INFLUENCE OF GERMINATED RED – GRAINS SORGHUM ON PRODUCTION OF BROILER CHICKEN PERFORMANCE

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ABSTRACT.
This experiment was conducted at the poultry \ Animal Production Department - College of Agricultural Engineering Sciences - University of Baghdad, for the period from 22/11/2020 to 2/1/2021 . To study the effect of adding germinated red grains sorghum (GRGS) and raw red grains sorghum(RRGS) as a complete substitute for maize to broiler diets on production performance. 225 broiler chicks were used in this experiment and randomly distributed to five treatments by 45 chicks/treatment with three replicates/treatment , 15 chicks/replicate : T1 control treatment (maize) , T2 (20%) GRGS + (80%) RRGS , T3 (40%) GRGS + (60%) RRGS , T4 (60%) GRGS + (40%) RRGS , T5 (80%) GRGS + (20%) RRGS . the data was analyzed statistically according to complete randomize design (CRD) , register Qualities understudy over three periods 1 to 10 days a starter diet, and during the period from 11 to 24 days on a growth diet, and during the period from 25 to 42 days on a finisher diet according to the production guide of Ross 308. The results were showed significant superiority (P<0.01) of the T2 treatment as compared with other treatments for the body weight and weight gain and feed intake, a significant superiority (P<0.01) in the feed conversion ratio of the T1 treatment as compared with other treatments T2, T3, T5.

Keywords: Red sorghum, raw, body weight.
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تأثير انبات بذور الذرة الحمراء رفيعة الأوراق واستعمالها في علائق فروج اللحم في الأداء الانتاجي

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المستخلص.
أجريت هذه التجربة في حقل الطيور الداجنة التابع لقسم الإنتاج الحيواني – كلية علوم الهندسة الزراعية – جامعة بغداد ، للفترة من 2020/11/22 الى 2021/1/2 . لدراسة تأثير إضافة الذرة الرفيعة الحمراء (GRGS) والذرة الرفيعة الحمراء الخام (RRGS) كبديل كلي للذرة الصفراء في العلائق على الاداء الانتاجي لفروج اللحم ، أستعمل في التجربة 225 فرخاً فروج لحم وزعت عشوائياً على خمسة معاملات بواقع 45 فرخ/معاملة وكل معاملة تحتوي على ثلاث مكررات وكل مكرر يحتوي على 15 فرخ : T1 معاملة سيطرة (تحتوي على ذرة صفراء) وT2 (20%) ذرة حمراء منبتة + (80%) ذرة حمراء خام وT3 (40%) ذرة حمراء منبتة + (60%) ذرة حمراء خام وT4 (60%) ذرة حمراء منبتة + (40%) ذرة حمراء خام وT5 (80%) ذرة حمراء منبتة + (20%) ذرة حمراء خام . وحللت البيانات وفق التصميم العشوائي الكامل (CRD) , سجلت الصفات قيد الدراسة على مدار ثلاث فترات من 1 إلى 10 أيام عليقة بادئ ، من 11 إلى 24 يومًا عليقة نمو ، من 25 إلى 42 يومًا عليقة نهائية وفقًا لدليل الإنتاج لـ Ross 308 . اشارت البيانات الى وجود تفوق معنوي (P<0.01) في المعاملة T2 مقارنة بالمعاملات أخرى لمعدل وزن الجسم ومعدل الزيادة الوزنية ومعدل استهلاك العلف ، تفوق معنوي (P<0.01) لنسبة التحويل الغذائي للمعاملة T1 مقارنة بالمعاملات الأخرى T2 و T3 و T5 .

الكلمات المفتاحية: ذرة حمراء رفيعة الأوراق . خام. وزن الجسم .
*** البحث مستل من اطروحة دكتوراه للباحث الاول.**

