



In vitro and *In sacco* Dry Matter Degradability of Healthy and Diseased Sorghum (*Sorghum bicolor*) Straw in Buffaloes (*Bos bubalis*)

Ramchandra Ramteke*, K Sivaiah and Michael Blummel

Department of Animal Nutrition, College of Veterinary Science, Rajendra Nagar, Hyderabad, India

*Corresponding Author: Ramchandra Ramteke, Department of Animal Nutrition, College of Veterinary Science, Rajendra Nagar, Hyderabad, India.

Received: March 20, 2019; Published: April 12, 2019

Abstract

Chemical composition, *in vitro* and *in sacco* dry matter degradability of healthy sorghum (*Sorghum bicolor*) straw were compared with diseased sorghum straw (H-112 variety) using two fistulated buffaloes (300 ± 25 kg) fed healthy sorghum straws (T₁) ad-lib along with 300 g of groundnut cake and feeding diseased sorghum straws (T₂) with 500 g of groundnut cake, respectively. The average IVDMD values were 37.37 and 31.21% for healthy and diseased sorghum straw, respectively. The mean *in sacco* DM degradability values were 31.45, 39.10, 45.36 and 53.57 per cent for T₁ and 22.52, 29.89, 35.25, 41.93 and 46.90% for T₂ respectively, at the end of 12, 24, 36, 48 and 72 hr of incubation. The readily soluble fraction (a), insoluble but degradable fraction (b) and rate constant/h (c) were 19.20, 38.69 and 0.0311 for T₁ and 12.37, 44.72, 0.0210 for T₂ respectively. The effective dry matter degradability (EDDM) of healthy sorghum straw (T₁) was 36.10 and 27.80 for diseased sorghum straw (T₂) with rumen outflow rate of 0.04/h. It is concluded that diseased sorghum straw had not much different in *in vitro* and *in sacco* dry matter degradability as compared to healthy sorghum straw.

Keywords: Sorghum Straw; *In vitro* Dry Matter Degradability

Introduction

The major crop residues used for feeding ruminants specially cattle and buffaloes are from coarse cereals. Sorghum (*Sorghum bicolor*) inspite of being considered as one of the prime cereals in the world and grown extensively in semi-arid tropics for the grain production, forms excellent green fodder and hay for ruminants. Sorghum crop by-product like stover is extensively used by the farmers, in most parts of our country including Andhra Pradesh for feeding their large ruminants as a bulk. This crop is subjected to several destructive diseases like anthracnose (*Colletotrichum graminicola*), rust (*Puccinia sorghi*) and leaf blight (*Exserohilum turcicum leo*) which directly affect the palatability and the chemical composition of sorghum straw [1]. The objective of the present study was to estimate effect of disease on the chemical composition, *in vitro* and *in sacco* dry matter degradability of sorghum straw.

Materials and Methods

Healthy (T₁) and diseased (T₂) sorghum straw (H-112) were procured from International Crop Research Institute on Semi-arid Tropics (ICRISAT), Patancheru, Hyderabad during the rabi season of 2000. The sorghum straw was chopped and stored in labelled gunny bags. The representative samples obtained from different gunny bags were dried and ground through wiley mill using 2 mm mesh screen for chemical analysis. The proximate analysis [2] and fibre fractions [3] were determined.

The healthy and diseased sorghum straw were evaluated *in vitro* using modified two stage Tilley and Terry [4] technique. The procedure consists of incubating the feed samples, buffered strained rumen liquor (SRL) bubbled with carbon dioxide at 37°C for 48 h followed by centrifugation and further incubation for 24 h with pepsin (1:3000) solution.

Two adult Murrah bulls (300 ± 25 kg) housed individually and fitted with permanent rumen cannulae were used for *in sacco* evaluation of experimental feeds. The animals were fed as per ICAR [5]. For healthy sorghum straw 300 g of groundnut cake, and for diseased straw, 500 g of groundnut cake was fed daily. The bulls were maintained on a feeding regimen comprising of roughage to which *in sacco* dry matter digestibility was estimated [6]. Incubation intervals of 12, 24, 36, 48 and 72 h were allowed as recommended by Kempton [7]. After allowing the bags to remain in the rumen for specific time interval, one bag from each of the animal was removed and gently washed under running tap water till the out coming fluid was clear. After a mild squeeze the nylon thread was cut and removed the marble. The bags were dried to a constant weight at 70° C for 24 h in a oven.

