Evaluation of Event 5307 Transgenic Maize Grain in a Broiler Chicken Feeding Study

Data Requirement(s): EPA Guideline No. 885.4050

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Report No.: SSB-211-10

Study Completion Date: November 12, 2010

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Company: *Syngenta Seeds, Inc.*

Company Representative:

Demetra Vlachos | November 19, 2010

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Regulatory Affairs Manager

Date

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STATEMENT CONCERNING GOOD LABORATORY PRACTICE STANDARDS

This study was not conducted in compliance with Good Laboratory Practice Standards (GLPS) 40 CFR 160 (US EPA 1989) pursuant to the Federal Insecticide, Fungicide and Rodenticide Act, and subsequent revisions. However, the study was conducted according to accepted scientific methods, and the raw data and study records have been retained.

Study Director: There is no Study Director for this volume.

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SUMMARY

A 49-day feeding study evaluated whether standard poultry diets prepared with Event 5307 transgenic maize (corn) grain had any adverse effect on male or female broiler chicken survival, feed consumption, growth, feed conversion, or carcass characteristics as compared with diets prepared with control maize grain. Maize plants derived from transformation Event 5307 contain the transgene *ecry3.1Ab* encoding an eCry3.1Ab protein and the transgene *pmi* (also known as *manA*) encoding the enzyme phosphomannose isomerase (PMI).

Grain from 5307 transgenic maize plants was used to prepare diets designated '5307'; grain from nontransgenic, near-isogenic maize plants was used to prepare diets designated 'nontransgenic'; and a commercially available source of North Carolina maize grain was used to prepare diets designated 'NCSU 2007.' Starter, grower, and finisher diets were prepared using each source of maize grain and were formulated to meet the nutritional requirements of broilers for each stage of growth, with the maize content of the diets ranging from approximately 52% to 64% by weight.

There were no statistically significant differences in body weight or feed consumption among broilers fed the 5307 diets, the nontransgenic diets, and the NCSU 2007 diets. During the starter and finisher periods there were no differences in feed conversion. In the grower period broilers fed 5307 diets had an improved feed conversion (i.e., lower feed conversion ratios) compared with broilers fed the commercially available NCSU 2007 diets, but they were no different from the nontransgenic group. There were no effects on mortality due to maize grain source, and no statistically significant differences in the carcass portions (on an absolute weight basis) for males or females. Male broilers fed 5307 diets had decreased thigh weights (as a percentage of total body weight), compared with the male broilers fed nontransgenic diets, but they were no different from the males consuming the NCSU 2007 diets. Female broilers fed 5307 diets had decreased thigh and *pectoralis minor* weights (as a percentage of total body weight), compared with female broilers fed the nontransgenic and NCSU 2007 diets. No other statistically significant differences in carcass yield were observed when comparing the fat pad, drums, wings, or *pectoralis major* portions of broiler carcasses. There were no interactions between maize grain source and sex for any of the parameters measured throughout the study.

At the end of the study feeding period, samples of the 5307 transgenic grain and the nontransgenic grain as well as the starter, grower, and finisher diets prepared with these grains were analyzed for concentrations of eCry3.1Ab and PMI. It was confirmed that the 5307 grain and starter, grower, and finisher diets contained eCry3.1Ab. The presence of PMI was confirmed in the 5307 grain, and the corresponding starter and finisher diets. These proteins were not detected in the nontransgenic grain or diet samples.

Overall, broiler chickens fed diets prepared with 5307 transgenic maize grain did not differ in growth, feed consumption, survival rate, feed conversion or carcass yield when compared with broiler chickens fed diets prepared with nontransgenic, near-isogenic

maize grain or commercially available control maize grain. Diets prepared with 5307 transgenic maize grain supported rapid broiler chicken growth at low mortality rates and excellent feed conversion ratios without adverse effects on overall carcass yield or quality. The results support the conclusion that the transgenic maize grain had no deleterious effects on bird health in this study.

INTRODUCTION

Chickens (*Gallus domesticus*) consume large quantities of maize (field corn) grain in commercial feeds. Broiler chickens, in particular, have relatively high maize consumption because conventional feeding regimens have been designed to provide maximal body weight gain in the shortest amount of time. A broiler chicken study model has previously been used to assess whether consumption of transgenic maize grain has adverse effects (Brake and Vlachos 1998, Brake *et al.* 2005, Mirales *et al.* 2000, Piva *et al*. 2001, Sidhu *et al*. 2000 and Taylor *et al*. 2001). Such effects could be due to the presence of the transgenic proteins in the diet or as a result of any unintended compositional changes in the grain that may have altered its nutritional value.

The purpose of this study was to evaluate whether broiler chickens fed diets prepared with 5307 transgenic maize grain exhibited any adverse effects on survival, feed consumption, growth, feed conversion, or carcass characteristics when compared with broiler chickens fed diets prepared with nontransgenic, near-isogenic maize grain or commercially available maize grain.

Syngenta has transformed maize (*Zea mays*) to produce Event 5307 maize, a new cultivar that has insecticidal activity against certain corn rootworm (*Diabrotica*) species. Maize plants derived from transformation Event 5307 ("5307 maize") contain the gene *ecry3.1Ab* encoding an eCry3.1Ab protein and the gene *pmi* (also known as *manA*) encoding the enzyme phosphomannose isomerase (PMI). The eCry3.1Ab protein is an engineered chimera of modified Cry3A (mCry3A) and Cry1Ab proteins. The gene *pmi* was obtained from *Escherichia coli* strain K-12 and the protein it encodes was utilized as a plant selectable marker during development of 5307 maize.

MATERIALS AND METHODS

Test and Control Maize Grain

Both transgenic and nontransgenic maize plants were field-grown concurrently in Waterloo, Nebraska (USA) in 2008 and were subjected to the same standard local agronomic procedures, growing conditions, harvesting, and grain storage conditions. Isolation procedures were taken to avoid the intermixing of grain types. The maize grain used to formulate the broiler diets was derived from two near-isogenic maize hybrids:

Hybrid Description	Pedigree	Hybrid Seed Identification no.
5307 transgenic	NP2171xNP2460 (5307)	07MG005417
Nontransgenic	NP2171xNP2460	07MG002998

Grain lots of the test and control substances were characterized by real-time polymerase chain reaction (PCR) testing to confirm identity and purity.

Additionally, broiler diets prepared with a commercially available, locally grown lot of North Carolina (NC) maize grain from the 2007 season (‘NCSU 2007’) were used for comparison purposes. The NCSU 2007 maize grain had previously been used at the North Carolina State University (NCSU) (Raleigh, NC, USA) poultry research facility and was known to be of adequate quality to support good broiler chicken growth. It was in storage at the time of initiation of the experiment.

Experimental Design

The experimental design, summarized in Table 1, compared three treatments (diets) made from three sources of maize grain fed to broiler chickens of both sexes contained within two location blocks (sides) of the growing facility (i.e., house). There were six replicates for each two-way maize grain source-by-sex interaction. Pens were placed in a randomized complete block design to compensate for known position effects (*i.e.*, blocks) in the growing house, such as sunlight and temperature.

Table 1 Summary of experimental design

Maize grain source	Sex	# Birds/pen	# Pens	Total birds
5307	Male	15	6	90
5307	Female	15	6	90
Nontransgenic	Male	15	6	90
Nontransgenic	Female	15	6	90
NCSU 2007	Male	15	6	90
NCSU 2007	Female	15	6	90

Grain from 5307 transgenic maize plants was used to prepare diets designated '5307'; grain from nontransgenic, near-isogenic maize plants was used to prepare diets designated 'nontransgenic'; and a commercially available source of North Carolina maize grain grown during the 2007 season was used to prepared diets designated 'NCSU 2007'. Starter, grower, and finisher diets were prepared using each source of maize grain and were formulated to meet the nutritional requirements of broilers for each stage of growth, with the maize content of the diets ranging from approximately 52% to 64% by weight. These diets were fed in succession over 49 days, allowing birds to reach an age and body weight approximating the upper end of the normal body weight range for broiler processing. The performance endpoints measured in this study were body weight, survival, feed consumption, feed conversion ratios, and carcass yield.

Source of Chicks and Assignment to Study Group

Broiler chicks were hatched from eggs produced and incubated at the North Carolina Department of Agriculture and Consumer Services (NCDA & CS) (Salisbury, NC, USA). The parent stock was a commercial strain of Heritage broiler breeders grown and maintained at the NCDA & CS Piedmont Research Station under the supervision of Prof. John T. Brake. The parent stock was vaccinated against common poultry diseases[1] and maintained on a coccidiostat (i.e., anti-protozoal agent). The broiler chicks were maintained on a coccidiostat only, and were not given antibiotics or vaccinations, per standard NCSU Department of Poultry Science practice. The broiler chicks were sexed at hatching by examining the primary wing feathers (feather-sexing). Very large and

[1]Marek's disease, infectious bronchitis, Newcastle disease, fowl pox, and avian encephalomyelitis.

small birds were excluded from the study, as were chicks exhibiting any obvious abnormality. A total of 900 birds were randomly distributed into 60 pens of a power-ventilated enclosed house at one day of age, with each pen containing 15 birds of the same sex. The number of birds used in this study is consistent with the International Life Sciences Institute recommendation for the conduct of animal studies utilized to evaluate genetically modified crops (ILSI 2003). Birds were identified by neck tag indicating their animal number.