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INTRODUCTION

The search for alternative feed sources to the traditional sources approved in poultry feeding continues to interest many researchers and workers in the poultry industry**,** ***(Sorghum bicolor L. Moench)*** is one of these important alternatives that can be used in poultry diets and is considered as source of energy and protein. It belongs to the Poaceae family and In terms of importance, sorghum is ranked fifth after wheat, maize, rice, and barley throughout the world in terms of production and cultivated area (24). There are different types of sorghum. red sorghum, two-color (white and red) sorghum, Sorghum bicolor, and Sorghum Vulgare. where the seed size and color of sorghum differ from one variety to another (22). The red grains sorghum has a high nutritional value and its nutritional content may be close to the protein and amino acid content of maize (15). As well as its content of vitamins, which are necessary to build body tissues and to perform a specific metabolic function or to prevent the emergence of certain deficiency symptoms (4).In addition to its good growth characteristics and its ability to grow in difficult environmental conditions, red sorghum also contains many phenolic acids and flavonoids (8; 26). And that most of these plant seeds have antioxidant activity, anti-carcinogenic activity, their effect in lowering cholesterol, their anti-microbial activity, and their effect in reducing the risk of developing some diseases (6; 11; 25). The main problem is that this crop is not mainly used in poultry feed because it contains some anti-nutritional properties that reduce the nutritional value of this crop (23). The proportions of these antibiotics vary according to the type of sorghum and the area where it is grown. Therefore, some techniques or methods are required before using them in poultry diets (16). The mechanism of action of these techniques is to reduce the level of these inhibitors and thus improve the nutritional value of the grain. In the presence of different techniques such as (removing the husks, heat, soaking, germination, adding enzymes or fat) the use of a particular method depends on the cost and effectiveness of the method in reducing or minimizing the negative effects of nutritional inhibitors (4, 5, 9, 18). Therefore, the process of germination has become one of the most important means as it improves the nutritional value of different types of grains, because of its effective effect in removing some nutritional inhibitors by increasing the movement of secondary metabolic compounds and improving the protein digestion parameters (10). research and studies tended towards finding solutions through the use of some food additives and the use of some treatment methods (2, 3, 27, 29). Therefore, this research was aimed to study the effect of germination of red grains sorghum on broiler chicken production performance.

MATERIALS AND METHODS

The red grains sorghum was germinated As shown in a planner (1) after making sure that it is clean and free from impurities, the seeds intended for germination were washed and soaked in a plastic container of (50 kg) capacity for 24 hours in the shade. After the grains were left to fully absorb the water until the germination process occurs for 48-72 hours until the rootstock and feather appear, then the grains were dried directly by spread on a concrete floor in a shadow place with constant stirring until the drying foreign matter, mold, and insects. Then a chemical analysis is carried out for it as in Table (1) and based on the results, nutritional rations of equal energy and protein are formed, as in Table (2, 3, 4). 225 chicks were used in the study. They were naturalized in the field at the age of one day and the chicks were distributed randomly into five treatments by 45 chicks/treatment, with three replicates/treatment, 15 chicks/replicate , The data was analyzed statistically according to Complete Randomize Design (CRD) .