Effective degradable DM of experimental feed was calculated using the computer model as per Mc Donald [8] using rumen out-flow rate of 0.04% per hour. The data were subjected to analysis of variance [9] and the treatment means were tested for significance by Duncans new multiple range test [10].

Results and Discussion

Chemical composition

The chemical composition and cell wall constituents of healthy and diseased sorghum straw are presented in Table 1. Healthy sorghum straw (T₁) contained 5.40, 0.99, 33.05, 54.34 and 6.22% CP, EE, CF, NFE and total ash, respectively on DM basis. The values of CF, NFE and EE, were in close agreement with those reported by Wanghmare., *et al* [11]. The proximate composition of diseased sorghum straw (T₂) for CP, EE, CF, NFE and total ash were 3.91, 1.00, 38.20, 50.82 and 6.07%, respectively. Similar trend was observed between healthy and diseased sorghum straw by Gandhi., *et al* [12].

The NDF, ADF, hemi-cellulose, cellulose, lignin and silica content of healthy sorghum straw (T₁) were 66.96, 47.59, 19.37, 35.03, 10.17 and 02.39% respectively. The diseased sorghum straw (T₂) contained were 69.57, 48.56, 20.71, 38.41, 09.03 and 1.42% for NDF, ADF, hemi-cellulose, cellulose, lignin and silica, respectively (Table 1).

Nutrient (%)	Sorghum straw	
	Healthy (T ₁)	Diseased (T ₂)
Proximate principles		
DM	90.75	87.56
OM	93.78	93.93
CP	05.40	03.91
EE	00.99	01.00
CF	33.05	38.20
NFE	54.34	50.82
Total Ash	06.22	06.07
Fibre fractions		
NDF	66.96	69.57
ADF	47.59	48.86
Hemi-cellulose	19.37	20.71
Cellulose	35.03	38.41
Lignin	10.17	09.03
Silica	02.39	01.42

Table 1: Proximate composition and fibre fractions (% DM Basis) of healthy and diseased sorghum straw on DM basis.

In Vitro dry matter degradability (IVDMD)

The IVDMD value for healthy and diseased sorghum straw was 37.37 ± 0.88 and $31.21 \pm 1.12\%$, respectively (Table 2). Bhatia, *et al.* [13] also reported at par values for healthy sorghum straw.

however Rajput, *et al* [14] reported higher IVDMD as compared to present study. Higher IVDMD values for healthy sorghum straw might be due to higher CP and lower CF and other fibre fractions as compared to diseased sorghum straw.

Parameter	Sorghum straw	
	Healthy (T ₁)	Diseased (T ₂)
<i>In vitro</i> dry matter degradability	37.37 ± 0.88	31.21 ± 1.12
Incubation period (hr)	DM Degradability	
12	31.45 ± 1.05	22.52 ± 1.00
24	39.10 ± 0.62	29.89 ± 0.92
36	45.36 ± 1.12	35.25 ± 0.96
48	49.64 ± 0.88	41.93 ± 1.23
72	53.57 ± 1.02	46.90 ± 0.68
Degradation kinetics		
a	19.20	12.37
b	38.69	44.72
c	0.0311	0.0210
Effective dry matter degradability (EDDM)	36.10	27.80

Table 2: *In vitro* and *in sacco* drymatter degradability (%) of healthy and diseased sorghum straw.