Maize Grain Analysis

Prior to the study, samples of the 5307 maize grain, the nontransgenic maize grain, and the NCSU 2007 maize grain were sent to the following facilities: Carolina Analytical Services (Bear Creek, NC, USA) for proximate analysis, the University of Missouri (Columbia, MO, USA) for amino acid analysis, and the Trilogy Analytical Laboratory, (Washington, MO, USA) for mycotoxin screening. The metabolizable energy was calculated for each maize grain source by including values obtained using standard techniques (AOAC 1990, 1993) for moisture, crude protein, fat, fiber, and ash (Table 2) into the prediction equations published by the (Dutch) Central Feed Bureau (CVB) (CVB 2001, 2002). After the end of the study feeding period, samples of the three maize grain types were transported at ambient temperature to Syngenta Biotechnology, Inc. (SBI) (Research Triangle Park, NC, USA). The 5307 and nontransgenic, near-isogenic grain samples were subsequently analyzed for the concentrations of eCry3.1Ab and PMI by enzyme-linked immunosorbent assay (ELISA) (Champon and Bednarcik 2010).

Diet Formulation and Analysis

To compensate for the small differences in proximates, amino acid content, and calculated metabolizable energy between maize grain sources, an attempt was made to standardize diets to a similar nutrient content by adding appropriate crystalline amino acids and an inert filler composed of a blend of washed sand and vermiculite. The final formulations for each maize grain source resulted in three broiler chicken diets: starter (Table 3), grower (Table 4), and finisher (Table 5), which had a similar calculated nutrient composition. The calculated nutrient content of the base diets met or exceeded the minimum nutrient requirements for broilers, specified by the CVB (CVB 2001, 2002) and National Research Council (NRC 1994), and was positioned to reflect general industry broiler specifications applied commercially in the USA.

Starter diets were mixed in a commercial 500-lb (227 kg) mixer while the grower and finisher diets were mixed in a commercial 4,000-lb (1,818 kg) mixer for five minutes; this time was previously confirmed by mixer profile tests to be the optimum time for complete mixing. Samples of each diet were taken for analysis of percentage crude protein, moisture, fat, fiber, and ash, as determined by proximate analysis. Diets were pelleted in a small commercial pellet mill immediately after mixing. Pelleted starter feed was crumbled (broken into finer pieces) to enable the young chicks to consume the diets.

At the end of the study feeding period, samples of the 5307 diets, the nontransgenic diets, and the NCSU 2007 diets were transported at ambient temperature to SBI. The 5307 diets and the nontransgenic diets were subsequently analyzed for the concentrations of eCry3.1Ab and PMI by ELISA (Champon and Bednarcik 2010).

Access to Feed and Water

Birds were provided feed and water *ad libitum* from four creep feeders and four automatic nipple-type waterers in each pen. The water source was a local well that is routinely checked for contaminants. Supplemental waterers, as well as supplemental flat feeders, were used during the first week to ensure unlimited access. The feeders were manually agitated as needed to maintain the flow of feed from the tube into the feeder pan. Birds had access to 2.5 lbs (1.13 kg) starter diet per bird at the start of the study. Birds consumed this feed rapidly and grower diet was added beginning at 16 days of age, when body weight and feed consumption were determined. At that point, the grower diet was fed exclusively to 35 days of age. At 35 days, any remaining grower diet was weighed and adjusted to approximately 5.5 lbs (2.5 kg) per bird, and finisher diet was then added to the feeders. Access to feed was discontinued on the 49th day of the experiment, approximately 12 hours before slaughter.

Housing and Environmental Conditions

Birds were housed in standard 32 x 60 x 32 inches high (81 x 152 x 81 cm high) pens constructed of wood frame and plastic-coated wire mesh. Pine shavings were used as litter. According to standard practices, house temperature was generally targeted as follows:

Week 1	90 ± 5°F	(≈ 32 ± 3°C)
Week 2	85 ± 5°F	(≈ 29 ± 3°C)
Week 3	82 ± 5°F	(≈ 28 ± 3°C)
Week 4	80 ± 8°F	(≈ 27 ± 4°C)
Weeks 5 to 7	70 ± 10°F	(≈ 21 ± 6°C)

When necessary, minimum temperatures were maintained using liquid propane gas brooders and circulating fans. The enclosed broiler house was ventilated using exhaust and stirring fans. Average house temperatures would have been expected to vary from these targets as there was no absolute environmental control system provided.

The birds received 23 hours of incandescent light per day until 7 days of age, 21 hours of light per day from 8 to 21 days of age, and 12 hours per day for the remainder of the experiment. This lighting program was used to limit growth slightly, to minimize problems normally associated with extremely rapid growth. Any light bulbs that burned out during the course of the study were replaced within 12 hours during normal inspection of the house and birds. Burned-out bulbs were not expected to have an effect on the study, due to the excellent light distribution in this house.

Scale Validation

Scales are routinely serviced and validated by J.A. King, Inc. (Garner, NC, USA). Standard check weights were used before and after all weighing operations to ensure proper calibration throughout the study. These data are maintained with the original study records.

Daily Observations

The house was checked twice daily for temperature, lighting conditions, and proper functioning of feeders and waterers. In addition, the birds were checked for overt clinical signs, injuries and mortalities.

Data Collection

Total pen body weight data were collected at hatch (Day 1), 16 days, 35 days, and 49 days of age. At the latter three times, feed consumption per pen was determined in order to calculate feed conversion ratios[2] and adjusted feed conversion ratios[3]. At day 50, a random sample of two birds from each pen was processed in order to determine carcass (meat) yield.

Disposition of Birds and Unused Maize Grain and/or Diet

After birds that were selected for processing were terminated, the carcasses were prepared for examination by the method of Brake *et al*. (1993). Following determination of carcass yield, these carcasses were buried. The remaining birds that were fed the NCSU 2007 and nontransgenic diets were transported to a local processing plant for slaughter whereas birds fed the 5307 diets were killed and buried. The unused 5307 grain and corresponding diets were ground and buried.

Statistical Analysis

Body weight, feed consumption, feed conversion, and survival data were analyzed to determine statistical differences among groups fed diets prepared from the three maize grain sources, and between males and females. Statistical analyses were performed using the General Linear Model (GLM) procedure of SAS Institute with sex and maize grain source as independent variables in a two-way analysis of variance within a completely randomized complete block design. Random error (between-pen variation) was used as the error term (SAS 1999). Carcass data on a gross- and adjusted-to-body weight basis were analyzed for effects due to maize grain source within sex using a one-way analysis of variance (SAS 1999) as effects due to sex are well known. Statements of statistical significance were based upon $P \leq 0.05$ unless otherwise indicated.

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[2]Feed conversion ratio (calculated for each pen) = total feed consumed ÷ total body weight of surviving birds.

[3]Adjusted feed conversion ratio (calculated for each pen) = total feed consumed ÷ total body weight of surviving birds + total terminal body weight of birds that died.

RESULTS

Maize Grain Analysis

Table 2 shows the results of the analyses for proximates and amino acids (reported as the percentage by weight on an 'as is' basis, *i.e.*, not as a percent of the dry weight), and mycotoxins for each grain source. The observed variations in proximate values and amino acid concentrations were within normally expected ranges and might be related to differences in maize grain density (test weight), moisture, and/or fertilization, which are known to occur between hybrids. These slight variations could also be related to the general health of the plants, geographical region, and/or cultivation practices. Amino acid analyses showed similar amino acid patterns relative to total crude protein. Routine mycotoxin determinations did not find detectable contamination in any of the three maize grain sources.

Diet Analysis

The results of proximate analysis for crude protein, moisture, fat, fiber, and ash in the formulated diets are shown in Table 6. The observed variability was within the normally expected range for broiler dietary formulations. The greater percentage of ash measured in the NCSU 2007 diets properly reflected the higher inclusion of the inert filler in that diet.

Daily Observations

Average weekly high and low temperatures are shown in Table 7. No significant overt clinical findings were observed during the study. Consistent with data generated for this facility and study type, there was a low incidence of mortality among all study groups with mortality numerically higher in males (see Survival section).

Body Weight Data

At placement into the various treatment groups (Day 1, start of feeding), there was no overall difference in mean body weight, and on average chicks weighed approximately 36.7 grams (Table 8). Male broilers weighed significantly more than females at placement, 16, 35, and 49 days of age, as expected due to their naturally larger size. There were no statistically significant differences in body weight among broilers fed 5307 diets, nontransgenic diets, or NCSU 2007 diets at any time. Furthermore, there were no maize grain source-by-sex interactions for body weight. The individual pen data for body weight are presented in the Appendix (Tables A1-A4).

Feed Consumption

There were no overall differences in feed consumption over the entire length of the experiment (days 1 to 49) (Table 9). Males consumed significantly more feed than females at 0 to 16, 16 to 35, and 35 to 49 days of age, as expected due to their naturally larger size. Furthermore, there were no maize grain source-by-sex interactions for feed consumption. The individual pen data for feed consumption are presented in the Appendix (Tables A1-A4).

Feed Conversion

Table 10 shows the unadjusted feed conversion ratios and Table 11 shows the adjusted feed conversion ratios during the feeding period of each diet and the cumulative values to 16, 35 and 49 days of age. The feed conversion ratio is an indicator of how efficiently a bird converts feed to live body weight. Improved efficiency could occur in gastrointestinal and/or general metabolic processes and is reflected in lower feed conversion ratios.