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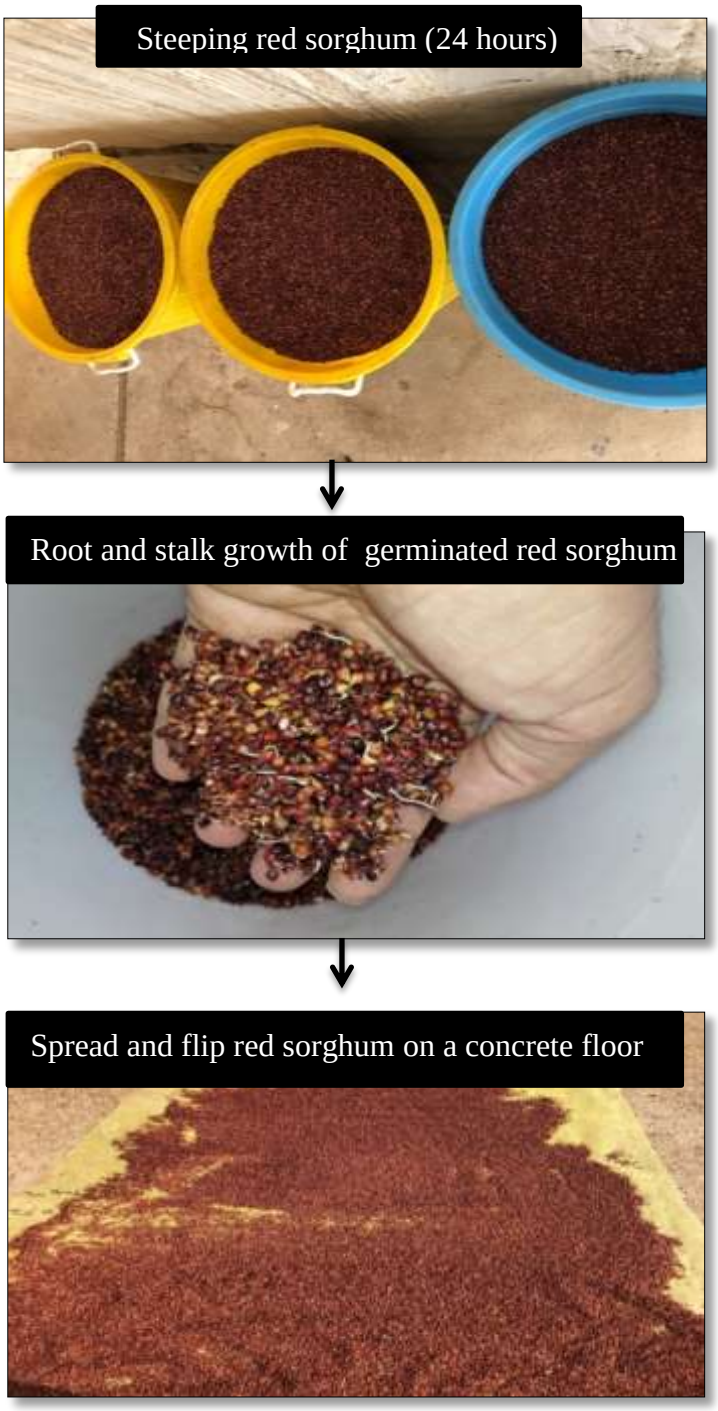

planner 1. red sorghum germination process.

Table 1 . Chemical analysis of red sorghum.

	RRGS	GRGS
Protein %	8.1	8.9
Lipid %	4.3	4.8
Ash %	10.2	10.3
moisture %	5.2	6.0
CHO %	71.6	69.9
B – carotene (ppm)	27.6	52.8
Linoleic acid %	41.5	50.1
Tannic acid (ppm)	45.3	33.2
Phytic acid (ppm)	26.3	18.4
Ca (ppm)	53.8	59.7
Metabolizable (Kcal\Kg)	357.8	358.6
Methionine (ppm)	72.3	181.4
Lysine (ppm)	123.8	198.3

Table 2. The starter diet for broilers for a period (1-10 days).

Feed material	treatments				
	T1	T2	T3	T4	T5
Maize	48	-	-	-	-
Raw red grains sorghum	-	9.6	19.2	28.8	38.4
Germinated red grains sorghum	-	38.4	28.8	19.2	9.6
wheat	9.7	13.1	12.9	12.7	12.5
soybean meal 48%	33	31.9	32.1	32.3	32.5
Protein Concentrate(1)	5	5	5	5	5
oil	2	-	-	-	-
limestone	1.2	1.6	1.6	1.6	1.6
D C P	0.7	-	-	-	-
A mixture of vitamins and minerals	0.2	0.2	0.2	0.2	0.2
salt	0.2	0.2	0.2	0.2	0.2
Computed Chemical Analysis(2)					
Crude Protein%	23.03	23.01	23.00	23.00	23.00
Metabolizable (Kcal\Kg)	3001.19	3012.94	3010.81	3008.68	3006.80
methionine%	0.50	0.49	0.48	0.47	0.47
Lysine%	1.32	1.264	1.26	1.26	1.26
Ca%	0.96	0.97	0.97	0.97	0.97
P%	0.47	0.50	0.49	0.48	0.47

1-Protein concentrate, Al-Wafi type, each kg of which contains: 40% crude protein, 2107 kilocalories /kg energy , 3.85% lysine, 3.7% methionine, 4.12% methionine + cysteine, 5% fat, 5% calcium, 4.68 % phosphorous , 2.4% sodium, 2.26 % fibre

2-Chemical analysis of the diet according to the NRC 1994

Table 3. The Growing diet for broilers for a period (11-24 days)

