Evaluation of Quality and Nutritive Value of Napier Grass Silage with Different Growth Stages Either Chopped or Unchopped in Northeast Thailand

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1. Introduction

Stable supply of forage throughout the year is the key constraint for further development in cattle production in Northeast Thailand. Although Napier grass (*Pennisetum purpureum)* is not popular in the region, it may have high possibility under an intensive management with high manure input. The present study aimed at identifying nutritive value and fermentative quality of silages made of Napier grass with different growth stages either chopped or unchopped, and physiological changes in cattle given the silages.

2. Materials and Methods

The following three kinds of Napier grass were ensiled in cylindrical concrete tanks (0.75m diameter and 0.5m height), pressed by foot and covered by plastic sheet with sand weight on top.

1) Chopped silage of 1m grass height (about 30 days after cut)

2) Unchopped silage of 1 m grass height (about 30 days after cut)

3) Chopped silage of 1.5 m grass height (about 80 days after transplanting)

Aliquot of silage sample from each silo was placed into a bottle with water and kept in a refrigerator for overnight. The extracted fluid was subjected to the analyses of VFAs with gas chromatography, lactic acid with diagnostic kit, volatile basic nitrogen (VBN) and total nitrogen content.

Two castrated male native cattle (average body weight 166kg) were used for digestion trials with the above-mentioned three feeding treatments, which were conducted in this order. Silage was given to the animals *ad libitum* to measure maximum intake. Nutrient digestibility was examined by total collection method. Blood samples were collected from the jugular vein into heparinised tube at the end of each collection period before feeding and 3hr post feeding, and subjected to the analysis.

3. Results and discussion

Although the original grass used in the treatments of 1 and 2 were the same, CP and NFE contents were lower in unchopped silage, which would be owing to the difference in the fermentation process during being ensiled (Table 1). CP content in the treatment 3 was lower than the others, which would be due to the difference in the maturity. Fermentative quality of unchopped silage was also worse than that of chopped silage of treatment 1 (Table 2). The unchopped silage showed higher pH and the ratio of volatile basic nitrogen to total nitrogen (VBN/TN), and lower lactic acid concentration. If grass was ensiled without chopping, there was considerable space between the pieces of grass, which made anaerobic fermentation difficult. V-score was calculated from VBN/TN, total content of acetate and propionate, and butyrate content (Masaki, 1996), which is one of methods to evaluate silage quality and used in Japan to evaluate low moisture silage and high moisture silage at the same criterion. It clearly showed the difference in the fermentative quality in spite of not using the value of lactic acid contents for the calculation. It would be a useful method for the evaluation of silage quality especially in developing countries where the analysis of lactic acid is not practical in terms of cost and facilities. The value of pH itself may also be a useful and very simple indicator for the evaluation of silage quality.

The TDN content of the silage in treatment 1 was significantly higher than that in treatment 2 (Table 3). It was considered, therefore, that large amounts of nutrients, especially NFE, were lost during the fermentation process in treatment 2. The voluntary intake of silage also decreased in treatment 2. Consequently, TDN intake in treatment 2 was about 68% of treatment 1.

There was no difference in D-3-hydroxybutyric acid (BHBA) level between at 0hr and at 3hr after feeding in cattle fed chopped silage (treatment 1). On the other hand, BHBA level in cattle fed unchopped silage became higher after feeding (Table 4). It was considered that the difference of butyrate concentration in the silage influenced BHBA level in blood. However, the physiological effects of butyrate on animals would be minimum even if cattle received such low quality silage for longer period, as the values of BHBA and NEFA in blood were within normal range and there was no change in glucose content.

Chopping of original grass before ensiling is highly recommended not only for making better quality silage but also for making better use of silo capacity. Proper preparation of silage minimises the loss of nutrients during the fermentation process and increases voluntary intake, which results in higher TDN intake.

