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RESEARCH NOTE

THE EFFECT OF FORMALIN TREATMENT ON THE NUTRITIVE VALUE OF SORGHUM GRAIN WITH A HIGH TANNIN CONTENT

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Grain sorghum is an important source of concentrate for the animal feed industry. About 280 000 tons are produced annually in South Africa, of which up to 10 percent has been used in animal feeds.

The bird-proof types of sorghum which at present constitute a significant amount (*c* 30%) of the total produced, have superior agronomic characteristics to the non-bird proof types. Thus it can be expected that more of these varieties will be produced in future.

A characteristic of the bird-proof types which is probably responsible for the fact that they are not eaten by birds is the high tannin content of the plants. The negative effects of a high tannin content in animal feeds on feed utilization is well documented. A reduction in the digestibility of, starch, (Waldo, 1973), structural components, (Ben-Ghedalia & Tagari, 1977) and protein, (Ford, 1977) have been observed as well as a decrease in voluntary feed intake and microbiological activity in the rumen, (Ben-Ghedalia *et al.*, 1977). The effect of tannin has been identified by Daiber (1975) on the enzyme level where enzyme-protein is bound and inactivated by tannins. According to Daiber, (1975) the formalin treatment process patented by the C.S.I.R. (1976) changes polifenoles, (tannin) to non-reactive resins. This could increase the nutritive value of high tannin sorghum and it was decided to test this hypothesis in a practical ruminant diet with sheep. Two experimental diets (Table 1) were prepared. These diets were identical in all aspects except that the concentrate part of the diet consisted of sorghum which was untreated or treated with formalin to reduce its tannin content.

The sorghum grain was steeped in a 0,16% formaldehyde solution (500 kg grain in 600 *l* of solution) for 5 hours. After steeping, the grain was rinsed three times with clean water and air dried to a moisture content of 12%. This treatment reduced the total reactive polifenole content from 1,55% to 0,22%. The grain was then ground through a 3,2 mm sieve and mixed into a complete diet (Table 1). The complete diet had a crude protein content of 11,8%. Mineral deficiencies were supplemented according to the NRC, 1971. Wheatstraw was ground through a 12 mm sieve.

Seven S.A. Mutton Merino wethers, approximately 1 year old, and fitted with large rumen cannulae (40 mm internal diameter) were used to evaluate the diets. The experiment was conducted as a change-over design where each sheep received each of the two experimental diets for a period of one month after initial 2 months adaptation to a high concentrate diet. Statistical analyses were done as a paired t-statistic according to Snedecor & Cochran (1967). Feed was supplied at a level of *ad lib* + 10% and was fed 6 times daily at 4-hour intervals. This was done to obtain steady state conditions in the rumen.

Faeces collections with faeces bags were done for 7 days on each diet. Faeces collections and rumen measurements were done over the last part of each experimental period.

The mass or organic matter in the rumen of each sheep was determined by emptying the rumen and determining the dry matter and organic matter content on a sample of the total mass. The apparent retention time of organic matter in the rumen was calculated as the mass of organic matter in the rumen divided by the hourly organic matter intake (daily organic matter intake $\times$ $\frac{1}{24}$).

Rumen ammonia concentration was determined on samples obtained on three days during each period. Rumen samples were acidified, centrifuged and the rumen ammonia determined on an Auto Analyzer II with ammoniumsulphate as standard. Retention time of water in the rumen was determined with a single dose of Chromium EDTA (Warner, 1966).

Results are given in Table 2.

[1]*Sorghumbeer unit, C.S.I.R. Pretoria.*

Table 1

Components of experimental diets

Component % of total	%	%
Bird proof sorghum grain (untreated)	44,8	—
Bird proof sorghum grain (treated)	—	44,8
Wheat straw	44,8	44,8
Molasses	4,9	4,9
Kasein	2,0	2,0
Urea	1,5	1,5
Sodium chloride	1,0	1,0
Dicalcium phosphate	0,5	0,5
Potassium sulphate	0,5	0,5
Vitamins-micromineral premix	+	+

Table 2

Intake, digestibility and rumen measurement on sheep fed treated and untreated sorghum grain

Parameter measured	Diet with treated sorghum	Diet with untreated sorghum	Standard error of differences
Organic matter intake, g/day	1 203	1 312	89,9
Mass of organic matter in rumen, g	751	657	61,8
Rumen, ammonia nitrogen concentration, mg/100 ml	16,8	20,1	7,2
Organic matter digestibility, %	62,6	60,0	1,38
Apparent retention time of organic matter in rumen, h	10,88	9,99	1,01
Mass of water in rumen, g	4 731	4 221	230
Mean retention time of water in rumen, h	8,61	8,82	0,04
Digestible organic matter intake, g/day	754	784	58

Differences in microbial activity in the rumen should be reflected by either organic matter intake or mass of organic matter in the rumen as well as rumen ammonia concentration. From Table 2 it is clear that none of these parameters were significantly influenced by treating the grain.

It was expected that a lower microbial activity would cause a longer retention time of organic matter in rumen. Results however indicated no such tendency.

A reduced organic matter digestibility could be expected with a high tannin diet, but no significant difference was obtained between diets.

The intake of digestible organic matter is important as it gives an indication of the productive value of the diet. This experiment showed no beneficial effect of treatment on the digestible organic matter intake, and therefore no difference in terms of animal production could be expected.

It may be postulated that the reaction of tannin in this kind of diet was probably largely with other food components. In this case it appears to be of small economical importance. If microbial or animal activity or productivity in terms of enzymatic inhibition was detected this could have had more serious consequences in terms of animal production. No such reaction could be detected in this experiment.

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Soli Deo Gloria.

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