

Sorghum as a source of Poultry Feed

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Introduction

Sorghum is a versatile grain used in many industries, including the animal feed, alcohol production, and starch industries. Beyond traditional food and fodder, it serves as a raw material for biofuel, a source of nutraceuticals with antioxidant properties for the health industry, and an ingredient in paper manufacturing, biodegradable products, and even adhesives. Its adaptability to challenging climates makes it a valuable, low-input, renewable resource for both bio industrial and food products, with emerging applications in packaging and various specialty food items.

Sorghum grain is a viable alternative to corn in poultry diets, especially when using **low-tannin varieties**. With proper balancing of amino acids, energy, and pigment supplementation, sorghum can replace corn **completely or partially** without negative effects on growth, egg production, or feed efficiency. It also provides an economic and sustainable option in regions where corn is expensive or scarce. Poultry diets must contain a large percentage of cereal grains that provide protein and energy within the ration. Rations, in general, include corn, wheat, barley, rice, and sorghum. The new varieties of sorghum are an excellent source of protein and energy for broilers, laying hens, turkeys, and waterfowl. Some sorghum users consider that the cultivation of sorghum generates a lower environmental impact compared to other cereals that require large amounts of moisture and fertilizers.

2. Nutritional Characteristics for poultry

- Both the nutritional profile and amino acid digestibility of sorghum are very similar to corn, especially when considering new varieties.
- The fat content of the sorghum grain and, therefore, its energy value, is slightly lower compared to corn.
- In turn, sorghum contains lower amounts of xanthophylls required for the pigmentation of the yolk and skin of broilers.

- In that case, other sources of pigments such as calendula oil, yeast products, synthetic compounds, and even corn-based DDGS can be used. These are widely available and can often be included in rations at a minimal cost.
- Another feature of sorghum is that it contains a little more available phosphorus. Due to these characteristics, when sorghum is valued at competitive prices, it can be used to replace corn at levels of up to 70% in broilers and layers.

3. Sorghum Grain as a Replacement for Corn in Poultry Diets

a. Nutritional Comparison (Corn vs. Sorghum)

- Energy:
 - Corn: 3300–3400 kcal/kg ME (Metabolizable Energy)
 - Sorghum: 3100–3300 kcal/kg ME (slightly lower)
- Protein:
 - Corn: ~8–9%
 - Sorghum: ~9–11% (slightly higher)
- Amino Acids:
 - Sorghum has less lysine and threonine than corn → requires supplementation.
- Fat Content:
 - Corn has higher oil (~4%) than sorghum (~2–3%).
- Fiber:
 - Sorghum tends to have more crude fiber.
- Pigments (xanthophylls):
 - Corn contributes yellow pigment (important for yolk and skin color in poultry).
 - Sorghum lacks pigments → pale yolk and skin unless supplemented.

b. Anti-Nutritional Factors in Sorghum

- Tannins (in some varieties):
 - Reduce protein digestibility and feed intake.
 - Modern *low-tannin sorghum hybrids* are much safer for poultry feeding.
- Phytates: May limit phosphorus availability (needs phytase enzyme supplementation).

c. Practical Use in Poultry Diets

- Broilers:
 - Sorghum can replace corn up to 50–100% in *low-tannin* varieties if amino acids and pigments are supplemented.
 - No adverse effect on growth if properly balanced.
- Layers:
 - Can replace 40–60% of corn.
 - Requires pigment supplementation (marigold extract, synthetic pigments, or yellow maize mix) for yolk color.
- Breeders:
 - Replacement possible but energy/protein balance and micronutrient supplementation are critical.

d. Advantages of Sorghum

- Drought-tolerant crop → cheaper and more sustainable in arid regions.
- Good source of energy (comparable to corn).
- Locally available in many parts of Asia & Africa → reduces feed cost.
- More resistant to mycotoxins (like aflatoxins) compared to corn.

e. Limitations & Considerations

- Lower metabolizable energy (especially high-tannin varieties).
- Lack of natural pigments → affects consumer preference for yolk/skin color.
- Slightly lower palatability in some cases.
- Needs enzyme (phytase, protease) supplementation for better nutrient availability.