References

Masaki, S. (1994) Judgment of silage quality. In “Guidebook for quality evaluation of roughage (edited by Japanese Research Association on Quality Evaluation of Self-supplied feed). Japanese Association of grassland. 79-87 (in Japanese).

Table 1. Chemical composition of silage

Treat.	**Height of grass**	**Chopping**	**DM[1]**	**OM**	**CP**	**EE**	**NFE**	**CF**	**ADF**	**NDF**
			%	**------------------- % of DM -------------------**						
1	1m	Chopped	16.9	89.3	11.9	3.9	42.7	30.7	37.7	64.2
2	1m	Unchopped	16.1	86.9	10.2	3.6	39.1	34.0	40.9	64.3
3	1.5m	Chopped	16.6	90.0	7.3	3.1	42.6	37.0	43.9	70.2

[1]DM, dry matter; OM, organic matter; CP, crude protein; EE, ether extracts; NFE, nitrogen free extracts; CF, crude fibre; ADF, acid detergent fibre; NDF, neutral detergent fibre.

Table 2. Fermentative quality of Napier grass silage

Treatment		**1**			**2**			**3**		
		LSM	**SE**	**No**	**LSM**	**SE**	**No**	**LSM**	**SE**	**No**
pH		4.02[b]	0.18	3	5.58[a]	0.15	4	3.87[b]	0.14	5
VBN/TN[1]	%	8.03[b]	2.87	3	17.40[a]	2.49	4	6.88[b]	2.22	5
Acetate	%	0.127	0.178	3	0.460	0.154	4	0.232	0.138	5
Propionate	%	0.007[b]	0.018	3	0.140[a]	0.016	4	0.002[b]	0.014	5
Butyrate	%	0.007	0.096	3	0.243	0.083	4	0.161	0.074	5
V-score		93.2[a]	12.9	3	47.1[b]	11.2	4	82.2[ab]	10.0	5
Lactate	%	1.21[a]	0.09	1	0.06[b]	0.09	1	0.99[a]	0.04	5

[1]VBN/TN: ratio of volatile basic nitrogen to total nitrogen; LSM, least square means; SE, standard error; No, the number of samples.

[a,b]Means with different superscripts among treatments significantly differ ($p<0.05$).

Table 3. Body weight, feed intake and nutrient digestibilities of native cattle given Napier grass silage

Treatment		**1**	**2**	**3**	**SE**
BW	kg	166	166	166	0.4
DM intake	gDM	4015[a]	3163[b]	3223[b]	48
Digestibilities of					
DM	%	70.5	62.7	66.8	1.4
CP	%	71.7	60.8	62.3	1.8
NFE	%	70.1[a]	55.9[b]	61.8[b]	1.3
CF	%	77.5	74.5	77.1	1.3
TDN	%	71.8[a]	61.6[b]	66.9[ab]	1.3

[a,b]Means with different superscripts among treatments significantly differ ($p<0.05$).

Table 4. The Change of NEFA, glucose, total protein and BHBA contents in plasma of cattle given Napier grass silage before and after feeding

	Treatment	**NEFA1**	**Glucose**	**TP**	**BHBA**
		mEq/l	**mg/dl**	**g/dl**	**mM**
Before feeding	1	0.049	94.5	5.78	0.276
	2	0.129	85	6.05	0.219
	3	0.076	82	5.91	NA
	SE	0.024	3	0.21	0.012
3 hours after feeding	1	0.046	88	6.73	0.291
	2	0.051	96.5	5.84	0.411
	3	0.074	127.5	5.96	NA
	SE	0.01	24	0.12	0.017
	Tr	-	-	-	-
	Ti	-	-	-	-
	T*T	-	-	-	**

[1]NEFA, non esterified free acid; TP, total protein;
BHBA, D-3-hydroxybutyric acid; Tr, Effect of treatment;
Ti, Effect of time after feeding;
T*T, Interaction between treatment and time after feeding.