Overall, males pooled across all treatments showed statistically significantly improved adjusted and unadjusted feed conversion (i.e., lower adjusted feed conversion ratios) relative to females, as expected, beginning with the starter period (0 to16 days) and continuing throughout the rest of the study. Broilers fed the 5307 diets had improved feed conversion (both unadjusted and adjusted for mortality) during the grower period (16 to 35 days of age) as well as cumulatively from 0 to 35 days of age compared with broilers fed the NCSU 2007 diets, with the nontransgenic group being intermediate. There were no maize grain source-by-sex interactions for unadjusted or adjusted feed conversion ratios at any time. The Appendix (Tables A1-A4) presents individual pen data for body weight and feed consumption, which were used to calculate feed conversion ratios.

Survival

The overall survival was approximately 98% for both males and females averaged together at the end of the study (Table 12). There were no maize grain source effects on survival at any time. Males exhibited statistically significantly increased mortality during the finisher period (35 to 49 days of age), which is to be expected. In addition, there were no maize grain source-by-sex interactions at any time. The individual pen data for mortality are presented in the Appendix (Table A5).

Carcass[4] and Parts Yield

The dressed carcass parts yield in grams and as a percentage of live body weight is displayed in Table 13 for males and Table 14 for females. There were no statistically significant differences in the carcass portions (on an absolute weight basis) for males. Male broilers fed 5307 diets had decreased thigh weights (as a percentage of total body weight) compared with males broilers fed nontransgenic diets, but were no different than the males consuming the NCSU 2007 control diets. These slight differences were most likely due to the numerical differences in body weight of males randomly selected for processing from each group (2 birds per pen). Also there were no differences noted in the other carcass parts including: fat pads, drums, wings, and *pectoralis major* and *minor* muscles.

There were no statistically significant differences in the carcass portions (on an absolute basis) for females. Female broilers fed 5307 diets had decreased thigh and *pectoralis*

[4] Fresh, unchilled carcass from which the head, neck, feet, feathers, viscera and blood have been removed.

minor weights (as a percentage of total body weight) compared with female broilers fed the nontransgenic and NCSU 2007 diets. This effect was not significant for the absolute thigh and *pectoralis minor* weights, and therefore, was most likely due to the numerical differences in body weight of females randomly selected for processing from each group (2 birds per pen). Also there were no differences noted in the other carcass parts including: fat pads, drums, wings, and *pectoralis minor* muscles

There were no maize source-by-sex interactions for carcass yield. The individual animal data from two birds randomly selected from each pen are presented in the Appendix (Tables A6-A7).

Quantification of Transgenic Proteins in Grain and Diets

Maize grain

At the end of the study feeding period, samples of the three maize grain sources were shipped to SBI. The 5307 and nontransgenic maize grains were analyzed for the concentrations of eCry3.1Ab and PMI by ELISA (Champon and Bednarcik 2010). Neither eCry3.1Ab nor PMI was detected in the nontransgenic maize grain. In the 5307 maize grain the mean concentration of eCry3.1Ab was 4.71 µg/g sample and the PMI mean concentration was 0.85 µg/g sample.

Starter, grower, and finisher diets

At the end of the study feeding period, samples of starter, grower, and finisher diets prepared with the 5307 maize grain or the nontransgenic maize grain were shipped to SBI and analyzed for the concentrations of eCry3.1Ab and PMI by ELISA (Champon and Bednarcik 2010). Neither eCry3.1Ab nor PMI was detected in the starter, grower, and finisher diets prepared with the nontransgenic grain. The concentrations of eCry3.1Ab and PMI in the 5307 diets are presented in Table 15.

Data Quality and Integrity

No circumstances occurred during the conduct of this study that would have adversely affected the quality or integrity of the data generated.

DISCUSSION

The data from this study show an absence of deleterious effects associated with broiler chickens consumption of diets prepared with transgenic 5307 maize grain when compared with consumption of diets made from either nontransgenic, near-isogenic control maize grain or commercially available control maize grain. Although efforts were made in this study to adjust the diets for observed small nutrient differences in maize grain source (Tables 2, 3, 4, and 5), the diets made from various maize grain sources were not identical (Table 7). Given the nutrient differences in the maize grain sources and the efforts to adjust for the differences in nutrient content while formulating the diets, it was not feasible to formulate the diets to be identical with respect to all ingredients and measured components (Tables 3, 4, 5, and 7). However, reasonable agreement was achieved as suggested by the performance of the broilers. There did not appear to be any problems in broiler performance that would be atypical in the experience at the study site.

CONCLUSIONS

This study demonstrated that diets prepared with Event 5307 transgenic maize grain did not have any adverse effect on performance of broiler chickens when compared with diets prepared with nontransgenic, near-isogenic maize grain or a commercially available source of maize grain. Poultry diets prepared with 5307 transgenic maize grain supported rapid broiler chicken growth at low mortality rates, with very good feed conversion ratios, and without negatively affecting carcass yield. There were no deleterious effects associated with consumption of 5307 transgenic maize grain when compared with consumption of control maize grain by broiler chickens.

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RECORDS RETENTION

Original copies of the protocol, protocol amendments, raw data, statistical analyses, and the study report will be retained at the NCSU Department of Poultry Science, Raleigh, NC, USA.

Reported by: ______________________________ 12 November 2010

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CRITICAL DATES

Start date (placement of chicks into groups):	April 7, 2009
End date (animal termination):	May 27, 2009

Table 2 Analysis of maize grain samples[1]

	Maize grain source		
	5307	**Nontransgenic**	**NCSU 2007**
Proximate Analyses[2]			
Moisture, %	15.36	15.52	14.48
Fat, %	2.98	3.32	3.16
Protein, %	7.21	6.98	7.35
Fiber, %	1.90	2.10	1.90
Ash, %	1.24	1.28	0.97
Amino acid Analyses[3]			
Aspartate, %	0.50	0.48	0.51
Threonine, %	0.22	0.21	0.24
Glutamate, %	1.33	1.30	1.29
Proline, %	0.62	0.59	0.58
Glycine, %	0.30	0.29	0.32
Alanine, %	0.55	0.53	0.54
Cysteine, %	0.17	0.17	0.17
Valine, %	0.40	0.39	0.37
Methionine, %	0.17	0.17	0.18
Cysteine + Methionine, %	0.34	0.34	0.35
Isoleucine, %	0.28	0.27	0.27
Leucine, %	0.90	0.88	0.84
Lysine, %	0.26	0.25	0.26
Calculated Metabolizable Energy[4]			
ME (MJ/g)	13.49	13.56	14.17
ME (kCal/g)	3224	3239	3386
Mycotoxin analyses[5]			
Aflatoxin, ppb	ND	ND	ND
Deoxynivalenol, ppb	ND	ND	ND
Fumonisin, ppm	ND	ND	ND
T2 Toxin, ppb	ND	ND	ND
Zearalenone, ppb	ND	ND	ND

[1] Data reported "as is", not on a dry weight basis

[2] Mean of duplicate analyses, Carolina Analytical Services, LLC, Bear Creek, NC 27207, USA

[3] Experiment Station Chemical Laboratory, Univ. of Missouri, Columbia, MO 65211, USA

[4] Calculated from proximate analyses using published prediction equations (CVB 2002)

[5] Trilogy Analytical Laboratory, Washington, MO 63090, USA

[6] ND = not detected. Detection limits for mycotoxins were as follows: deoxynivalenol 0.1 ppm, fumonisin 0.1 ppm, T2 toxin 0.1 ppm, and zearalenone 1 ppb.

Table 3 Starter diet formulas[1]

	Diet Formulations		
	5307	**Nontransgenic**	**NCSU 2007**
Ingredients			
Maize grain, %	54.22	54.51	52.05
Soybean oil cake (48%), %	35.29	35.18	36.43
Limestone, %	0.88	0.88	0.99
Dicalcium phosphate, %	2.33	2.34	2.11
Poultry fat, %	5.48	5.28	5.00
D,L-Methionine, %	0.26	0.26	0.25
Lysine HCl, %	0.14	0.15	0.10
L-Threonine, %	0.19	0.20	0.16
Salt, %	0.50	0.50	0.50
Choline chloride (60%), %	0.20	0.20	0.20
Mineral premix[2], %	0.20	0.20	0.20
Vitamin premix[3], %	0.05	0.05	0.05
Coban coccidiostat, %	0.05	0.05	0.05
Selenium premix[4], %	0.10	0.10	0.10
Inert filler[5], %	0.10	0.10	1.82
Total, %	100.0	100.0	100.0
Calculated analyses[6]			
Crude protein, %	22.00	22.00	22.00
Lysine, %	1.32	1.32	1.32
Cysteine + Methionine, %	0.93	0.93	0.95
Threonine, %	0.89	0.89	0.88
ME, MJ/g	12.77	12.77	12.77
ME, kCal/g	3050	3050	3050
Calcium, %	0.95	0.95	0.95
Available phosphorus, %	0.45	0.45	0.45
Sodium, %	0.19	0.19	0.20

[1] Formulas developed with standard commercial linear programming software. Data reported "as is", not on a dry weight basis

[2] Supplied per kg diet: manganese 120 mg, zinc 120 mg, iron 80 mg, copper 10 mg, iodine 2.5 mg, and cobalt 1.0 mg

