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The determination ruminal degradation of sorghum hybrids

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Abstract

In this study four sorghum silage were tested with nylon bag technique. Tow fistulae Gizel sheep with average BW 50.5±2.5 kg used in a complete randomized design. Ruminal DM and CP disappearance were measured 0,4,8,12,16,24,36,48,72 and 96 h. Dry matter degradability of R161 and R165 at 96h were 66.88 and 62.35%, respectively were higher and lower DM degradability that showed significant differences ($p<0.05$).

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Introduction

Balancing rations for ruminants requires knowledge of the proportion of feed protein that escapes ruminal degradation (NRC, 1985). Fermentation characteristics of feedstuffs in rumen fluid can be studied using in vivo, in situ and in vitro techniques (Cone et. al 1999). Exposure to air during feeding and storage can cause silages to spoil. Yeasts that are able to metabolize lactic acid are the primary initiators of spoilage, which leads to an increase in silage pH. This change in the silage environment allows for the growth of opportunistic bacteria and fungi, causing further spoilage. Predicting the feeding value of feedstuffs as accurately as possible and with methods of low cost and easy to handle is an important economical target.

This goal is of particular importance for grazing and browsing ruminants that valorize local resources often of low and variable nutritive value. Chemical composition can give an idea of the nutritive value of feeds, but it is not sufficient (Krishnamoorthy *et al*., 1995). Biological methods involving microorganisms and enzymes that are sensitive to factors influencing the rate and extent of digestion seem more appropriate in this case than chemical methods. Among them, the most popular are the in situ dry matter degradability (Mehrez and Ørskov, 1977).

The in situ technique has been widely used to study ruminal digestion kinetics of feeds for cattle. Although in this technique the incubated feed is not subject to mastication and passage, it is no better way to simulate the rumen environment to study ruminal digestion kinetics (Nocek, 1988).

This technique has been reported to be well correlated with animal performance (Orskov, 1989; Khazaal *et al*., 1993), with voluntary feed intake and in vivo dry matter digestibility (Khazaal *et al*., 1995). In Brazil, researchers have used the in situ method to evaluate tropical forages, agricultural residues and industrial by-products for feeding cattle (Vilela *et al*., 1994; Gomes *et al*., 1994; Aroeira *et al*., 1995). The in vitro gas production system helps to better quantity the nutrient utilization and its accuracy in describing digestibility in animal has been validated in numerous experiments. Although, gases produced during rumen fermentation are colossal waste products and of no nutritive value to the ruminant, but gas production test are used routinely in feed research as gas volumes are related to both the extent and rate of substrates degradation (Akinfemi *et al*., 2009). This experiment was designed to determine nutritive value of some sorghum silage using in situ technique.

Materials and methods

Animals and feeding

Two yearling (Gizil) wethers (50.5±2.5 kg) were used. At least 30 d before initiation of the experiment, each wether was surgically fitted with a ruminal cannula. The wethers were housed in tie stalls under controlled environmental conditions with continueus lighting and constant temperature (24 to 26°C). All whether were fed a diet containing of 60% hay and 40% concentrate.The feed was fed in equal portions every 8 h to maintain a relatively stable rumen environment.

Sample Collection

sorghum samples harvested from Golestan, Research Center field. Samples were collected from at least 7 different areas of field. All 7 samples were thoroughly mixed, and a composite sample (100g) was taken. And all of the samples put inside the rubber bucket to prepare silo environment. After 21 days, all samples were dried in an oven at 100°C until a constant weight was achieved. Samples were then ground to pass thought a 2-mm screen in Wiley mill (model 4, Arthur H. Thomas Co., Philadelphia, PA) before incubation.

Chemical analysis

DM was determined by drying the samples at 105° C. Nitrogen (N) content was measured by the Kjeldahl method (Taghizadeh *et al* 2005). Neutral detergent fiber and ADF were measured according to the

In situ degradation

In situ methods procedures was determined using Nocek (1988) and reviewed by Taghizadeh *et al* (2005), the ground samples (5g) were placed in Dacron bags (5.5×10 cm;47-µm pore size) and were sealed with waterproof glue. Each feed sample was incubated in 4 replicates (2 replicates for each whether) in the rumen. The incubation times for silage samples were 0,4,8,12,16,24,36,48,72 and 96 h. Nylon bags were suspended in the rumen in a polyester mesh bag (25×40 cm;3mm pore size) and were removed from the rumen at the same time so that all bags could be washed simultaneously. The nylon bags were then removed from the mesh bag and washing until the rinse water remained clear.