Feed material	treatments				
	T1	T2	T3	T4	T5
Maize	48	-	-	-	-
Raw red grains sorghum	-	9.6	19.2	28.8	38.4
Germinated red grains sorghum	-	38.4	28.8	19.2	9.6
wheat	12.8	16.4	16.1	15.9	15.6
soybean meal 48%	29.1	28	28.2	28.4	28.7
Protein Concentrate(1)	5	5	5	5	5
oil	3.1	0.9	1	1	1
limestone	1.1	1.3	1.3	1.3	1.3
D C P	0.5	-	-	-	-
A mixture of vitamins and minerals	0.2	0.2	0.2	0.2	0.2
salt	0.2	0.2	0.2	0.2	0.2
Computed Chemical Analysis(2)					
Crude Protein%	21.50	21.50	21.50	21.50	21.50
Metabolizable (Kcal\Kg)	3101.75	3100.69	3105.49	3103.36	3100.54
methionine%	0.48	0.47	0.46	0.45	0.44
Lysine%	1.22	1.20	1.20	1.20	1.20
Ca%	0.87	0.86	0.86	0.85	0.85
P%	0.43	0.49	0.48	0.46	0.45

1-Protein concentrate, Al-Wafi type, each kg of which contains: 40% crude protein, 2107 kilocalories /kg energy , 3.85% lysine, 3.7% methionine, 4.12% methionine + cysteine, 5% fat, 5% calcium, 4.68 % phosphorous , 2.4% sodium, 2.26 % fibre

2-Chemical analysis of the diet according to the NRC 1994

Table 4. The Finisher diet for broilers for a period (25-42 days)

Feed material	treatments				
	T1	T2	T3	T4	T5
Maize	48	-	-	-	-
Raw red grains sorghum	-	9.6	19.2	28.8	38.4
Germinated red grains sorghum	-	38.4	28.8	19.2	9.6
wheat	15.6	19	18.7	18.5	18.3
soybean meal 48%	25.3	24.3	24.5	24.7	24.9
Protein Concentrate(1)	5	5	5	5	5
oil	4.3	2.1	2.2	2.2	2.2
limestone	1	1.2	1.2	1.2	1.2
D C P	0.4	-	-	-	-
A mixture of vitamins and minerals	0.2	0.2	0.2	0.2	0.2
salt	0.2	0.2	0.2	0.2	0.2
	Computed Chemical Analysis(2)				
Crude Protein%	20.02	20.04	20.02	20.02	20.02
Metabolizable (Kcal\Kg)	3204.29	3200.57	3204.33	3202.2	3200.06
methionine%	0.46	0.45	0.44	0.43	0.42
Lysine%	1.1	1.1	1.1	1.1	1.1
Ca%	0.80	0.80	0.80	0.80	0.80
P%	0.40	0.48	0.47	0.46	0.45

Protein concentrate, Al-Wafi type, each kg of which contains: 40% crude protein, 2107 kilocalories /kg energy , 3.85% lysine, 3.7% methionine, 4.12% methionine + cysteine, 5% fat, 5% calcium, 4.68 % phosphorous , 2.4% sodium, 2.26 % fibre

Chemical analysis of the diet according to the NRC 1994.

RESULTS AND DISCUSSION

Average live body weight

Results in Table 5 reveal that in 1st and 2nd feeding period There were no significant effect of treatments on mean live body weight , while in 3rd period , T2 gave highest mean of body weight and it was significantly different to all treatments except T5 which was not significantly different to T1 , T3 and T4 .

Table 5. Effect adding (GRGS) and (RRGS) as a total substitute for maize on the mean Average live body weight (gm) of broilers (mean ± standard error).

treatment	Average live body weight (g)			
	(0 - 10 days)	(11-24 days)	(25 - 42 days)	
T1	195.83 ± 4.47	1068.10± 13.28	2861.57 ± 25.74	B
T2	205.13 ± 4.57	1079.50 ±27.83	3082.43± 26.07	A
T3	191.46 ± 7.14	1049.10 ± 25.54	2806.57 ± 28.61	B
T4	191.50 ± 11.44	1031.67 ± 67.51	2868.37 ± 63.33	B
T5	199.36 ± 2.13	1085.73 ± 18.37	2948.07 ± 66.20	AB

- A, B, C: The difference between letters indicates a significant difference between the treatment

