CORN FROM DIFFERENT ORIGINS

SMALL DIFFERENCES PER BIRD, LARGE SAVINGS PER FARM

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Poultry feed typically contains a combination of various cereal grains, including corn, wheat, barley, and sorghum. Corn grain, however, is often used as the main ingredient in poultry feed formulations because it is relatively inexpensive and readily available. Corn is also a highly digestible grain, meaning that the nutrients are easily absorbed and utilized by poultry. It also provides protein, vitamins and minerals, and is a good source of natural pigments that can enhance the coloration of animal tissues, including skin and egg yolks, which are highly valued in certain markets. This helps support growth and development and can improve feed conversion rates (FCR), which is the efficiency of converting the nutrients in feed into meat or eggs.

The main advantage of corn grain is that it is very energy-dense, particularly because of its high concentration in carbohydrates. The exact amount of carbohydrates in corn grain changes depending on the variety and growing conditions. On average, corn contains around 75 to 80% carbohydrates. Most of these carbohydrates are in the form of starch, a highly digestible complex carbohydrate that provides a steady source of energy to animals that consume it. Starch constitutes nearly 74% of the nutrients present in the corn kernel, and almost 93% of all carbohydrates. This is the reason why corn is a major component of broiler feed, and changes in the price of corn can have a significant impact on the cost of producing broilers. The typical corn percentage in broiler rations in the U.S. can vary depending on the specific feed formulation, feeding phase, and the nutritional requirements of the birds. However, corn is a common ingredient and can make up 50 to 70% of the ration, with the remaining portion consisting of other ingredients such as soybean meal, phosphate and carbonate sources and various supplements and additives.

The nutritional value of corn for broilers can be influenced by several factors, including genetic background, growing conditions, soil type, climate, cultivation practices, and post-harvest processing. Therefore, important differences in the nutritional value of corn can be observed between corn batches from different origins. For example, corn grown in regions with fertile soils, favorable weather conditions, adequate agronomic practices, and optimum post-harvest processing may have higher content of available nutrients, which can positively favor animal performance.

EFFECTS OF COUNTRY OF ORIGIN

A recent experiment conducted at Auburn University (Vargas et al., 2023) looked at the physical, chemical and nutritional variability of corn from different origins and its impact on broiler performance. Broilers were fed starter, grower and finisher commercial diets formulated to only differ in corn origin (U.S., Argentina and Brazil) to assess its impact on growth performance, carcass traits and nutrient digestibility. The experimental diets were prepared using whole corn sourced from the U.S. (re-imported), Argentina (ARG) and Brazil (BRA), which was gathered at Cartagena, Colombia, as a central location.

Overall, the growth performance results indicated variations in FCR, as shown in Table 1. Feed conversion is a measure of how efficiently an animal converts feed into bodyweight gain. A lower FCR indicates better efficiency, as less feed is required to produce a given amount of weight gain. Feeding broilers with corn from the U.S. and Brazil resulted in improved FCR throughout the experiment. Table 1 shows the bodyweights, bodyweight gains, feed intake and FCR of birds fed corn from the three different countries.

TABLE 1

Feed efficiency and conversion rate of YPM x Ross 708 male broilers fed diets with corn from different origins (Vargas et al., 2023).

Treat-ment	BW[1], g/bird			BWG[2], g/bird			FI[3], g/bird			FCR[4], g:g		
	10 d	21 d	35 d	1-10 d	1-21 d	1-35 d	1-10 d	1-21 d	1-35 d	1-10 d	1-21 d	1-35 d
USA	314	1073	2574	269	1029	2530	294^{b}	1304	3697	0.938^{b}	1.215^{b}	1.434^{b}
ARG	315	1048	2540	270	1003	2495	304^{a}	1310	3693	0.966^{a}	1.248^{a}	1.452^{a}
BRA	315	1065	2608	271	1021	2564	300^{ab}	1313	3756	0.948^{ab}	1.266^{b}	1.434^{b}
SEM[5]	3	8	21	3	8	21	2	9	27	0.007	0.003	0.004
P-VALUE	0.906	0.099	0.078	0.922	0.081	0.073	0.011	0.788	0.189	0.019	<0.0001	0.002

$^{a-b}$Least square means within a column with different superscripts differ significantly (P ≤0.05)
[1]Body weight
[2]Body weight gain
[3]Feed intake
[4]Feed conversion ratio corrected for mortality
[5]Standard error of the mean

Particularly, a statistical difference was observed on feed intake from 1 to 10 days of age, as broilers fed diets with inclusion of corn from Argentina had a higher intake in comparison to broilers fed diets with inclusion of corn from the U.S., which had a direct impact on the FCR exhibited by the birds during the same period, as broilers fed U.S. corn had a lower FCR compared to broilers fed ARG corn.