[3] Supplied per kg diet: retinol 6600 IU, cholecalciferol 2000 IU, vitamin E 33 IU, vitamin B12 19.8 µg, riboflavin 6.6 mg, niacin 55 mg, pantothenic acid 11 mg, vitamin K 2 mg, folic acid 1.1 mg, thiamine 2 mg, pyridoxine 4 mg, and biotin 126 µg

[4] Selenium premix provided 0.10 mg selenium per kg of diet

[5] Inert filler composed of a 50/50 mix of washed sand and vermiculite to achieve a similar density to that of corn

[6] Based on analytical values of ingredients or published reference values of ingredients (CVB 2002; Degussa 2001)

Table 4 Grower diet formulas[1]

	Diet Formulations		
	5307	**Nontransgenic**	**NCSU 2007**
Ingredients			
Maize grain, %	58.19	58.51	56.00
Soybean oil cake (48%), %	30.60	30.47	32.00
Limestone, %	0.80	0.80	0.91
Dicalcium phosphate, %	2.09	2.09	1.84
Poultry fat, %	6.57	6.35	6.00
D,L-Methionine, %	0.23	0.24	0.22
Lysine HCl, %	0.15	0.17	0.05
L-Threonine, %	0.18	0.18	0.07
Salt, %	0.50	0.50	0.50
Choline chloride (60%), %	0.20	0.20	0.20
Mineral premix[2], %	0.20	0.20	0.20
Vitamin premix[3], %	0.05	0.05	0.05
Coban coccidiostat, %	0.05	0.05	0.05
Selenium premix[4], %	0.10	0.10	0.10
Inert filler[5], %	0.10	0.10	1.80
Total, %	100.0	100.0	100.0
Calculated analyses[6]			
Crude protein, %	20.00	20.00	20.00
Lysine, %	1.20	1.20	1.16
Cysteine + Methionine, %	0.85	0.85	0.87
Threonine, %	0.80	0.80	0.74
ME, M/g	13.19	13.19	13.19
ME, kCal/g	3150	3150	3150
Calcium, %	0.85	0.85	0.85
Available phosphorus, %	0.40	0.40	0.40
Sodium, %	0.19	0.19	0.20

[1] Formulas developed with standard commercial linear programming software. Data reported “as is”, not on a dry weight basis

[2] Supplied per kg diet: manganese 120 mg, zinc 120 mg, iron 80 mg, copper 10 mg, iodine 2.5 mg, and cobalt 1.0 mg

[3] Supplied per kg diet: retinol 6600 IU, cholecalciferol 2000 IU, vitamin E 33 IU, vitamin B12 19.8 µg, riboflavin 6.6 mg, niacin 55 mg, pantothenic acid 11 mg, vitamin K 2 mg, folic acid 1.1 mg, thiamine 2 mg, pyridoxine 4 mg, and biotin 126 µg

[4] Selenium premix provided 0.10 mg selenium per kg of diet

[5] Inert filler composed of a 50/50 mix of washed sand and vermiculite to achieve a similar density to that of corn

[6] Based on analytical values of ingredients or published reference values of ingredients (CVB 2002, Degussa 2001)

Table 5 Finisher diet formulas[1]

	Diet Formulations		
	5307	**Nontransgenic**	**NCSU 2007**
Ingredients			
Maize grain, %	62.95	63.29	61.25
Soybean oil cake (48%), %	25.76	25.63	27.04
Limestone, %	0.84	0.84	0.97
Dicalcium phosphate, %	1.84	1.84	1.57
Poultry fat, %	6.86	6.63	6.00
D,L-Methionine, %	0.21	0.21	0.19
Lysine HCl, %	0.17	0.18	0.13
L-Threonine, %	0.17	0.17	0.07
Salt, %	0.50	0.50	0.50
Choline chloride (60%), %	0.20	0.20	0.20
Mineral premix[2], %	0.20	0.20	0.20
Vitamin premix[3], %	0.05	0.05	0.05
Coban coccidiostat, %	0.05	0.05	0.05
Selenium premix[4], %	0.10	0.10	0.10
Inert filler[5], %	0.10	0.10	1.68
Total, %	100.0	100.0	100.0
Calculated analyses[6]			
Crude protein, %	18.00	18.00	18.00
Lysine, %	1.08	1.08	1.08
Cysteine + Methionine, %	0.77	0.79	0.79
Threonine, %	0.72	0.72	0.66
ME, MJ/g	13.44	13.44	13.44
ME, kCal/g	3210	3210	3210
Calcium, %	0.80	0.80	0.80
Available phosphorus, %	0.35	0.35	0.35
Sodium, %	0.19	0.19	0.20

[1] Formulas developed with standard commercial linear programming software. Data reported “as is”, not on a dry weight basis

[2] Supplied per kg diet: manganese 120 mg, zinc 120 mg, iron 80 mg, copper 10 mg, iodine 2.5 mg, and cobalt 1.0 mg

[3] Supplied per kg diet: retinol 6600 IU, cholecalciferol 2000 IU, vitamin E 33 IU, vitamin B12 19.8 µg, riboflavin 6.6 mg, niacin 55 mg, pantothenic acid 11 mg, vitamin K 2 mg, folic acid 1.1 mg, thiamine 2 mg, pyridoxine 4 mg, and biotin 126 µg

[4] Selenium premix provided 0.10 mg selenium per kg of diet

[5] Inert filler composed of a 50/50 mix of washed sand and vermiculite to achieve a similar density to that of corn

[6] Based on analytical values of ingredients or published reference values of ingredients (CVB 2002, Degussa 2001)

Table 6 Analysis of diet samples[1]

Proximates	Diets	5307	Nontransgenic	NCSU 2007
Crude protein, %				
	Starter	19.46	19.85	18.44
	Grower	17.86	18.67	16.01
	Finisher	15.00	18.54	17.35
Moisture, %				
	Starter	12.66	12.78	10.92
	Grower	13.88	13.03	11.01
	Finisher	13.71	12.48	11.11
Fat, %				
	Starter	6.74	6.62	6.22
	Grower	7.84	7.36	7.27
	Finisher	7.85	7.60	7.88
Fiber, %				
	Starter	2.90	3.00	3.00
	Grower	2.80	2.90	2.90
	Finisher	2.60	2.70	2.80
Ash, %				
	Starter	6.85	6.20	8.30
	Grower	6.07	5.72	8.14
	Finisher	5.68	6.26	6.75

[1]Analyses performed by Carolina Analytical Services, LLC, Bear Creek, NC, USA 27207

Table 7 House temperature ranges (°F)

	Days	Mean high[1]	Mean low[1]
7-13 April	Tues-Mon	91.7 ± 1.50	87.7 ± 1.41
14-20 April	Tues-Mon	88.0 ± 0.00	84.0 ± 0.58
21-27 April	Tues-Mon	84.3 ± 0.78	76.4 ± 0.84
28 April – 4 May	Tues-Mon	81.2 ± 0.40	73.7 ± 0.42
5-11 May	Tues-Mon	81.9 ± 0.94	72.3 ± 1.11
12-18 May	Tues-Mon	79.3 ± 0.99	70.9 ± 0.40
19-25 May	Tues-Mon	80.1 ± 1.03	72.9 ± 0.40

Table 8 The effect of maize grain source and sex on body weight of broiler chickens[1,2]

Maize Grain Source	Sex	Body weight at placement		Body weight at 16 days		Body weight at 35 days		Body weight at 49 days	
		Mean	SEM[3]	Mean	SEM	Mean	SEM	Mean	SEM
		(g)							
5307		36.50	0.16	542.9	9.25	2028.7	48.73	3246.7	93.43
Nontransgenic		36.81	0.19	542.0	10.28	2010.1	57.69	3206.0	109.55
NCSU 2007		36.92	0.18	542.0	8.29	2002.0	53.52	3209.7	101.40
P-value		0.21		0.98		0.31		0.58	
	Male	36.96^a	0.15	570.8^A	2.72	2186.0^A	8.41	3543.3^A	26.13
	Female	36.52^b	0.13	513.9^B	3.11	1841.2^B	11.91	2898.3^B	22.43
P-value		0.03		< 0.0001		< 0.0001		< 0.0001	
5307	**Male**	36.61	0.22	571.0	5.11	2186.1	7.55	3539.4	48.24
5307	**Female**	36.39	0.23	514.8	5.88	1871.3	21.87	2954.0	42.58
Nontransgenic	**Male**	37.11	0.29	573.7	5.42	2197.4	19.86	3555.1	47.89
Nontransgenic	**Female**	36.50	0.19	510.3	5.91	1822.7	14.33	2856.9	41.96
NCSU 2007	**Male**	37.17	0.22	567.6	4.04	2174.5	14.74	3535.4	47.95
NCSU 2007	**Female**	36.67	0.26	516.5	5.02	1829.6	22.05	2884.1	23.58
P-value		0.71		0.51		0.25		0.43	

[a, b] Means that possess different subscripts differ significantly ($P \leq 0.05$)
[A,B] Means that possess different superscripts differ significantly ($P \leq 0.01$)
[1] Starter, grower, and finisher diets were used to 16, 35, and 49 days of age, respectively
[2] There were six replicate pens of 15 birds each for each interaction mean
[3] SEM = standard error of the mean

Table 9 The effect of maize grain source and sex on feed consumption of broiler chickens[1,2]

