, Truro, NS, Canada.*

Increasing metabolizable energy and decreasing protein levels in broiler chicken diets is the traditional phase feeding concept intended to approximate the requirements of the bird to avoid wastage of nutrients and reduce feed costs. Commercial feed weighers are capable of blending several feeds prior to delivery to feeders and therefore, provide the opportunity to increase the number of phases administered to a broiler flock without formulating additional rations. The objective of this project was to determine the value of feeding an additional two phases as 50/50 blends of starter and grower and grower and finisher in a broiler chicken feeding regime. 912 male broiler chickens were randomly assigned to one of 24 pens (38 birds/pen). There were 12 replications of either a standard three phase diet or 5 phase diet. The control birds were fed starter (23% crude protein (CP), 3050 Kcal of ME/kg) for the first two weeks, grower (20% CP, 3150 Kcal of ME/kg) for the next two weeks and finisher (18% CP, 3200 Kcal of ME/kg) until 35 days of age at which point the birds were shipped. The treatment birds were fed starter the first week, a 50/50 blend of starter and grower the second week, grower the third week, a 50/50 blend of grower and finisher the fourth week and finisher the last week. All birds were weighed on days 7, 14, 21, 28, and 35 and feed consumed was monitored. Pen means were analyzed using the proc mixed function of SAS with repeated measures. The body weight of birds was unaffected by the feed treatments for all dates measured with the birds reaching 1993g by day 35. Overall feed efficiency was the same for both feeding programs. However, during the second week of growth the birds on the starter (FE=1.44) were more efficient ( $P < 0.05$ ) than the birds on the starter/grower 50/50 blend (FE=1.62). Results indicate that the use of a feed weigher to blend feed phases could provide an economic benefit to producers since birds performance is not reduced but feed costs would be since the earlier phase feeds are more expensive.

**Key Words:** broiler chicken, phase feeding, growth performance

**105 Phosphorus bioavailability, TME<sub>n</sub>, and amino acid digestibilities of high protein corn distillers dried grains with solubles and dehydrated corn germ meal.** E. J. Kim\*, P. L. Utterback, and C. M. Parsons, *University of Illinois, Urbana.*

There is currently much ongoing research and interest for developing new processing technologies to produce corn distillers dried grains with solubles (DDGS). The current study evaluated a high protein (HP) DDGS and a dehydrated corn germ meal which are the products that can be produced by a modified dry milling process. To evaluate the nutritional characteristics of these products, a chick experiment was conducted to determine the phosphorus (P) bioavailability based on tibia ash. In addition, precision-fed rooster assays were conducted to determine TME<sub>n</sub> and amino acid digestibility. For the chick assay, a P-deficient cornstarch-dextrose-soybean meal basal diet containing 0.10% non-phytate P was supplemented with 0.0, 0.05 and 0.10% P from KH<sub>2</sub>PO<sub>4</sub> or 7 and 14% conventional DDGS, HP DDGS, and corn germ meal. New Hampshire x Columbian female chicks were fed the experimental diets from day 9-23 days post hatch and bioavailability of P was estimated using the slope-ratio method where tibia ash was regressed on P intake. The total P content (90% DM basis) of the conventional DDGS, HP DDGS, and corn germ meal were 0.76, 0.33, and 1.22%, respectively. Bioavailability of the P in conventional DDGS, HP DDGS, and corn germ were found to be 60%, 58%, and 25%, respectively. The TME<sub>n</sub> in conventional roosters was found to be significantly increased for the corn germ meal when compared to the HP DDGS. The protein content (90% DM basis) of the HP DDGS and corn germ meal was 33% and 14%, respectively, and the total lysine as a % of CP was approximately two times greater for the corn germ meal than for the HP DDGS. Amino acid digestibilities in cecectomized roosters were consistently higher for the corn germ meal than in the HP DDGS.

**Key Words:** distillers dried grains with solubles, corn germ meal, phosphorus

**106 Evaluating by-products of the Atlantic Shellfish Industry as alternative feed ingredients for laying hens.** M. A. Daniel\* and D. M. Anderson, *Nova Scotia Agricultural College, Truro, NS, Canada.*

The low biodegradability of waste products generated from the Atlantic Shellfish Industry has raised concerns over disposal practices and their impact on the environment.

