# INFLUENCE OF RECONSTITUTED HIGH AND LOW TANNIN SORGHUM GRAINS ON THREONINE BIOAVAILABILITY IN BROILER CHICKS

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## Story in Brief

This experiment was conducted to evaluate the effect of reconstitution and subsequent incubation upon the relative threonine bioavailability of two high-tannin (Darset, a commercial Brown sorghum) and one low-tannin (Redlan) sorghum grain variety. The process involved imbibing grains with water to bring the moisture content to 30 percent and 12-day anaerobic incubation at 32 C. Reconstituted and unreconstituted sorghum grain based rations were supplemented with crystalline amino acids to meet at least 60 percent of the amino acid requirement for maximal growth except for threonine which was supplied totally by sorghum grain and met 45 percent of the chick requirements. The tannin content of high-tannin Darset (2.53 percent) and Brown (2.41 percent) sorghums was eliminated as a result of the reconstitution incubation process while the low tannin Redlan variety was not impacted. Body weight gain and feed efficiency increased ($P<.005$) with reconstituted and incubated high-tannin sorghum grains and numerically with the low tannin. Reconstitution and incubation of bird resistance sorghum grain is a potential method to enhance utilization.

## Introduction

Studies have demonstrated that weight gain and feed utilization are reduced when high-tannin sorghum grains are fed to broiler chicks and layers in contrast to low-tannin sorghum grains. A portion of tannin's toxic effects have been ascribed to reduced nitrogen digestibility and hence retention. Rostagno (1973) observed mean amino acid digestilbities of 73, 41 and 22 percent for low, intermediate and high tannin sorghums, respectively.

The purpose of the study described herein was to evaluate the effect of reconstituting sorghum grain incubation upon threonine bioavailability and the overall feeding value of bird resistant sorghum grain in broiler rations.

## Materials and Methods

Darset and a commercial brown sorghum grain (High tannin) and Redlan (low tannin sorghum grain) were reconstituted by the addition of water to bring grain moisture content to 30 percent. The grain and water were

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mixed in a rotary mixer until water was completely absorbed. A commercial mold inhibitor[a] was added to eliminate mold growth during incubation. The reconstituted grains were stored anaerobically in polyethylene bags, incubated for 12 days at 32 C, dried and ground through a 2 mm screen. The rations (Table 1) were supplemented with crystalline amino acids (Table 2) to bring all amino acids except threonine to 60 percent of the chicks requirement. Supplemental threonine was added to untreated Darset, Brown, and Redlan threonine deficient rations, respectively to validate threonine as the first limiting nutrient. The experiment utilized 270 Commercial broiler chicks randomly assigned to 9 treatments, with three replicates per treatment and 10 birds per replicate. Birds were allowed to consume feed and water ad libitum during the 8 day experimental period.

Table 1.

| Ingredients (%) | Darset | Commercial Brown Sorghum | Redlan |
|---|---|---|---|
| Sorghum grain | 90.00 | 90.00 | 90.00 |
| Sorghum AA-mix | 3.96 | 5.11 | 2.81 |
| Mineral mix | 3.30 | 3.30 | 3.30 |
| Vitamin premix | 0.20 | 0.20 | 0.20 |
| Corn starch | 0.13 | 0.17 | 0.10 |
| Threonine[a] | -- | -- | -- |
| Chromium | 0.10 | 0.10 | 0.10 |
| Protein (%) | 13.80 | 13.80 | 13.80 |
| Threonine (%) | 0.34 | 0.32 | 0.33 |
| ME (Kcal/kg) | 3033.00 | 3033.00 | 3033.00 |

[a] .13% threonine was added at the expense of cornstarch in one treatment of sorghum grain variety to validate thronine on the 1st limiting nutrient.

Table 2. Crystalline amino acid mix.

| Amino acids (%) | Darset | Brown | Redlan |
|---|---|---|---|
| L-glutamine | 2.80 | 3.80 | 1.80 |
| L-lysine HCl | 0.47 | 0.49 | 0.43 |
| L-arginine HCl | 0.42 | 0.46 | 0.36 |
| Dl-methionine | 0.16 | 0.17 | 0.15 |
| L-cysteine | 0.09 | 0.11 | 0.06 |
| L-tryptophan | 0.02 | 0.04 | 0.01 |
| L-glycine | -- | 0.02 | -- |
| L-serine | -- | 0.01 | -- |

[a] Agrimerica, Inc., Northbrook, IL. 60062

Table 3.

| Treatments | Tannin | Threonine (%) | Chick Performance: Weight Gain (g) | Chick Performance: Feed Intake | Chick Performance: Feed/ Gain |
|---|---|---|---|---|---|
| | % | % | | g | g |
| Darset | 2.53 | 0.34 | $218^{g}$ | $965^{g}$ | $4.4^{b}$ |
| Reconstituted Darset[a] | 0.00 | 0.34 | $415^{e}$ | $1131^{ef}$ | $2.7^{de}$ |
| Darset + Threonine | 2.53 | 0.47 | $584^{d}$ | $1474^{c}$ | $2.5^{e}$ |
| Commercial Brown Sorghum | 2.41 | 0.32 | $265^{g}$ | $1085^{ef}$ | $4.1^{c}$ |
| Commercial Brown Sorghum Reconstituted[a] | 0.00 | 0.32 | $347^{f}$ | $1020^{fg}$ | $3.0^{d}$ |
| Commercial Brown Sorghum + Threonine | 2.41 | 0.49 | $641^{c}$ | $1558^{c}$ | $2.4^{e}$ |
| Redlan | 0.00 | 0.33 | $413^{e}$ | $1251^{d}$ | $2.4^{d}$ |
| Redlan Reconstituted[a] | 0.00 | 0.30 | $436^{e}$ | $1187^{de}$ | $2.7^{de}$ |
| Redlan + Threonine | 0.00 | 0.43 | $851^{b}$ | $1787^{b}$ | $2.1^{f}$ |

[a] Incubated for 12 days at 32 C.

[b,c,d,e,f,g] Mean within a column with unlike superscripts differ ($P<.05$).

## Results and Discussion

Reconstitution of high-tannin sorghums (Darset, Brown) significantly ($P<0.01$) improved body weight gain, and feed efficiency presumably due to the complete removal of tannin from the grain (Table 3). Reconstituting low-tannin (Redlan) grain numerically increased body weight gain. Supplementing untreated sorghum grains with threonine to bring the ration's threonine content from 45 to 60 percent of the chick's requirement for maximal growth, similar to the other amino acids, increased body weight gain ($P<0.01$) and feed efficiency (P0.05) validating that threonine was indeed the first limiting nutrient and that the reconstitution incubation process increases amino acid digestibility.

Reconstituting sorghum grain and subsequent anaerobic incubation provides an effective method to detoxify sorghum grain tannin in the varieties evaluated. However, to fully utilize the technique in a commercial setting would likely necessitate feeding higher moisture rations to poultry, unless rapid and economical drying methods existed. Prolonged grain and/or ration exposure to moisture can result in mold growth with subsequent mycotoxin production unless precautionary steps are taken, through the use of mold inhibitors to limit mold growth, or in maintaining a strict anaerobic environment.

## Literature Cited

Rostagno, H.S., J.C. Rogler and W.R. Featherston. 1973. Poultry Sci. 52:772.