4. Sorghum grain processing for poultry

- The physical and chemical effects of heat, steam or moisture, pressure and grinding influence the digestibility of grains, including sorghum.
- Broilers and turkeys are fed feed in the form of pellets, resulting in an improvement in weight gain and feed efficiency, regardless of the type of grain used. Virtually 100% of meat poultry rations in the United States are supplied as pellets.
- Experienced food manufacturers will agree that feeds containing sorghum are harder to pelletize. This is partly since its slightly lower energy value is sometimes corrected with the addition of additional oil or grease, which in turn reduces pellet quality.
- If the price of sorghum is favorable for replacing a portion of the wheat or corn fraction, the most cost-effective way to include a small amount of grain within the diet is to simply add it in whole form.
- Group of researchers has also presented a study where they indicate that whole sorghum can be added to poultry rations without negatively affecting growth.

5. Corn vs. Sorghum in Poultry Diets

Parameter	Corn (Maize)	Sorghum Grain	Remarks
Metabolizable Energy (ME)	3300–3400 kcal/kg	3100–3300 kcal/kg	Sorghum slightly lower
Crude Protein (%)	8–9	9–11	Sorghum slightly higher
Amino Acid Profile	Better lysine, methionine, threonine	Lower lysine & threonine	Needs supplementation

Crude Fat (%)	3.5–4	2–3	Corn richer in oil
Fiber (%)	2–3	3–4	Sorghum has more fiber
Pigments (xanthophylls)	Rich → yellow yolk & skin pigmentation	Absent → pale yolk & skin	Needs pigment supplementation
Anti-Nutritional Factors	Low	Tannins (high in some varieties), phytates	Use low-tannin sorghum + enzymes
Mycotoxin Susceptibility	More prone to aflatoxins	Relatively resistant	Sorghum safer in humid climates
Palatability	High	Slightly lower (esp. high tannin types)	Improves with processing
In Broiler Diets	Gold standard (100% inclusion)	Can replace 50–100% (low tannin types)	Supplement AAs & pigments
In Layer Diets	Good yolk color	40–60% replacement practical	Pigments must be added
Cost & Availability	Expensive in some regions	Cheaper, drought-tolerant crop	Economically viable alternative

6. Benefits of Replacing Corn with Sorghum

- **Nutritional Value:** Low-tannin sorghum has a nutritional profile similar to corn, providing energy and protein.
- **Drought Tolerance:** Sorghum is a drought-resistant crop, making it a sustainable and feasible option in semi-arid areas.
- **Improved Gut Health:** Sorghum can positively alter gut microflora, leading to lower levels of detrimental bacteria like *Clostridium* and higher counts of beneficial ones like *Lactobacillus*.
- **Antioxidant Properties:** Sorghum contains polyphenols with antimicrobial and antioxidant properties that may enhance nutrient absorption and utilization.
- **Economic Benefits:** Using locally grown sorghum can reduce feed costs and support sustainable, long-term poultry operations.
- **Meat and Fat Characteristics:** Sorghum diets can lead to a reduction in abdominal fat and increased muscle color intensity in broilers.

7. Considerations and Potential Drawbacks

- **Tannin Content:** It is crucial to use modern, low-tannin sorghum varieties. High-tannin sorghum can reduce protein utilization and negatively affect broiler performance.

- **Amino Acid Availability:** While sorghum is nutritionally similar to corn, some amino acids, such as methionine, are less available.
- **Energy Value:** Sorghum's metabolizable energy value is often slightly lower than corn's.
- **Yolk Color:** If yellow corn is replaced by other grains like sorghum, a source of yellow pigment, such as alfalfa meal, may need to be added to maintain yolk color in laying hens.

8. Recommendations

- **Use Low-Tannin Varieties:** Always choose modern, low-tannin (99% tannin-free) sorghum varieties to avoid negative impacts on poultry.
- **Consider Partial to Total Replacement:** Studies show that partial or even total replacement of corn with low-tannin sorghum can be successfully implemented in broiler diets.
- **Monitor Performance:** Monitor broiler performance, feed intake, and growth rates to ensure no adverse effects when implementing sorghum in diets.
- **Adjust for Yolk Color:** For laying hens, consider adding a yellow pigment source to diets where corn is replaced by sorghum to maintain desired yolk color.

9. Conclusion

Sorghum grain is a viable alternative to corn in poultry diets, especially when using low-tannin varieties. With proper balancing of amino acids, energy, and pigment supplementation, sorghum can replace corn completely or partially without negative effects on growth, egg production, or feed efficiency. It also provides an economic and sustainable option in regions where corn is expensive or scarce.