Values are average of 4 observations

a = readily soluble fraction

b = insoluble but degradable fraction

c = rate constant/h

In Sacco Dry Matter Digestibility

The average *in sacco* dry matter degradability values were 31.45 and 22.52; 39.10 and 29.89; 45.36 and 35.25; 49.64 and 41.93; and 53.57 and 46.90% at the end of 12, 24, 36, 48, 72 h of incubation, respectively for healthy (T₁) and diseased (T₂) sorghum straw. The readily soluble fraction (a), insoluble but degradable with time (b); and rate constant (c) were 19.20 and 12.37; 38.69 and 44.72; and 0.0311 and 0.0210, respectively for healthy and diseased sorghum straw. Effective dry matter degradability (EDDM) of healthy and diseased sorghum straw with rumen outflow rate of 0.04/h was 36.1 and 27.80%. There was linear increase in the dry matter disappearance of straw sample by extending the period of incubation in the rumen from 12 to 72 h. Rajput, *et al* [14]

reported *in sacco* dry matter degradability value were at par with the present study. However higher CP content had enhanced the microbial fermentation in the rumen which had an increase in dry matter degradability. A higher soluble dry matter fraction (a) and lower insoluble but, degradable fraction (b) contributed for high EDDM value. But, a lower soluble dry matter fraction (a) and higher insoluble, but degradable fraction (b) value resulted in a lower EDDM value in diseased sorghum straw.

Conclusion

Based on the above findings of present study, it can be concluded that disease would have an adverse affect on the nutritional quality of sorghum straw.

Acknowledgment

The assistance received from Indian Council of Agriculture Research (ICAR) and International Crop Research Institute on semi-arid Tropics (ICRISAT), Patancheru, Hyderabad for financial assistance are duly acknowledged.

Bibliography

1. Ramadevi K., *et al.* "Farmers perceptions of the effects of plant diseases on the yield and nutritive value of crop residues used for peri-urban dairy production on the Deccan plateau". Finding from participation rural appraisal. Information bulletin No. 60. Patancheru, Andhra Pradesh, India, International Crop Research Institute for Semi-arid Tropics (ICRISAT) (2000).
2. AOAC. Official Method of Analysis, 16th ed. Association of Official Analytical Chemists, Washington, DC (1997).
3. Goering HG and Van Soest PJ. "Forage fibre analysis". Agriculture hand book no. 379, USDA Washington DC (1970).
4. Tilley JMA and Terry RA. "A two stage technique for the *in vitro* digestion of forage crops". *Journal of British Grassland Society* 18 (1963): 104-111.
5. ICAR. "Nutrient requirement of livestock and poultry". Publication and Information Division, Indian Council of Agricultural Research, New Delhi (1998).
6. Orskov ER., *et al.* "The use of nylon bag technique for the evaluation of feed stuffs". *Tropical Animal Production* 5 (1980): 195-213.
7. Kempton TJ. "The use of nylon bags to characterise the potential degradabilities of feeds for ruminants". *Tropical Animal Production* 5 (1980): 107-116.
8. Mc Donald. "Computer model for calculation of effective degradable dry matter". *Journal of Agriculture Science Cambridge* 96 (1981): 251-252.
9. Snedecar GW and Cochran WG. "Statistical method 7th edition". Iowa state University Press Ames, Iowa, USA (1980).
10. Duncan DB. "Multiple range and multiple F tests". *Biometrics* 11 (1955): 1-42.
11. Waghmare., *et al.* "Steam treatment of hybrid sorghum straw (*Sorghum vulgare*) for feeding cattle". *Indian Journal Animal Nutrition* 4 (1987): 83-86.
12. Gandhi SK., *et al.* "Note on the influence of the date of sowing on the incidence of foliar diseases and their effect on the quality of forage sorghum". *Indian Journal of Agricultural Science* 50 (1980): 363-366.
13. Bhatia SK., *et al.* "In vitro metabolic profile due to various feeds fermented with rumen inoculum of cattle and buffalo". *Indian Journal of Dairy Sciences* 49 (1996): 551-555.
14. Rajput., *et al.* "Evaluation of fodder by *in vitro* and nylon bag techniques and their comparison with conventional values". *Indian Journal Animal Nutrition* 8 (1991): 83-86

Volume 3 Issue 5 May 2019

© All rights are reserved by Ramchandra Ramteke., *et al.*