Overall, cumulative growth performance data indicated that feeding U.S. corn resulted in better FCR compared to feeding corn from Argentina. At 21 and 35 days of age, the use of U.S. corn (FCR = 1.215 and 1.434) resulted in a reduction in FCR, compared to corn sourced from Argentina (FCR = 1.248 and 1.452). This is important for two reasons: first, the rations of broilers during the early stages of growth, particularly in the first 21 days of age, are more expensive than rations for older birds. This is because younger chicks have higher nutritional requirements for growth and development, and their digestive systems are not fully

developed to efficiently utilize nutrients from feed. In these early rations, the quality of feed ingredients is important to maximize early growth performance and feed efficiency. Secondly, even small differences in the amount of feed consumed per bird can compound over time and have a significant impact on the overall profitability of a poultry business. This can be particularly important for large commercial broiler operations, where thousands or even tens of thousands of birds are raised in a single production cycle. In this experiment, if the birds eating rations with U.S. corn have a total intake of 3.697 kg of ration per bird over a 35-day production cycle, we can estimate the average daily feed consumption per bird as follows:

POULTRY FARM WITH 60,000 BROILERS

Assuming a broiler farm with 60,000 new broiler chicks added per cycle, with seven cycles per year and feed cost of $0.50/kg on average, the total cost savings with different FCRs can be calculated as follows:

Birds per cycle (A) 60,000	**U.S. Corn - Re-imported**	**ARG Corn**
Feed conversion rates (B)	1.434	1.452
Feed costs per kg (C)	$0.50	$0.50
Feed to achieve 2.4 kg gain per broiler (kg)	3.4416	3.4848
Feed cost per broiler	$1.721	$1.742
Annual costs of feed (7 cycles)	$722,736	$731,808
Increased annual feed costs versus U.S. corn		**$9,072**

ANNUAL FEED COST CALCULATIONS

Feed required to get 2.4 kg of gain per broiler = (2.4 kg/FCR[(B)]) = XX kg of feed per broiler

Feed costs to get 2.4 kg of gain per broiler = XX kg of feed per broiler * $0.50/kg[(C)] = $YY

Total feed costs of producing 60,000 broilers per cycle, with 7 cycles per year = $YY * 60,000[(A)] broilers per cycle * 7 cycles per year = $ZZ per year for feed

With a lower feed conversion rate of 1.434, the use of **U.S. corn is expected to result in cost savings of approximately $9,072 per year over Argentinian corn** for a poultry farm raising 60,000 chicks per cycle, with seven cycles per year.

POULTRY FARM WITH 1,200,000 BROILERS

Assuming an integration of 1,200,000 chicks entering per cycle with seven cycles per year and feed costs of $0.50/kg on average, the total cost savings with different FCRs can be calculated as follows:

Birds per cycle (A) 1,200,000	**U.S. Corn - Re-imported**	**ARG Corn**
Feed conversion rates (B)	1.434	1.452
Feed costs per kg (C)	$0.50	$0.50
Feed to achieve 2.4 kg gain per broiler (kg)	3.4416	3.4848
Feed cost per broiler	$1.721	$1.742
Annual costs of feed (7 cycles)	$14,454,720	$14,636,160
Increased annual feed costs versus U.S. corn		**$181,440**

ANNUAL FEED COST CALCULATIONS

Feed required to get 2.4 kg of gain per broiler = (2.4 kg/FCR[(B)]) = XX kg of feed per broiler

Feed costs to get 2.4 kg of gain per broiler = XX kg of feed per broiler * $0.50/kg[(C)] = $YY

Total feed costs of producing 1,200,000 broilers per cycle, with 7 cycles per year = $YY * 1,200,000[(A)] broilers per cycle * 7 cycles per year = $ZZ per year for feed

With a lower FCR of 1.434, the use of **U.S. corn is expected to result in cost savings of approximately $181,440 per year over Argentinian corn** for a poultry farm raising 1,200,000 chicks per cycle, with seven cycles per year.

CONCLUSION

Feed accounts for a significant portion of the cost of broiler production and improving feed efficiency can result in significant cost savings. By using less feed to produce the same amount of meat, poultry farms can reduce their feed costs and increase their profits. Improving feed efficiency can also help reduce the environmental impact of broiler production. Less feed consumption means less waste and demand for land, water, and other resources used in feed production. Broilers that are fed efficiently can maintain healthy body condition, which is essential for good health and welfare. Poor feed efficiency can lead to undernourishment, poor growth rates, and other health problems. In the highly competitive broiler industry, improving feed efficiency can give farmers a competitive advantage. By producing more meat with less feed, they can offer their products at a lower cost, which can help them capture a higher market share. Overall, feed efficiency is a key factor in the success and sustainability of broiler production, and poultry producers should strive to improve it through careful management and feed purchases.

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REFERENCES:

Jose I. Vargas[1],*, Joseph P. Gulizia[1], Susan M. Bonilla[1], Santiago Sasia[1] and Wilmer J. Pacheco[1],* Effect of Corn Origin on Broiler Performance, Processing Yield, and Nutrient Digestibility from 1 to 35 Days of Age. 2023. [1]Department of Poultry Science, Auburn University, Auburn, AL 36849, USA; jiv0001@auburn.edu (J.I.V.); jzg0120@auburn.edu (J.P.G.); XXXXX (S.M.B); ssasia@g.clemson.edu (S.S); wjp0010@auburn.edu (W.J.P)
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