Processing of shellfish by-products isolates valuable compounds and provides protein rich feed ingredients for poultry. A 34-wk production study will be conducted to evaluate the effects of supplementing laying hen diets with crab meal (CM) and lobster meal (LM). Four hundred and thirty-two Shaver White Leghorn pullets (34 wks of age) will be randomly allocated to 1 of 6 diets (Control, 2.5% CM, 2.5% LM, 5% CM, 5% LM, 2.5% CM + 2.5% LM). Feed consumption, egg weight, egg specific gravity, albumen height, and egg yolk parameters will be evaluated monthly for 34 wks. Egg production will be monitored daily. Calcium (Ca) retention will be determined at early (34 wks), mid (54 wks) and late (68 wks) production by analyses of dietary treatment, egg shell and excreta Ca content. Wing bones collected at 36 wks (10 birds), 54 wks (36 birds) and 68 wks (36 birds) will be analyzed for bone density, bone breaking strength and Ca content. An in vitro solubility trial will be conducted to examine the potential of mollusc shells, CM and LM as dietary Ca sources. Preliminary results on egg yolk parameters showed that there was an increase in red pigmentation on d28 and d56 from treatments supplemented with CM and LM when

compared to control ( $p < 0.05$ ). This suggests that the laying hen is capable of depositing dietary carotenoids in the egg yolk, which could be beneficial in producing eggs with elevated antioxidant content.

**Key Words:** laying hen, crab and lobster meal, egg yolk pigmentation

**107 Corn hybrid kernel trait variation affects broiler chicken growth performance.** S. Moore\*<sup>1</sup>, D. Beitz<sup>1</sup>, K. Stalder<sup>1</sup>, C. Stahl<sup>1</sup>, W. Fithian<sup>2</sup>, and K. Bregendahl<sup>1</sup>, <sup>1</sup>*Iowa State University, Ames,* <sup>2</sup>*Golden Harvest Seeds, Inc., Waterloo, Nebraska.*

Variation in corn kernel physical and chemical traits among corn hybrids may affect broiler chicken growth performance. Six commercial Golden Harvest brand corn hybrids (A, B, C, D, E, F) were added to a soybean meal-based basal diet and formulated for 0–2 wk of age (Phase [Ph] 1; 0.77% TSAA, 1.06% Lys), 2–4 wk (Ph 2; 0.71% TSAA, 0.98% Lys), and 4–6 wk (Ph 3; 0.61% TSAA, 0.85% Lys). All diets contained 3.2 Mcal/kg ME<sub>n</sub>. A total of 720 male 1-d-old Ross-308 broiler chicks were allotted to floor pens (10 chicks/pen) in a randomized complete block design (12 blocks). Feed intake and BW were recorded every 2 wk and flock uniformity (pen CV) was determined at 6 wk of age. Data were analyzed using ANOVA, and hybrids compared by using Fisher's least significant difference ( $P < 0.1$  considered significant). In Ph 1, the average daily gain (ADG) of chicks fed Hybrid F was 4.4% greater than that of those fed E ( $P < 0.1$ ). Feeding Hybrids A, C, or F improved the feed utilization (gain-to-feed ratio; GF) by up to 5.3% compared with D or E ( $P < 0.1$ ). Over the 6-wk period, chickens fed Hybrid E had up to a 4.4% higher GF compared with F or A ( $P < 0.1$ ), but no differences ( $P > 0.1$ ) were observed for ADG (55.5 g/d) or final BW (2.37 kg). The flock uniformity of chickens fed Hybrid C (10.8%) was better than when E (14.1%) or F (14.0%) was fed ( $P < 0.1$ ). During Ph 1, the improved ADG and GF of broilers fed Hybrid F correlated with smallest kernel size, second highest seed density, highest oil content, and midrange Lys and TSAA contents. During the overall 6-wk period, the GF improvement from feeding Hybrid E correlated with the second largest kernel size, midrange seed density, lowest oil content, and highest Lys and TSAA contents. In both cases, corn kernel fiber content did not correlate with growth performance. These results show that corn kernel physical and chemical traits can affect broiler growth performance and flock uniformity. In addition, growth performance improvements resulting from different corn hybrids are dependent on the age of the chickens.