- treatment: : T1 control treatment (maize) , T2 (20%) GRGS + (80%) RRGS , T3 (40%) GRGS + (60%) RRGS , T4 (60%) GRGS + (40%) RRGS , T5 (80%) GRGS + (20%) RRGS

Average weight gain

It shows from Table (6) that there are no significant differences in the first and second age period for the rate of weight gain between treatments T2, T3, T4, T5, and comparison treatment T1. As for the stage (25-42 days), treatment T2 significantly (P<0.01) (20% GRGS + 80% RRGS) was superior to treatment T1 (control treatment containing maize) and all other replacement treatments. Also, no significant differences were observed during this period between the substitution treatments T3, T4, and T5 and the T1 treatment. As for the accumulative weight gain rate (0-42 days), Table (6) shows that the same significant superiority (P<0.01) for treatment T2 over treatment T1 and all other substitution treatments, except for treatment T5 that did not differed significantly from it, as well as no significant differences, were observed for T3, T4 and T5 treatments for T1 treatment.

Table 6. Effect adding (GRGS) and (RRGS) as a total substitute for maize on the mean Average weight gain (g)of broilers(mean ± standard error).

treatment	Average weight gain (g)			
	(0 - 10 days)	(11-24 days)	(25 - 42 days)	(0 - 42 accumulative)
T1	155.70 ± 4.07	872.26± 16.15	1793.47 ± 38.98 B	2821.43 ± 25.36 B
T2	164.63 ± 4.35	874.36 ±31.81	2002.93± 53.91 A	3041.93 ± 25.81 A
T3	150.80 ± 7.63	857.63 ± 31.28	1757.47 ± 5.49 B	2765.90 ± 27.98 B
T4	150.03 ± 12.43	840.16 ± 56.94	1836.70 ± 12.19 B	2826.90 ± 64.13 B
T5	158.20 ± 2.43	886.36 ± 17.24	1862.33 ± 52.23 B	2906.90 ± 66.51 AB

- A, B, C: The difference between letters indicates a significant difference between the treatment
- treatment: : T1 control treatment (maize) , T2 (20%) GRGS + (80%) RRGS , T3 (40%) GRGS + (60%) RRGS , T4 (60%) GRGS + (40%) RRGS , T5 (80%) GRGS + (20%) RRGS

Feed consumption rate

It is noted from Table (7) that there are significant differences (P<0.01), where treatment T2 recorded a significant superiority in the amount of feed consumed during the period (0-10 days) compared to the comparison treatment T1 and treatment T4. While there were no significant differences between T2 treatment and both T3 and T5, the replacement treatments T3 and T4 were did not differed significantly t from the control treatment. In the second phase (11-24 days), a significant increase (P<0.01) was observed in the amount of feed consumed in favor of treatment T3 and T5 compared to the comparison treatment T1. Also, treatment T2 was significantly superior to control treatment T1, which was not significant to T2 over treatment T3 and T5. As for the period (25-42 days), as well as the general (accumulative) average (0-42 days), no significant differences were observed between the treatments T2, T3, T4, T5, and T1 treatment.

Table 7 . Effect adding (GRGS) and (RRGS) as a total substitute for maize on the Feed consumption rate (g / bird) (mean ± standard error).

treatment	Feed consumption rate (g / bird)			
	(0 - 10 days)	(11-24 days)	(25 - 42 days)	(0 - 42 accumulative)
T1	234.33 ± 9.52 C	1140.33± 11.46 C	3358.00 ± 139.60	4732.67 ± 149.98
T2	263.66 ± 7.26 A	1398.67 ±51.30 AB	3478.33± 153.09	5140.67 ± 185.89
T3	239.66 ± 7.68 ABC	1456.67 ± 78.81 A	3369.67 ± 108.20	5066.00 ± 123.62
T4	238.66 ± 3.75 BC	1257.67 ± 15.76 BC	3602.67 ± 176.78	5099.00 ± 173.15
T5	262.66 ± 7.21 AB	1412.00 ± 34.00 A	3486.33 ± 54.33	5161.00 ± 50.50