Maize Grain Source	Sex	Feed Consumed 0-16 days		Feed Consumed 16-35 days		Feed Consumed 35-49 days		Feed Consumed 0-35 days		Feed Consumed 0-49 days	
		Mean	SEM[3]	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
		(g)									
5307		647.7	9.49	2315.2	49.34	2551.2	65.00	2962.9	57.23	5533.0	129.29
Nontransgenic		657.7	7.19	2299.9	57.23	2562.8	82.18	2957.6	64.13	5557.8	157.58
NCSU 2007		654.2	10.56	2316.3	59.28	2570.8	78.51	2978.5	69.42	5588.9	158.16
P-value		0.54		0.81		0.94		0.80		0.84	
	Male	676.1[A]	3.42	2482.7[A]	15.74	2776.4[A]	38.66	3164.2[A]	18.26	6004.5[A]	64.01
	Female	630.2[B]	6.12	2138.2[B]	15.75	2346.8[B]	21.93	2768.4[B]	18.29	5115.3[B]	37.67
P-value		< 0.0001		< 0.0001		< 0.0001		< 0.0001		< 0.0001	
5307	**Male**	670.8	8.62	2467.0	17.11	2737.7	51.79	3137.7	24.59	5913.3	94.48
5307	**Female**	624.7	10.45	2163.4	34.76	2364.7	44.63	2788.1	39.80	5152.8	82.42
Nontransgenic	**Male**	680.8	2.63	2480.3	32.43	2791.1	81.95	3161.1	33.18	6027.1	130.93
Nontransgenic	**Female**	634.6	2.64	2119.4	18.38	2334.4	46.31	2754.0	20.54	5088.4	63.36
NCSU 2007	**Male**	676.9	5.27	2500.8	32.66	2800.3	73.44	3193.8	37.10	6073.3	114.04
NCSU 2007	**Female**	631.4	16.00	2131.8	27.86	2341.3	25.82	2763.2	35.83	5104.6	56.77
P-value		1.00		0.46		0.70		0.45		0.50	

[A,B] Means that possess different superscripts differ significantly ($P \leq 0.01$).

[1] Starter, grower, and finisher diets were used to 16, 35, and 49 days of age, respectively.

[2] There were six replicate pens of 15 birds each for each interaction mean.

[3] SEM = standard error of the mean

Table 10 The effect of maize grain source and sex on feed conversion ratio (FCR) of broiler chickens [1,2]

Maize Grain Source	Sex	Starter FCR 0-16 days		Grower FCR 16-35 days		Finisher FCR 35-49 days		Cumulative FCR 0-35 days		Cumulative FCR 0-49 days	
		Mean	SEM[3]	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
		(g:g)									
5307		1.28	0.01	1.56^{B}	0.01	2.12	0.02	1.49^{B}	0.01	1.73	0.01
Nontransgenic		1.30	0.01	1.57^{B}	0.01	2.20	0.04	1.50^{AB}	0.01	1.76	0.02
NCSU 2007		1.30	0.02	1.60^{A}	0.01	2.19	0.06	1.52^{A}	0.01	1.77	0.02
P-value		0.44		0.008		0.37		0.007		0.13	
	Male	1.27^{B}	0.01	1.54^{B}	0.01	2.12^{b}	0.04	1.47^{B}	0.01	1.71^{B}	0.02
	Female	1.32^{A}	0.01	1.61^{A}	0.01	2.22^{a}	0.01	1.53^{A}	0.00	1.79^{A}	0.01
P-value		0.0009		< 0.0001		0.05		< 0.0001		< 0.0001	
5307	**Male**	1.26	0.02	1.53	0.01	2.07	0.02	1.46	0.01	1.69	0.01
5307	**Female**	1.31	0.01	1.59	0.01	2.18	0.01	1.52	0.00	1.77	0.00
Nontransgenic	**Male**	1.27	0.01	1.53	0.01	2.14	0.07	1.46	0.01	1.71	0.02
Nontransgenic	**Female**	1.34	0.02	1.62	0.01	2.26	0.03	1.54	0.01	1.80	0.01
NCSU 2007	**Male**	1.28	0.00	1.57	0.02	2.16	0.12	1.49	0.01	1.74	0.04
NCSU 2007	**Female**	1.32	0.03	1.62	0.01	2.22	0.03	1.54	0.01	1.79	0.01
P-value		0.69		0.32		0.84		0.17		0.63	

^{a,b} Means that possess different superscripts differ significantly ($P \leq 0.05$)
^{A,B} Means that possess different superscripts differ significantly ($P \leq 0.01$)
[1] Starter, grower, and finisher diets were used to 16, 35, and 49 days of age, respectively
[2] There were six replicate pens of 15 birds each for each interaction mean
[3] SEM = standard error of the mean

Table 11 The effect of maize grain source and sex on feed conversion ratio (FCR) of broiler chickens adjusted for mortality[1,2]

Maize Grain Source	Sex	Starter Adj. FCR 0-16 days		Grower Adj. FCR 16-35 days		Finisher Adj. FCR 35-49 days		Cumulative Adj. FCR 0-35 days		Cumulative Adj. FCR 0-49 days	
		Mean	SEM[3]	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
		(g:g)									
5307		1.27	0.01	1.56^{b}	0.01	2.12	0.02	1.49^{B}	0.01	1.72	0.01
Nontransgenic		1.30	0.01	1.57^{ab}	0.01	2.14	0.04	1.50^{AB}	0.01	1.74	0.02
NCSU 2007		1.29	0.01	1.59^{a}	0.01	2.14	0.06	1.51^{A}	0.01	1.75	0.02
P-value		0.09		0.04		0.81		0.01		0.35	
	Male	1.26^{B}	0.01	1.54^{B}	0.01	2.05^{B}	0.04	1.47^{B}	0.01	1.69^{B}	0.01
	Female	1.32^{A}	0.01	1.61^{A}	0.01	2.22^{A}	0.01	1.53^{A}	0.00	1.79^{A}	0.01
P-value		< 0.0001		< 0.0001		0.0001		< 0.0001		< 0.0001	
5307	**Male**	1.24	0.01	1.53	0.01	2.05	0.03	1.46	0.01	1.68	0.01
5307	**Female**	1.30	0.01	1.59	0.01	2.18	0.01	1.52	0.01	1.76	0.01
Nontransgenic	**Male**	1.27	0.01	1.53	0.01	2.03	0.03	1.46	0.01	1.68	0.01
Nontransgenic	**Female**	1.34	0.02	1.62	0.01	2.26	0.03	1.54	0.01	1.80	0.01
NCSU 2007	**Male**	1.28	0.00	1.55	0.01	2.07	0.10	1.48	0.01	1.70	0.04
NCSU 2007	**Female**	1.31	0.02	1.62	0.01	2.22	0.03	1.54	0.00	1.79	0.01
P-value		0.36		0.57		0.57		0.28		0.41	

[a,b] Means that possess different superscripts differ significantly ($P \leq 0.05$)
[A,B] Means that possess different superscripts differ significantly ($P \leq 0.01$)
[1] Starter, grower, and finisher diets were used to 16, 35, and 49 days of age, respectively
[2] There were six replicate pens of 15 birds each for each interaction mean
[3] SEM = standard error of the mean

Table 12 The effect of maize grain source and sex on survival of broiler chickens [1,2,3]

Maize Grain Source	Sex	Starter Deaths 0-16 days		Grower Deaths 16-35 days		Finisher Deaths 35-49 days		Cumulative Deaths 0-35 days		Cumulative Deaths 0-49 days	
		Mean	SEM[4]	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
		(%)									
5307		1.11	0.75	0.00	0.00	0.56	0.56	1.11	0.75	1.67	0.87
Nontransgenic		0.00	0.00	0.00	0.00	1.11	0.75	0.00	0.00	1.11	0.75
NCSU 2007		0.56	0.56	1.11	0.75	1.11	0.75	1.67	0.87	2.78	1.29
P-value		0.38		0.10		0.79		0.23		0.48	
	Male	0.37	0.37	0.74	0.51	1.85[a]	0.72	1.11	0.60	2.96	0.97
	Female	0.74	0.51	0.00	0.00	0.00[b]	0.00	0.74	0.51	0.74	0.51
P-value		0.57		0.12		0.02		0.64		0.06	
5307	**Male**	1.11	1.11	0.00	0.00	1.11	1.11	1.11	1.11	2.22	1.41
5307	**Female**	1.11	1.11	0.00	0.00	0.00	0.00	1.11	1.11	1.11	1.11
Nontransgenic	**Male**	0.00	0.00	0.00	0.00	2.22	1.41	0.00	0.00	2.22	1.41
Nontransgenic	**Female**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NCSU 2007	**Male**	0.00	0.00	2.22	1.41	2.22	1.41	2.22	1.41	4.44	2.22
NCSU 2007	**Female**	1.11	1.11	0.00	0.00	0.00	0.00	1.11	1.11	1.11	1.11
P-value		0.73		0.10		0.79		0.81		0.72	

[a,b] Means that possess different superscripts differ significantly (*P* ≤ 0.05)
[1] Starter, grower, and finisher diets were used to 16, 35, and 49 days of age, respectively
[2] There were six replicate pens of 16 birds each for each interaction mean
[3] Survival expressed as percentage (%) deaths
[4] SEM = standard error of the mean

Table 13 The effect of maize grain source on gross and percentage carcass yield of male broiler chickens at 50 days of age [1,2]