**Key Words:** broiler, growth performance, corn hybrid

**108 Corn hybrid kernel trait variation affects laying-hen egg production.** S. Moore\*<sup>1</sup>, D. Beitz<sup>1</sup>, C. Stahl<sup>1</sup>, K. Stalder<sup>1</sup>, W. Fithian<sup>2</sup>, and K. Bregendahl<sup>1</sup>, <sup>1</sup>*Iowa State University, Ames,* <sup>2</sup>*Golden Harvest Seeds, Inc., Waterloo, Nebraska.*

Variation in corn kernel physical and chemical traits among corn hybrids may affect laying-hen egg-production performance. Six commercially available Golden Harvest corn hybrids (A, B, C, D, E, F) were added to a soybean meal-based basal diet to contain 85% of NRC (1994) nutrient recommendations (0.55% TSAA, 0.65% Lys). All diets contained at least 100% of NRC-recommended ME<sub>n</sub> (2.87 Mcal/kg), Ca (4.2%), and nonphytate P (0.33%). A total of 240 52-wk-old Hy-Line W-36 laying hens were allotted to cages (2 hens/cage) in a randomized complete block design (20 blocks). Egg production was recorded daily during the 14-wk-long study. Feed intake

and 1-d egg weights were recorded weekly. Data were analyzed using ANOVA with starting BW as a covariate, and hybrids compared using Fisher's least significant difference ( $P < 0.1$  considered significant). In the overall 14-wk period, egg production ranged from 77.1–84.5% and was up to 8.7% higher when Hybrid F was fed compared to A, C, D, or E ( $P < 0.1$ ). Egg weights only differed among Hybrids B (60.7 g) and C (62.4 g) ( $P < 0.1$ ). Egg mass (egg weight  $\times$  egg production) ranged from 47.3–51.9 g/d and was up to 7.7% higher when Hybrid F was fed compared to A or D ( $P < 0.1$ ). Feed intake ranged from 96.7–102.0 g/d and was up to 5.2% higher when Hybrid F was fed compared to A, B, or D ( $P < 0.1$ ). Egg specific gravity ranged from 1.069–1.073 and hens fed Hybrid F had the strongest eggshells compared to A, B, or D ( $P < 0.1$ ). Feed utilization ranged from 484–513 g egg-mass/kg feed and was up to 5.6% higher when Hybrid F was fed compared to A or D ( $P < 0.1$ ). The improved egg-production performance of hens fed Hybrid F; indicated by egg weight, egg mass, egg production, eggshell thickness, and feed utilization; correlated with smallest kernel size, second highest seed density, highest oil content, and midrange Lys and TSAA contents. Corn fiber content did not affect egg-production performance. These results demonstrate that corn kernel physical and chemical traits affect laying hen egg production performance.

**Key Words:** laying hen, corn hybrid, egg-production performance

**109 Effect of fat and fiber inclusion in the diet on ileal and fecal utilization of nutrients in broiler chicks.** J. M. González-Alvarado<sup>\*1</sup>, E. Jiménez-Moreno<sup>2</sup>, A. González-Serrano<sup>2</sup>, R. Lázaro<sup>2</sup>, and G. G. Mateos<sup>2</sup>, <sup>1</sup>Universidad Autónoma de Tlaxcala, México, <sup>2</sup>Universidad Politécnica de Madrid, Spain.