- A, B, C: The difference between letters indicates a significant difference between the treatment
- treatment: : T1 control treatment (maize) , T2 (20%) GRGS + (80%) RRGS , T3 (40%) GRGS + (60%) RRGS , T4 (60%) GRGS + (40%) RRGS , T5 (80%) GRGS + (20%) RRGS

food conversion factor

It is indicates from Table (8) that there are no significant differences for the feed conversion factor between the experimental treatments T2, T3, T4, T5, and the control treatment T1 in the age period (0-10 days) and (25-42 days). In the second age period (11-24 days), a significant (P<0.01) was observed in favor of T1 (control treatment containing grains maize) over treatment T2, T3, and T5, while it did not differ from T4. As for the accumulative period (0-42 days), no significant differences were observed between the substitution treatments of raw and germinated red grains sorghum with the control treatment.

Table 8 . Effect adding (GRGS) and (RRGS) as a total substitute for maize on the food conversion factor (g feed / g weight gain) (mean ± standard error).

treatment	food conversion factor (g feed / g weight gain)			
	(0 - 10 days)	(11-24 days)	(25 - 42 days)	(0 - 42 accumulative)
T1	1.50 ± 0.08	1.30± 0.01 B	1.87 ± 0.09	1.67 ± 0.05
T2	1.60 ± 0.08	1.60 ± 0.06 A	1.74± 0.12	1.69 ± 0.07
T3	1.59 ± 0.04	1.70 ± 0.11 A	1.91 ± 0.05	1.83 ± 0.03
T4	1.61 ± 0.11	1.51 ± 0.10 AB	1.96 ± 0.10	1.80 ± 0.02
T5	1.65 ± 0.02	1.59 ± 0.06 A	1.87 ± 0.03	1.77 ± 0.02

- A, B, C: The difference between letters indicates a significant difference between the treatment
- treatment: : T1 control treatment (maize) , T2 (20%) GRGS + (80%) RRGS , T3 (40%) GRGS + (60%) RRGS , T4 (60%) GRGS + (40%) RRGS , T5 (80%) GRGS + (20%) RRGS

Replacing grains maize with red grains sorghum (raw or germinated) did not had any negative effect on the production performance of birds, and this may be due to several reasons: • The germination process may have a positive role in beneficent the nutritional value of red grains sorghum by reducing cross-linked kafirin protein in sorghum grains and increasing the content of other proteins such as albumin and globulin (21). The content of amino acids improved during the process of seed germination due to the activity of the enzyme Protease, which breaks down the peptide component into free amino acids (lysine and methionine) and convert the starch into a simple sugar that is easily eaten and digested by young broilers (3). The fat content also decreases, and the availability of important minerals such as phosphorous, calcium, magnesium, iron, and zinc increases (19). Reducing the proportion of anti-nutrients, especially phytic acid and tannin (Table 1), and thus benefiting from these feed alternatives without any negative impact on the performance of birds. The nutritional value of red sorghum and its content of nutrients may be close to what maize contains protein and amino acids (15). As well as its content of vitamins, which are necessary to build body tissues and to perform a specific metabolic function or to prevent the emergence of certain deficiency symptoms (4). In addition, the coefficient of digestion and facilitation of these nutrients may be high, which has a positive impact on the representation and benefit of these elements significantly. The active compounds found in the red sorghum, especially the phenolic compounds, are because of their many advantages as antioxidants (17). Anti-inflammatory drugs (28). and anti-allergic (13). Antibacterial (1). It also protects the heart from diseases and blood vessels (14) Sultan's disease and has a role in protecting the nervous system (28). As the mechanism of these phenolic compounds may act as growth promoters by enhancing the secretions of digestive enzymes (digestive enzymes, saliva, bile, and mucus) as well as by reducing the numbers of pathogenic bacteria in the digestive tract or by modifying the morphology of the gut due to its functions and its antioxidant and anti-oxidant activity for inflammation (14). It also improves the flavor of the feed and thus increases its palatability, which leads to an increase in the amount of feed consumed and thus improves its production performance (7). It also has a role in maintaining the optimal balance between beneficial bacteria and pathogenic bacteria in the digestive system, which helps maintain intestinal health and improve growth (12).

C0NCLUSION

The germination process can be considered one of the good and easy means of application, and it proved effective in reducing the level of nutritional inhibitors in grains. Also, the inclusion of red grains sorghum in broiler diets did not have any negative impact on the production performance.

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