Maize Grain Source	Body weight		Dressed carcass		Fat pad		Drums		Thighs		Wings		*Pectoralis major*		*Pectoralis minor*	
	Mean	SEM[3]	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
	(g)															
5307	3278.0	70.15	2471.8	60.26	49.33	5.63	345.8	11.50	416.8	11.14	253.3	6.09	647.1	27.99	134.3	4.44
Nontransgenic	3247.8	85.02	2441.3	69.96	41.83	4.40	346.0	9.20	438.8	13.57	252.9	6.91	648.1	22.67	138.3	4.66
NCSU 2007	3260.2	103.98	2458.3	82.30	41.33	3.13	339.4	12.50	411.0	16.52	257.2	7.31	641.1	30.06	138.8	5.58
P-value	0.97		0.96		0.38		0.89		0.34		0.89		0.98		0.78	

Maize Grain source	Dressed carcass		Fat pad		Drums		Thighs		Wings		*Pectoralis major*		*Pectoralis minor*	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
	(%)													
5307	75.36	0.36	1.50	0.16	10.53	0.21	12.73[b]	0.29	7.74	0.13	19.66	0.51	4.09	0.08
Nontransgenic	75.12	0.36	1.29	0.13	10.66	0.14	13.51[a]	0.22	7.79	0.10	19.92	0.28	4.27	0.11
NCSU 2007	75.36	0.32	1.28	0.11	10.41	0.21	12.58[b]	0.22	7.91	0.14	19.58	0.45	4.25	0.08
P-value	0.85		0.44		0.65		0.03		0.60		0.84		0.35	

[a,b] Means that possess different superscripts differ significantly ($P \leq 0.05$)

[1] Starter, grower, and finisher diets were used to 16, 35, and 49 days of age, respectively

[2] There were 12 birds processed within each corn source and sex

[3] SEM = standard error of the mean

Table 14 The effect of maize grain source on gross and percentage carcass yield of female broiler chickens at 50 days of age [1,2]

	Body weight		Dressed carcass		Fat pad		Drums		Thighs		Wings		*Pectoralis major*		*Pectoralis minor*	
	Mean	SEM[3]	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
	(g)															
5307	2823.0	88.68	2055.3	32.91	56.42	5.65	277.0	6.49	331.1	7.71	213.1	3.41	515.4	16.33	122.3	2.71
Nontransgenic	2572.9	61.85	1936.1	51.31	45.92	3.99	263.4	8.08	328.5	10.69	199.5	4.15	511.6	18.69	118.8	2.56
NCSU 2007	2694.4	57.30	2025.7	48.90	45.33	3.19	272.6	5.69	342.8	11.98	209.1	4.44	518.7	20.10	123.7	3.16
P-value	0.06		0.17		0.15		0.38		0.58		0.06		0.96		0.46	

Maize Grain Source	Dressed carcass		Fat pad		Drums		Thighs		Wings		*Pectoralis major*		*Pectoralis minor*	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
	(%)													
5307	73.31	1.71	2.01	0.21	9.92	0.37	11.81[b]	0.37	7.59	0.16	18.38	0.65	4.35[b]	0.09
Nontransgenic	75.21	0.35	1.77	0.13	10.24	0.12	12.75[a]	0.22	7.78	0.16	19.84	0.36	4.63[a]	0.08
NCSU 2007	75.14	0.38	1.68	0.12	10.12	0.09	12.69[a]	0.23	7.77	0.10	19.21	0.50	4.59[a]	0.06
P-value	0.35		0.32		0.62		0.04		0.60		0.15		0.03	

[a,b] Means that possess different superscripts differ significantly ($P \leq 0.05$)

[1] Starter, grower, and finisher diets were used to 16, 35, and 49 days of age, respectively

[2] There were 12 birds processed within each corn source and sex

[3] SEM = standard error of the mean

Table 15 The mean concentrations of eCry3.1Ab and PMI in 5307 diets, expressed as µg/g sample

Diets	eCry3.1Ab	PMI
Starter	2.13	0.67
Grower	0.34	< LOD[a]
Finisher	0.38	< LOD[b] – 0.015[c]

These data are taken from Bednarcik and Champon 2010
N= 3 replicate analyses for each sample
[a] Limit of detection (LOD) = 0.024 µg/g
[b] LOD = 0.012 µg/g
[c] For one replicate, the result was < LOD so the range is reported instead of the mean

APPENDIX

INDIVIDUAL PEN AND ANIMAL DATA

Table A1 Body weight and feed consumption measurements of broiler chickens fed diets prepared with 5307 grain, nontransgenic grain, or commercially available grain at Day 1.

Treatment	Pen	Sex	Mean BW[ab]	# Birds	Feeder weight[a]	Initial feed[a]
5307	16	F	0.535	15	6.91	13.5
5307	31	F	0.55	15	6.89	13.5
5307	33	F	0.545	15	6.85	13.5
5307	38	F	0.56	15	6.8	13.5
5307	42	F	0.54	15	6.88	13.5
5307	57	F	0.545	15	6.9	13.5
5307	8	M	0.555	15	6.87	13.5
5307	22	M	0.545	15	6.95	13.5
5307	25	M	0.555	15	6.89	13.5
5307	48	M	0.555	15	6.8	13.5
5307	51	M	0.55	15	6.92	13.5
5307	65	M	0.535	15	6.89	13.5
Nontransgenic	2	F	0.55	15	6.95	13.5
Nontransgenic	15	F	0.54	15	6.87	13.5
Nontransgenic	21	F	0.54	15	6.86	13.5
Nontransgenic	50	F	0.545	15	6.85	13.5
Nontransgenic	58	F	0.555	15	6.9	13.5
Nontransgenic	59	F	0.555	15	6.96	13.5
Nontransgenic	3	M	0.56	15	6.93	13.5
Nontransgenic	12	M	0.54	15	6.89	13.5
Nontransgenic	26	M	0.555	15	6.9	13.5
Nontransgenic	41	M	0.565	15	6.88	13.5
Nontransgenic	52	M	0.57	15	6.87	13.5
Nontransgenic	61	M	0.55	15	6.86	13.5
NCSU 2007	14	F	0.545	15	6.9	13.5
NCSU 2007	19	F	0.55	15	6.83	13.5
NCSU 2007	24	F	0.56	15	6.86	13.5
NCSU 2007	40	F	0.55	15	6.81	13.5
NCSU 2007	49	F	0.56	15	6.9	13.5
NCSU 2007	71	F	0.535	15	6.91	13.5
NCSU 2007	7	M	0.565	15	6.85	13.5
NCSU 2007	29	M	0.55	15	6.97	13.5
NCSU 2007	32	M	0.55	15	6.77	13.5
NCSU 2007	44	M	0.565	15	6.91	13.5
NCSU 2007	47	M	0.565	15	6.91	13.5
NCSU 2007	66	M	0.55	15	6.8	13.5

[a] Measurements expressed in pounds (1 kg = 2.2 lbs).
[b] BW = body weight.

Table A2 Body weight and feed consumption measurements of broiler chickens fed diets prepared with 5307 grain, nontransgenic grain, or commercially available grain at Day 16.

Treatment	Pen	Sex	Mean BW[ab]	# Birds	Feed add 1[a,c]	Feeder WB[a,d]
5307	16	F	7.55	15	3.52	14.52
5307	31	F	7.72	15	3.52	14.61
5307	33	F	7.35	14	3.29	14.39
5307	38	F	8.03	15	3.52	14.16
5307	42	F	7.73	15	3.52	14.8
5307	57	F	7.43	15	3.52	15.08
5307	8	M	8.54	15	3.52	13.78
5307	22	M	8.34	15	3.52	14.27
5307	25	M	8.57	15	3.52	13.9
5307	48	M	8.59	15	3.52	13.97
5307	51	M	7.89	14	3.29	13.79
5307	65	M	8.9	15	3.52	13.84
Nontransgenic	2	F	7.9	15	3.52	14.39
Nontransgenic	15	F	7.56	15	3.52	14.54
Nontransgenic	21	F	7.94	15	3.52	14.4
Nontransgenic	50	F	7.52	15	3.52	14.35
Nontransgenic	58	F	7.61	15	3.52	14.29
Nontransgenic	59	F	7.4	15	3.52	14.43
Nontransgenic	3	M	8.78	15	3.52	13.68
Nontransgenic	12	M	8.44	15	3.52	13.83
Nontransgenic	26	M	8.54	15	3.52	13.77
Nontransgenic	41	M	8.68	15	3.52	13.7
Nontransgenic	52	M	8.85	15	3.52	13.53
Nontransgenic	61	M	8.34	15	3.52	13.67
NCSU 2007	14	F	7.9	15	3.52	14.39
NCSU 2007	19	F	7.16	14	3.29	14.25
NCSU 2007	24	F	7.54	15	3.52	14.52
NCSU 2007	40	F	7.58	15	3.52	15.39
NCSU 2007	49	F	8.01	15	3.52	13.88
NCSU 2007	71	F	7.78	15	3.52	14.51
NCSU 2007	7	M	8.59	15	3.52	13.53
NCSU 2007	29	M	8.4	15	3.52	14.01
NCSU 2007	32	M	8.44	15	3.52	13.67
NCSU 2007	44	M	8.4	15	3.52	14.03
NCSU 2007	47	M	8.78	15	3.52	13.54
NCSU 2007	66	M	8.47	15	3.52	13.63

[a] Measurements expressed in pounds (1 kg = 2.2 lbs).
[b] BW = body weight.
[c] Feed add 1 = first time feed is added to the feeder containers.
[d] Feeder WB = feeder weight + weight of leftover feed.

