Tropentag 2010
ETH Zurich, September 14 - 16, 2010
Conference on International Research on Food Security, Natural Resource Management and Rural Development

Digestibility of Nutrient and Evaluation of Energy of Pangola Grass in Sheep Compared with Napier Grass

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Introduction

Northern Thailand is one of the biggest regions of ruminant production. Roughages play a major role as feed resources for ruminants in the tropic. But one of the most common problems facing smallholder farmers is the scarcity of good quality roughages and sometimes at very high prices during the dry season from December to May. One way to overcome the problems and to maintain the continuity of feed supply is to conserve surplus forage or crops as hay or silage for later use when feed is in short supply.

Pangola grass (*Digitaria eriantha*., Synonyms *Digitaria decumbens*) is often considered as one of the high quality tropical grasses. It is utilized extensively as grass for grazing, hay and silage making, mostly with N-fertilization rather than a companion legume (Meeske *et al*, 1999). Pangola grass contains 10 % crude protein, 29% crude fiber and 59% TDN (Total digestible nutrient) (Animal Nutrition Division of Thailand, 2002). Napier Grass (*Pennisetum purpureum*) is a productive, persistent and high-quality forage grass widely grown in tropics and subtropics (Macoon *et al*., 2002).

Since 2002, Thai government has promoted forage production and encouraged marketing, by supporting 6,280 farmers to produce hay and silage instead of rice and regular cash crops. The 2,480 farmer's cultivated Pangola grass replacing rice in lowland, which was called "Paddy pasture". It was called in Thai as "Na Yaa Project". In 2005, paddy pasture project has scaled up to grow forage for sale in 43 provinces especially the provinces in the Northeast of Thailand. Farmers earn good income from growing grass. Until now, the total gross benefits in 4 year (2002-2005) are 250 million baht, from the total 159,689 tons of fodder products (Animal Nutrition Division of Thailand, 2006). Nowadays, the farmers have planting Pangola grass widely in Northern Thailand, particularly the provinces of Lampang and Lamphun.

Earlier studies showed only the chemicals composition of Pangola grass, background information and benefit of Pangola production in the Northern, Central and Northeast Thailand but not yet reported about utilization of Pangola grass as animal feed (ruminants) especially for nutrient digestibility and energy contents.

This study was aimed to investigate the nutritive values and utilization of Pangola grass in 3 different (fresh, hay and silage) for ruminants in Northern Thailand. The results of this experiment would be used as baseline data to introduce and promote Pangola grass to smallholder farmers in the future.

Material and Methods

The treatments of this study were as follows: -

Treatment 1 (T1) Napier grass (*ad libitum*) (Control)
Treatment 2 (T2) Pangola grass (*ad libitum*)
Treatment 3 (T3) Pangola hay (*ad libitum*)
Treatment 4 (T4) Pangola silage ensiled with 5% molasses (*ad libitum*)

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Sixteen cross-bred of native x Merino sheeps, were randomly allocated into 4 treatment groups, and were confined in the metabolic cages with clean water supply all the time. Nutrients digestibility was studied by conventional method. During the first 14 days, all animals were fed with respective diets on *ad libitum* basis while during the last 7 days, feed samples and feces were collected for chemical composition (AOAC, 2000) and energy values (Kellner *et al*., 1984) were calculated as follow:

$$GE\ (MJ/kg) = 0.242CP + 0.0366EE + 0.0209CF + 0.0170NFE$$
$$ME\ (MJ/kg) = 0.0152DCP + 0.0342DEE + 0.0128DCF + 0.0159DNFE$$
$$NE_L(MJ/kg) = 0.4632 + 0.0024q \times ME$$

$$q = (ME/GE) \times 100$$

DCP = Digestible crude protein, DEE = Digestible ether extract
DCF = Digestible crude Fiber and DNFE= Digestible nitrogen free extract digestibility

The experimental design was CRD and the means were compared by Duncan's New Multiple Range Test (Steel and Torrie, 1980)

The Napier grass and Pangola grass used in the experiments were harvested at the approximate age of 45 days. After that Pangola hay and silage were made. For Pangola silage, the grass was sampled separately chopped into 2-3 cm lengths, ensiled with 5% molass and kept for over 21 days. Fresh Napier grass, Pangola grass and Pangola hay (45 days of age) were chopped before feeding.

The experiment was conducted at the farm and laboratory the Department of Animal and Aquatic Science, Faculty of Agriculture, Chiang Mai University**,** Chiang Mai Province, Thailand 50200.

Results and Discussion

The Chemical composition of Napier grass and Pangola grass

The data on chemical composition of the grasses were shown in Table 1. Crude protein (CP) and EE contents of Pangola grass silage (Treatment 4) were significant higher than other treatments (9.21 and 2.57% DM, respectively) ($P<0.05$) while Pangora hay (Treatment 3) was better than the rest for OM, NDF, ADF, ADL and NFE contents ($P<0.05$). However, CF content (32.08 %DM) of Pangola hay (Treatment 3) was higher than Napier grass, Pangola grass and Pangola silage with CF contents of 31.17, 31.36 and 30.52 % DM, respectively ($P<0.05$). Crude protein content of Pangola grass (Treatment 2) was lower than those reported by Animal Nutrition Division, Thailand (2002)(10 %DM) which might be due to the differences of age of cutting, location, climate and environment.