Samples were then dried in an oven at 55˚C until a constant weight was achieved befor determination of DM disappearance. The DM degradation data was fitted to the exponential equation P = a+b(1 – e-ct), where P: is the disappearance of nutrients during time t, a: the soluble nutrients fraction which is rapidly washed out of the bags and assumed to be completely degradable, b: the proportion of insoluble nutrients which is potentially degradable by microorganisms, c: is the degradation rate of fraction b per hour and t is time of incubation.

Calculations and Statistical Analysis

Data were analyzed as a completely randomized design using a general linear model (GLM) procedure of SAS, with Duncan's multiple range test used for the comparison of means. Feeds were the only sources of variation considered.

Results and discussion

Nutrient composition of treatments were shown at table1. The data show that Speed Feed has greater DM and ADF composition and the R161 has the lowest DM and ADF composition. Average of DM disappearance of four sorghum silage were shown in Table1.

Table 1. Chemical composition of treatments (% of DM).

silages	DM	CP	ADF	NDF
R161	21.67	7.59	42.33	59.04
R166	23.95	6.55	44.28	58.06
R165	23.72	7.41	45.78	58.57
Speed Feed	26	7.16	46	60.39

Data showed that the R161 were showed higher ruminal degradability in 96h compared with R165 samples. The obtained results for DM degradability were according to NRC (1989). There were differences among levels of disappearance for DM of silages at the different incubation times (P<0.05). Since disappearance of DM was little during the first 8h of fermentation, R166 showed

lower ruminal disappearance of DM (P<0.05), but processing of ruminal DM degradation showed that R165 have a lowest ruminal degradation in other times (P<0.05). The chemical composition of silages influenced ruminal degradation process.

The ruminal CP disappearance of Speed Feed is higher and the R165 showed lower ruminal CP disappearance in all of the incubation times, there were significant differences (P<0.05).

Table 2. In situ DM disappearance (% of DM).

silages	Incubation time (h)									
	0	4	8	12	16	24	36	48	72	96
R161	12.03^{a}	18.83^{a}	23.1^{a}	26.59^{a}	40.94^{a}	48.61^{a}	56.71^{a}	63.18^{a}	65.99^{a}	66.88^{a}
R166	7.10^{d}	11.45^{d}	14.33^{c}	21.64^{d}	29.03^{d}	40.46^{c}	51.10^{b}	57.43^{b}	60.70^{bc}	62.68^{c}
R165	9.78^{c}	13.55^{c}	15.75^{b}	23.06^{c}	34.28^{c}	42.20^{c}	51.94^{b}	56.95^{b}	60.09^{c}	62.35^{c}
Speed Feed	11.04^{b}	16.00^{b}	22.52^{a}	24.97^{b}	36.82^{b}	47.05^{b}	54.82^{a}	57.02^{b}	62.34^{b}	65.17^{b}
SEM	0.2011	0.2477	0.2860	0.1878	0.5140	0.4679	0.8092	0.3987	0.5398	0.3546
P-Value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0040	<0.0001	0.0002	<0.0001

Table 3. In situ CP disappearance (% of DM).

silages	Incubation time (h)									
	0	**4**	**8**	**12**	**16**	**24**	**36**	**48**	**72**	**96**
R161	13.41	20.79^{a}	25.93^{a}	29.19	37.47^{a}	47.94^{a}	54.26^{a}	59.75^{b}	61.93^{b}	63.56^{b}
R166	12.48	18.88^{b}	24.44^{b}	28.24	35.11^{b}	46.04^{b}	52.89^{b}	58.83^{bc}	60.41^{c}	62.38^{c}
R165	12.65	19.66^{b}	24.76^{b}	28.51	34.85^{b}	45.75^{b}	51.93^{c}	58.01^{c}	59.82^{c}	61.21^{d}
Speed Feed	13.64	20.86^{a}	25.46^{ab}	29.01	37.87^{a}	48.25^{a}	54.74^{a}	61.04^{a}	63.13^{a}	65.06^{a}
SEM	0.4069	0.2502	0.3111	0.3332	0.3806	0.3113	0.2618	0.3507	0.1869	0.3270
P-Value	0.2008	0.0013	0.0360	0.2120	0.008	0.0008	0.0002	0.0016	<0.0001	0.0002

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