Table A3 Body weight and feed consumption measurements of broiler chickens fed diets prepared with 5307 grain, nontransgenic grain, or commercially available grain at Day 35.

Treatment	Pen	Sex	Mean BW[ab]	# Birds	Feed add 2[ac]	Feed add 3[ac]	Feed add 4[ac]	Feed add 5[ac]	Feed add 6[ac]	Feed add 7[ac]	Feeder WB[ad]
5307	16	F	28.79	15	7	7	7	7	0	3	11.57
5307	31	F	27.86	15	7	7	7	7	0	3	13.47
5307	33	F	26.09	14	7	7	7	7	0	3	16
5307	38	F	29.07	15	7	7	7	7	0	3	11.15
5307	42	F	27.95	15	7	7	7	7	0	3	13.58
5307	57	F	26.79	15	7	7	7	7	0	3	15.18
5307	8	M	32.8	15	7	7	7	7	5	4.5	13.68
5307	22	M	32.61	15	7	7	7	7	5	4.5	15.59
5307	25	M	32.75	15	7	7	7	7	5	4.5	14.54
5307	48	M	32.8	15	7	7	7	7	5	4.5	15.1
5307	51	M	31.08	14	7	7	7	7	5	2	13.71
5307	65	M	32.49	15	7	7	7	7	5	4.5	13.91
Nontransgenic	2	F	28.05	15	7	7	7	7	0	3	13.02
Nontransgenic	15	F	27.02	15	7	7	7	7	0	3	14.39
Nontransgenic	21	F	27.39	15	7	7	7	7	0	3	14.02
Nontransgenic	50	F	27.25	15	7	7	7	7	0	3	13.62
Nontransgenic	58	F	27.76	15	7	7	7	7	0	3	12.45
Nontransgenic	59	F	26.57	15	7	7	7	7	0	3	14.15
Nontransgenic	3	M	34.16	15	7	7	7	7	5	4.5	12.45
Nontransgenic	12	M	33.04	15	7	7	7	7	5	4.5	14.14
Nontransgenic	26	M	31.94	15	7	7	7	7	5	4.5	16.04
Nontransgenic	41	M	33.19	15	7	7	7	7	5	4.5	13.9
Nontransgenic	52	M	32.78	15	7	7	7	7	5	4.5	14.27
Nontransgenic	61	M	32.66	15	7	7	7	7	5	4.5	13.15
NCSU 2007	14	F	28.27	15	7	7	7	7	0	3	12.66
NCSU 2007	19	F	26.46	14	7	7	7	7	0	3	14.02
NCSU 2007	24	F	26.8	15	7	7	7	7	0	3	14.6
NCSU 2007	40	F	26.81	15	7	7	7	7	0	3	14.29
NCSU 2007	49	F	27.87	15	7	7	7	7	0	3	13.06
NCSU 2007	71	F	26.56	15	7	7	7	7	0	3	14.68
NCSU 2007	7	M	31.96	15	7	7	7	7	5	4.5	14.79
NCSU 2007	29	M	32.95	15	7	7	7	7	5	4.5	14.33

Treatment	Pen	Sex	Mean BW[ab]	# Birds	Feed add 2[ac]	Feed add 3[ac]	Feed add 4[ac]	Feed add 5[ac]	Feed add 6[ac]	Feed add 7[ac]	Feeder WB[ad]
NCSU 2007	32	M	29.98	14	7	7	7	7	5	2	14.38
NCSU 2007	44	M	32.35	15	7	7	7	7	5	4.5	14.52
NCSU 2007	47	M	33.24	15	7	7	7	7	5	4.5	11.6
NCSU 2007	66	M	30.88	14	7	7	7	7	5	2	12.73

[a] Measurements expressed in pounds (1 kg = 2.2 lbs).
[b] BW = body weight.
[c] Feed add 2,3,4,5,6,and7 = second, third, fourth, fifth, sixth, and seventh time feed is added to the feeder containers.
[d] Feeder WB = feeder weight + weight of leftover feed.

Table A4 **Body weight and feed consumption measurements of broiler chickens fed diets prepared with 5307 grain, nontransgenic grain, or commercially available grain at Day 49.**

Treatment	Pen	Sex	Mean BW[ab]	# Birds	Feed add 8[a]	Feed add 9[a]	Feed add 10[a]	Feed add 11[a]	Feed add 12[ac]	Feeder WB[ad]
5307	16	F	45.67	15	6.5	7	14	0	7	9.44
5307	31	F	43.48	15	6.5	7	7	0	12	11.82
5307	33	F	41.27	14	4	7	7	7	5	13.37
5307	38	F	46.52	15	6.5	7	7	7	12	12.41
5307	42	F	43.79	15	6.5	7	7	0	12	11.33
5307	57	F	42.18	15	6.5	7	7	0	12	13.59
5307	8	M	51.88	14	7	7	7	7	7	8.66
5307	22	M	52.85	15	7	7	7	7	7	9.88
5307	25	M	52.06	15	7	7	7	7	7	9.7
5307	48	M	50.4	15	7	7	7	7	7	11.93
5307	51	M	50.09	14	7	7	7	7	7	9.88
5307	65	M	53.98	15	7	7	7	7	12	10.72
Nontransgenic	2	F	45.52	15	6.5	7	7	7	7	9.65
Nontransgenic	15	F	42.35	15	6.5	7	7	0	12	12.4
Nontransgenic	21	F	41.45	15	6.5	7	7	0	12	13.34
Nontransgenic	50	F	42.28	15	6.5	7	7	0	12	11.87
Nontransgenic	58	F	43.81	15	6.5	7	7	7	7	10.78
Nontransgenic	59	F	41.71	15	6.5	7	7	0	7	7.51
Nontransgenic	3	M	52.78	14	7	7	14	7	7	10.23
Nontransgenic	12	M	53.21	15	7	7	7	7	12	11.93
Nontransgenic	26	M	48.28	14	7	7	7	0	12	11.446
Nontransgenic	41	M	53.23	15	7	7	7	7	12	11.42
Nontransgenic	52	M	51.75	15	7	7	7	7	7	9.93
Nontransgenic	61	M	53.49	15	7	7	7	7	7	8.64
NCSU 2007	14	F	43.82	15	6.5	7	7	7	7	12.1
NCSU 2007	19	F	41.52	14	4	7	7	7	7	11.87
NCSU 2007	24	F	42.79	15	6.5	7	7	0	12	12.53
NCSU 2007	40	F	41.95	15	6.5	7	7	0	12	13.02
NCSU 2007	49	F	43.26	15	6.5	7	7	7	7	12.41
NCSU 2007	71	F	43.26	15	6.5	7	7	0	12	11.6
NCSU 2007	7	M	49.92	14	7	7	7	7	7	9.99

Treatment	Pen	Sex	Mean BW[ab]	# Birds	Feed add 8[a]	Feed add 9[a]	Feed add 10[a]	Feed add 11[a]	Feed add 12[ac]	Feeder WB[ad]
NCSU 2007	29	M	55.96	15	7	7	7	7	12	9.84
NCSU 2007	32	M	48.26	14	7	7	7	7	7	11.68
NCSU 2007	44	M	53.25	15	7	7	7	7	7	12.01
NCSU 2007	47	M	50.81	15	7	7	14	7	7	8.97
NCSU 2007	66	M	45.91	13	7	7	7	7	7	11.02

[a] Measurements expressed in pounds (1 kg = 2.2 lbs).
[b] BW = body weight.
[c] Feed add 8,9,10,11,and 12 = eighth, ninth, tenth, eleventh, and twelfth time feed is added to the feeder containers.
[d] Feeder WB = feeder weight + weight of leftover feed.

Table A5 Mortality of broiler chickens fed diets prepared with 5307 grain, nontransgenic grain, or commercially available grain.

Treatment	Period[a]	Pen	Mean BW[b]	Sex
5307	1	33	0.183	F
5307	1	51	0.425	M
5307	3	8	0.86	M
Nontransgenic	3	3	3.935	M
Nontransgenic	3	26	2.195	M
NCSU 2007	1	19	0.315	F
NCSU 2007	2	32	0.785	M
NCSU 2007	2	66	0.525	M
NCSU 2007	3	7	2.0	M
NCSU 2007	3	66	2.635	M

[a] Period 1 = 0-16 days; period 2 = 17-35 days; period 3 = 36-48 days.
[b] BW = body weight.

Table A6 Body weights at time of termination of broiler chickens fed diets prepared with 5307 grain, nontransgenic grain, or commercially available grain.