The differences in chemical composition among Pangola grass, Pangola hay and Pangola silage could be due to some reasons. First, Pangola silage was ensiled with 5% molasses which probably added the nutritive values. Second, the lower values of chemical compositions (CP, EE and ash) from Pangola hay compared to fresh Pangola grass and Pangola silage were probably due to chemical changes during the drying process resulting in losses of valuable nutrients during the drying process as reported by McDonald *et al*. (2002). Finally, the difference in the proportion of leaves and stems in the harvested materials might be affected in chemical composition. For NFE, the Pangola hay was higher than Pangola silage probably due to the low nutrient contents especially CP, EE and ash.

Table 1 Chemical compositions of Napier grass, Pangola grass, Pangola hay and Pangola silage.

	Napier grass	Pangola grass	Pangola hay	Pangola silage
DM	22.72 [b] ±0.01	22.55 [b] ±0.02	85.21 [a] ±0.03	21.99 [c] ±0.03
Nutrients (%DM basis)				
OM	89.55 [b] ±0.56	89.26 [b] ±0.51	91.54 [a] ±0.06	86.69 [c] ±0.59
CP	7.65 [c] ±0.33	7.91 [b] ±0.34	7.35 [d] ±0.19	9.26 [a] ±0.07
EE	2.36 [c] ±0.06	2.49 [b] ±0.02	1.92 [d] ±0.27	2.57 [a] ±0.25
Ash	10.45 [b] ±0.50	10.74 [b] ±0.52	8.46 [c] ±0.06	13.30 [a] ±0.59
CF	31.17 [c] ±0.32	31.36 [b] ±0.66	32.08 [a] ±0.41	30.52 [d] ±0.76
NDF	65.91 [c] ± 0.24	72.38 [b] ±0.33	73.46 [a] ±0.76	72.19 [b] ±0.21
ADF	38.14 [c] ±0.43	41.77 [b] ±0.01	42.15 [a] ±0.16	41.18 [b] ±0.20
ADL	4.14 [d] ±0.08	4.34 [b] ±0.01	4.92 [a] ±0.03	4.26 [c] ±0.15
NFE	48.37 [b] ±0.13	47.50 [c] ± 0.07	50.19 [a] ±0.15	44.35 [d] ±0.24

[a b c d] Different superscripts in the same row differ significantly (P<0.05)

Digestion coefficients of dry matter and nutrient of Napier grass and Pangola grass

The results from apparent digestibility showed that the digestibility coefficients of dry matter, organic matter, crude protein and ether extract of Pangola silage (Treatment 4) were highest (P<0.05) might be due to the high nutrients (DM, OM, CP and EE) in Pangola silage. The metabolizable energy (ME) of Treatment 4 was also significantly higher than those of Treatment 2, 3 and Treatment 1 in respective order (P<0.05) (Table 2). The ME value of Pangola hay of this study was higher than Pangola hay reported by Nitipot *et al.* (2009) which was only 6.42 MJ/kg DM.

The digestibility of nutrients in Pangola silage was highest compared to those from the other treatments which might be due to its higher contents of chemical composition (DM, CP, EE and ash). The highest digestible crude fiber, Neutral detergent fiber, Acid detergent fiber and Acid detergent lignin (DCF, DNDF, DADF and DADL) of Pangola hay might be due to the higher CF, NDF, ADF and ADL content.

Table 2 Digestion coefficients of dry matter and nutrient digestibility of Napier grass and Pangola grass.

Item	Napier grass	Pangola grass	Pangola hay	Pangola silage
DDM (%)	70.69 [d] ±2.40	73.47 [c] ±7.35	71.83 [b] ±3.84	75.68 [a] ±5.47
Nutrient digestibility (%)				
DOM	57.88 [d] ±2.01	63.21 [b] ±0.42	62.15 [c] ±0.12	65.18 [a] ±2.56
DCP	49.13 [d] ±1.82	51.43 [b] ±1.55	50.19 [c] ±1.16	57.82 [a] ±0.67
DEE	30.30 [c] ±6.22	34.35 [b] ±5.88	28.75 [d] ±1.07	50.90 [a] ±1.14
DCF	62.39 [d] ±1.31	69.67 [c] ±4.18	79.95 [a] ±0.94	72.44 [b] ±1.65
DNDF	49.53 [c] ± 0.19	52.49 [b] ±0.15	54.27 [a] ±1.09	51.94 [b] ±0.13
DADF	48.46 [c] ±0.83	50.65 [b] ±0.67	53.67 [a] ±0.05	49.99 [b] ±0.10
DADL	22.61 [d] ±0.65	24.12 [c] ±0.41	26.14 [a] ±0.13	23.76 [b] ±0.23
DNFE	54.25 [b] ±0.41	52.35 [c] ± 0.37	56.40 [a] ±0.34	50.54 [d] ±0.48
ME (MJ/kg DM)	7.70 [d] ± 0.65	8.38 [b] ± 0.25	8.08 [c] ±1.36	8.50 [a] ± 0.58
NE_L(MJ/kg DM)	4.38 [d] ± 0.35	4.85 [b] ± 0.28	4.63 [c] ± 0.11	4.95 [a] ± 0.09

[a b c d] Different superscripts in the same row differ significantly (P>0.05)

Conclusions and Outlook

From this study, it was found that pangola grass was a good source of roughage. It could be well preserved as silage and hay. In this study, Pangola silage seemed to be the best while Napier grass was the worst. The results of this experiment could be used as the baseline data to introduce and promote Pangola grass to smallholder farmers in the future. These data will be useful for establishing a feeding table for ruminants in Thailand.

Acknowledgements

The authors are very grateful to the Japan International Research Center for Agricultural Sciences (JIRCAS) for funding this research. Finally we would like to thank Her Majesty the Queen's Initiated Projects to supported experimental animals (sheep) for this research project.

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