We studied the effects of type of fat [vegetable oil mixture (VO) vs. yellow grease (YG)] and source of fiber in the diet [none vs. oat hulls (OH) vs. sugar beet pulp (SBP)] on apparent ileal digestibility (AID)

and total tract apparent retention (TTAR) of nutrients in broilers. One-d-old male chicks (Cobb-500) were randomly allotted to 36 cages (18 birds/cage) and six cages were assigned to each treatment. The control diets (VO or YG without fiber inclusion) contained 1.5% crude fiber and were based on rice, soy protein concentrate, fish meal, fat (5%), and sepiolite (3%). In the remaining diets the fiber source was included at the expenses of sepiolite (wt/wt). Average daily gain (ADG) and feed conversion ratio (F:G) were measured from 1 to 15 d of age. Also, AID of DM, CP, and starch (ST), TTAR of nitrogen (NR) and ether extract (EE), and AMEn of the diets were measured at 15 d of age using 2% celite as an indigestible marker. Fecal retention of N (70.9% vs. 68.8%,  $P < 0.05$ ) and of EE (91.6% vs. 87.4%,  $P < 0.001$ ), and AMEn (3,237 vs. 3,178 kcal/kg,  $P < 0.001$ ) were higher for VO than for YG-based diets. However, type of fat did not affect AID of nutrients and had little effect on productive performance of broilers. The inclusion of a fiber source, either OH or SBP, tended to increase ADG (25.3 vs. 24.5 g/d, for the fiber diets and control diet, respectively;  $P = 0.07$ ) and improved F:G (1.245 vs. 1.308;  $P < 0.001$ ), TTAR of EE ( $P < 0.05$ ), and AMEn ( $P < 0.05$ ). Inclusion of SBP reduced AID of DM, CP, ST, and NR ( $P < 0.05$ ) whereas the OH inclusion did not affect AID of nutrients. An interaction type of fat  $\times$  inclusion of fiber was observed; the beneficial effects of fiber on AMEn were more noticeable with YG than with VO ( $P < 0.05$ ). The results indicate that type of fat and nature of the fiber influence nutrient utilization and that young broilers have a minimum requirement of insoluble fiber in the diet.

**Key Words:** nutrient digestibility, fat, crude fiber

## Physiology, Endocrinology, and Reproduction: Reproduction

**110 Transplantation of chicken ovaries: A breakthrough for germplasm conservation.** Y. Song\* and F. G. Silversides, *Agriculture and Agri-Food Canada, Agassiz, BC, Canada.*

Cryopreservation and transplantation of ovarian tissue is an effective method for conserving the female germline in rodents, but comparable techniques have not been available for birds. We recently developed a surgical technique for orthotopic transplantation of ovarian tissue in newly hatched chickens and demonstrated that the grafted tissue could attach and undergo development in the host. Normal ovarian function and the production of donor-derived offspring remained to be demonstrated. Twenty one day-old White Leghorn chicks were surgically transplanted with fresh ovarian tissue from day-old Barred Plymouth Rock chicks. Nine chicks were administered an immunosuppressant (100mg/kg CellCept<sup>®</sup>) after the surgery. All transplanted birds grew to sexual maturity but two of the immunosuppressed chicks underwent sex-reversal. Hens that had received the transplanted tissue were inseminated with semen from Barred Plymouth Rock roosters to determine the gametic origin of the offspring. Of the 12 hens in the non-immunosuppressed group, 9 have produced eggs. Of these 9 hens, 1 produced only black chicks originating from the

transplanted ovaries, 4 produced only white chicks from regenerated host ovaries, and one produced a mixture of black and white chicks. Eggs from the other 3 hens were fertile but all embryos died before pigment deposition. Six of the 7 hens in the immunosuppressed treatment produced eggs. Of the 6 hens, 1 produced only black chicks, 3 produced only white chicks, and 2 produced only embryos that died early in incubation. These results demonstrated that transplanted ovaries could produce normal eggs and give rise to donor-derived offspring, and provide a new approach to developing protocols for the cryopreservation of poultry stocks.

**Key Words:** chicken, ovary transplantation, germplasm conservation

**111 Storage of turkey semen at 4°C for 24h alters the sperm glycolyx.** J. Peláez and J. Long\*, *Beltsville Agricultural Research Center, Beltsville, Maryland.*

The glycolyx, a carbohydrate-rich zone on the surface of all eukaryotic cells, represents the primary interface between the male gamete and its environment and is known to be involved with immunoprotection in the