Treatment	Pen	Tag[a]	Mean Body Weight[b]
5307	8	6159	3388
5307	8	6162	3340
5307	16	9264	2754
5307	16	9270	2736
5307	22	6202	3348
5307	22	6205	2756
5307	25	5977	2986
5307	25	5984	3342
5307	31	9108	2674
5307	31	9117	2844
5307	33	9019	2968
5307	33	9027	2802
5307	38	9416	2702
5307	38	9417	2628
5307	42	9335	2694
5307	42	9344	3702
5307	48	6272	3570
5307	48	6275	3264
5307	51	6041	3266
5307	51	6043	3046
5307	57	9190	2460
5307	57	9191	2912
5307	65	6091	3428
5307	65	6092	3602
Nontransgenic	2	9228	2676
Nontransgenic	2	9229	2626
Nontransgenic	3	5901	3170
Nontransgenic	3	5908	3532
Nontransgenic	12	6178	3220
Nontransgenic	12	6185	3364
Nontransgenic	15	9050	2518
Nontransgenic	15	9055	2518
Nontransgenic	21	9078	2288
Nontransgenic	21	9084	2490
Nontransgenic	26	6217	2982
Nontransgenic	26	6225	3570
Nontransgenic	41	6008	3184
Nontransgenic	41	6014	3124
Nontransgenic	50	9365	2422
Nontransgenic	50	9375	2498
Nontransgenic	52	6288	3300
Nontransgenic	52	6289	3218
Nontransgenic	58	9400	3158
Nontransgenic	58	9405	2646
Nontransgenic	59	9197	2605
Nontransgenic	59	9210	2430

Treatment	Pen	Tag[a]	Mean Body Weight[b]
Nontransgenic	61	6068	2590
Nontransgenic	61	6074	3720
NCSU 2007	7	5925	3662
NCSU 2007	7	5929	2964
NCSU 2007	14	9253	2906
NCSU 2007	14	9254	2682
NCSU 2007	19	9064	2886
NCSU 2007	19	9073	2792
NCSU 2007	24	9288	2778
NCSU 2007	24	9295	2945
NCSU 2007	29	5998	3262
NCSU 2007	29	6002	3598
NCSU 2007	32	6234	3046
NCSU 2007	32	6239	3390
NCSU 2007	40	9386	2564
NCSU 2007	40	9387	2540
NCSU 2007	44	6257	3664
NCSU 2007	44	6258	3388
NCSU 2007	47	6031	3338
NCSU 2007	47	6034	2564
NCSU 2007	49	9152	2674
NCSU 2007	49	9153	2292
NCSU 2007	66	6347	2740
NCSU 2007	66	6348	3506
NCSU 2007	71	9216	2460
NCSU 2007	71	9221	2814

[a] Tags are used to identify individual animals.
[b] Measurements expressed in grams.

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Table A7 Dressed carcass and carcass portion weights of broiler chickens fed diets prepared with 5307 grain, nontransgenic grain, or commercially available grain.[a]

Treatment	Pen[a]	Tag[b]	Dressed carcass[c]	Fat pad[d]	Legs[d]	Thighs[d]	Wings[d]	Breast skin[d]	Major breast[d]	Minor breast[d]	Ribs/back[d]
5307	8	6159	2472	74	404	824	1070	1136	1748	1882	2450
5307	8	6162	2520	36	387	767	1051	1100	1705	1826	2497
5307	16	9264	2067	37	342	665	895	967	1524	1649	2063
5307	16	9270	2099	52	327	691	898	981	1526	1652	2088
5307	22	6202	2514	52	400	834	1100	1174	1840	1980	2508
5307	22	6205	2053	31	294	643	861	900	1389	1503	2042
5307	25	5977	2234	40	354	776	1004	1060	1604	1726	2230
5307	25	5984	2524	88	416	850	1095	1183	1880	2009	2518
5307	31	9108	2003	22	278	606	820	896	1452	1578	1996
5307	31	9117	2068	68	349	689	898	989	1542	1661	2061
5307	33	9019	2236	56	354	712	934	1052	1619	1757	2215
5307	33	9027	2099	62	309	648	843	896	1490	1612	2088
5307	38	9416	2042	95	387	654	863	912	1366	1474	2032
5307	38	9417	1918	47	333	693	896	938	1384	1503	1912
5307	42	9335	2035	51	315	625	841	896	1373	1495	2005
5307	42	9344	2031	73	313	652	884	930	1416	1552	2022
5307	48	6272	2784	59	456	922	1184	1260	2111	2254	2778
5307	48	6275	2436	34	388	804	1072	1134	1784	1920	2428
5307	51	6041	2456	42	414	862	1124	1186	1828	1958	2450
5307	51	6043	2286	64	382	790	1016	1076	1662	1788	2278
5307	57	9190	1830	74	344	656	854	910	1328	1434	1824
5307	57	9191	2236	40	350	683	905	951	1483	1603	2227
5307	65	6091	2619	20	434	790	1069	1111	1758	1900	2608
5307	65	6092	2764	52	412	880	1136	1212	1988	2162	2748
Nontransgenic	2	9228	2007	59	337	694	884	952	1474	1594	2004
Nontransgenic	2	9229	1965	32	286	657	856	893	1385	1496	1952
Nontransgenic	3	5901	2341	4	350	752	1000	1035	1646	1791	2331
Nontransgenic	3	5908	2660	60	426	906	1178	1246	1898	2050	2654
Nontransgenic	12	6178	2450	40	400	887	1144	1216	1871	2001	2442
Nontransgenic	12	6185	2507	51	398	881	1144	1219	1875	2008	2501
Nontransgenic	15	9050	1849	35	298	600	805	873	1343	1465	1838

Treatment	Pen[a]	Tag[b]	Dressed carcass[c]	Fat pad[d]	Legs[d]	Thighs[d]	Wings[d]	Breast skin[d]	Major breast[d]	Minor breast[d]	Ribs/back[d]
Nontransgenic	15	9055	1862	42	298	620	824	878	1344	1464	1858
Nontransgenic	21	9078	1736	32	270	552	756	810	1244	1354	1732
Nontransgenic	21	9084	1876	60	329	668	852	910	1411	1523	1870
Nontransgenic	26	6217	2166	48	354	720	946	998	1574	1692	2158
Nontransgenic	26	6225	2732	38	400	874	1148	1228	1994	2156	2710
Nontransgenic	41	6008	2417	31	400	821	1082	1148	1808	1932	2413
Nontransgenic	41	6014	2348	59	410	853	1106	1180	1763	1878	2342
Nontransgenic	50	9365	1827	49	295	590	765	825	1343	1470	1820
Nontransgenic	50	9375	1927	42	283	583	782	829	1320	1438	1916
Nontransgenic	52	6288	2476	40	390	834	1090	1164	1852	1992	2470
Nontransgenic	52	6289	2481	39	390	832	1102	1191	1836	1978	2469
Nontransgenic	58	9400	2430	77	420	823	1050	1143	1814	1956	2419
Nontransgenic	58	9405	2020	40	314	673	893	951	1518	1633	2008
Nontransgenic	59	9197	1946	33	284	586	783	819	1380	1494	1935
Nontransgenic	59	9210	1788	50	300	610	800	844	1290	1404	1786
Nontransgenic	61	6068	1913	36	299	645	834	856	1355	1488	1905
Nontransgenic	61	6074	2805	56	437	914	1180	1271	2057	2223	2798
NCSU 2007	7	5925	2714	51	422	873	1126	1184	1916	2074	2698
NCSU 2007	7	5929	2242	31	309	657	918	963	1526	1657	2225
NCSU 2007	14	9253	2216	50	334	711	936	986	1502	1629	2208
NCSU 2007	14	9254	2009	34	309	642	862	927	1504	1630	2003
NCSU 2007	19	9064	2128	47	334	723	941	981	1504	1640	2120
NCSU 2007	19	9073	2131	35	318	684	885	965	1548	1690	2123
NCSU 2007	24	9288	2050	55	347	707	914	954	1460	1583	2039
NCSU 2007	24	9295	2283	50	347	722	954	1050	1707	1838	2276
NCSU 2007	29	5998	2466	39	404	818	1066	1101	1742	1880	2453
NCSU 2007	29	6002	2702	33	399	884	1153	1230	2000	2146	2697
NCSU 2007	32	6234	2250	41	363	744	995	1072	1578	1701	2233
NCSU 2007	32	6239	2596	52	426	904	1174	1234	1904	2040	2586
NCSU 2007	40	9386	1894	52	310	651	846	881	1338	1458	1886
NCSU 2007	40	9387	1933	40	297	587	791	861	1380	1496	1920
NCSU 2007	44	6257	2838	48	447	897	1182	1247	1919	2085	2816
NCSU 2007	44	6258	2586	30	362	784	1056	1130	1888	2038	2576

Treatment	Pen[a]	Tag[b]	Dressed carcass[c]	Fat pad[d]	Legs[d]	Thighs[d]	Wings[d]	Breast skin[d]	Major breast[d]	Minor breast[d]	Ribs/back[d]
NCSU 2007	47	6031	2533	31	377	800	1068	1113	1783	1939	2526
NCSU 2007	47	6034	1926	58	303	590	786	839	1304	1415	1918
NCSU 2007	49	9152	2024	61	349	712	937	1004	1497	1614	2019
NCSU 2007	49	9153	1694	21	257	532	716	747	1164	1268	1689
NCSU 2007	66	6347	2028	28	351	716	943	1006	1524	1626	2026
NCSU 2007	66	6348	2618	54	406	834	1120	1202	1930	2078	2612
NCSU 2007	71	9216	1816	53	297	569	757	794	1212	1322	1807
NCSU 2007	71	9221	2130	46	316	688	898	966	1524	1656	2124

[a] Two birds per pen were selected randomly for carcass preparation and analysis.
[b] Tags are used to identify individual animals.
[c] Fresh, unchilled carcass from which the head, neck, feet, feathers, viscera, and blood have been removed and is expressed in grams.
[d] Carcass parts were weighed additively on the scale and are expressed in grams