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Some nutritional properties of Taiwan Napier grass leaves (*Pennisetum purpureum*) harvested at different time

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ABSTRACT

The effect of different harvesting time on Napier grass's nutrient composition (*Pennisetum purpureum*) leaves was investigated. Taiwan Napier grass grown under field conditions were harvested on day-15, 30, 45, 60, 75, and 90 after planting. The leaves samples subjected for analyses on dry matter, moisture, ash, crude fibre, crude fat, crude protein and acid detergent fibre, and the data expressed as a percentage. The present study found that the different harvesting time had changed all nutrients composition, except, crude protein where no variation in crude protein during any harvesting time observed. The present study recommends harvesting time for Taiwan Napier grass between 45 and 60 days after planting was the best. This finding is useful as baseline data that provides information on Taiwan Napier's nutritional composition grown at a particular cropping site. It helps plan and strategy for new planting activity, especially when determining the best time for harvesting.

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INTRODUCTION

Napier grass (*Pennisetum purpureum*) is a fast-growing monocot grass belonging to the family Poaceae and morphologically stout, tall and deep-rooted perennial bunchgrass and mainly propagated through stem cutting. It is used primarily as a feed crop (fodder grass) for livestock. Napier grass is currently the most popular fodder grass in dairy and feedlot production systems due to high productivity and good nutritive value (Wadi *et al.*, 2014). This grass is productive, easy to cultivate, drought-tolerant and adaptable to various soil and climatic conditions, especially under different tropical soils (Halim *et al.*, 2013). Livestock production requires a substantial amount of nutrients for growth and reproduction. Napier grass can provide nutrients sourced from naturally grown or farming. Determining the level of feed nutrients is vital to ensure that the nutrients' level meets growth and reproduction requirements. Additional feed input may be required to fulfil a dietary requirement. Besides that, evaluating the nutritional status at different growth or maturity stages is also essential. The growth or maturity stages may affect plant certain dietary content when growing on

different soil types and environment (Lounglawan *et al.*, 2013). Each soil type and location may alter Napier grass levels, thus influencing the animal feed quality. For example, Zailan *et al.* (2016) reported that dwarf Napier cultivar exhibited different nutritional potential at different harvesting ages. The crude protein was at maximum peaked when harvested during the sixth week. The dry matter was at a maximum when harvested during the eighth week. This phenomenon indicates that the time of harvesting has different consequences on nutritional composition. Therefore, this research aims to evaluate Napier cultivar Taiwan's chemical composition content at different harvesting time.

MATERIALS AND METHODS

This experiment conducted at the pasture field at Ladang Kongsi 1, Pasture Unit of University Agricultural Park located at the Universiti Putra Malaysia Bintulu Sarawak Campus, Sarawak, Malaysia, from October 2018 to January 2019. The average daily temperature at the field during planting and the growing season was 29 – 36°C. Napier grass of Taiwan cultivar

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used. About 20 cm length of fresh stem cuttings of Taiwan Napier grass was prepared for field planting and transplanted on the soil with 45° angle with two nodes buried in the ground. The type of soil covers the area was under Bekenu soil series and characterised as subtle loamy, siliceous, isohyperthermic, red yellow to yellow. The structure is a weak medium to coarse sub-angular blocky and friable (Paramanathan, 2000). The cuttings arranged in the plot with planting distance between cuttings was 30 cm and between row at 60 cm. Observations made, and care, maintenance and watering conducted as per standard practices. During growing days, subsampling of leaf and stem of Taiwan Napier grass was achieved by manual harvesting using sickle at 15, 30, 45, 60, 75, and 90 days after planting. The random harvesting for samples performed at three different points. All plant samples cut into small pieces (2-5 cm) for oven-drying, which taken four to seven days to achieve constant weight before further analysis. Dried leaf and stem samples were then ground into a powder then sieved to pass through 2 mm mesh sieve.

Powdered samples in triplicates were then ready for proximate analysis. The parameters were the percentages of dry matter, moisture content, ash, crude fibre, ether extract, crude protein, and acid detergent fibre. Determination of dry matter, moisture content, and ash were following AOAC Method (AOAC, 1990). The crude fibre was determined, according to Van Soest *et al.* (1990) using the fibertec system. Crude fat determined by extracting a known weight of powdered plant sample with petroleum ether, using Soxtec system-tecator according to method 930.09, AOAC method (AOAC, 2000). The petroleum ether used for fat extraction then evaluated for weight percentage. Crude protein was determined using the total N Kjeldahl method and then transformed using the conversion factor (6.25) to obtain crude protein (Conklin-Brittain *et al.*, 1999). Van Soest *et al.* (1990) method used to determined acid detergent fibre. This study analysed all data for the variance. Means comparison among sample's proximate analysis data of leaves and stem (dry matter, moisture content, ash, crude fibre, ether extract, crude protein, and acid detergent fibre) of different days (15, 30, 45, 60, 75, and 90 days after planting) were separated by least significance difference at 5% significance level. The data analysis conducted using SAS Statistical Software version 9.4.

RESULTS AND DISCUSSION

Proximate composition of Napier grass leaves over the different days were different significantly ($p < 0.05$), except crude protein

which recorded no different over a growing period up to 90 days (Table 1). Dry matter of Taiwan Napier grass leaves was increasingly higher from 75 days after planting up to harvesting day 90. The dry matter was in the range of 12% to 18%, where the dry weight went higher when older. However, at day 30, the dry leaf matter was significantly lowered ($12.02 \pm 0.17\%$). This phenomenon may be associated with the fluctuation on plant water uptake and intense metabolic and physiological activities at the early growing stage (Jing and Malladi, 2020). Thus, lower dry matter indicates that higher plant water content consistently showed in Taiwan Napier grass leaves' moisture content recorded significantly lower moisture content when the plant gets older from day 30 to 90 (88% to 82% moisture content). The present study indicates that the crude fibre in Taiwan Napier grass leaves was significantly lower at day 15. The crude fibre increased at 30 days after planting not changed during day 30 until day 90. Crude fat was significantly different in every harvesting date. The crude fat of Napier leaves was fluctuating over 90 days of growth after planting. Taiwan Napier grass leaves' crude fat was at the lowest level at day 90 (1.00%) but highest at early development (day 15) at 3.28%. This outcome indicates that the crude fat of Taiwan Napier grass was lower when the Taiwan Napier grass went older. In contrast, Imoro (2020) stated that the crude fat in indigenous savanna forage shrub species in Ghana was more excellent at the matured plant stage. Different species and climatic condition may be changing the role and structure of fat in the plant is a plausible explanation.

The present study found that Taiwan Napier grass leaves' crude protein had not changed during 15 to 90 days of growth. This study is similar to Napier variety "Red" as reported by Zailan *et al.* (2016), who indicates that the "Red" variety was unchanged on week-4 to week-8 of harvesting dates. However, in a similar study, a different phenomenon was observed on the dwarf variety, which indicates decreased crude protein with increasing maturity. The acid detergent fibre (ADF) content had slight fluctuation over the growing period. The ADF content was highest at 30 days after planting (33%) at lowest at 75 days after planting (23%). This finding indicates that the ADF content was high during early growth and was low when Napier grass went older. In contrast, Rambau *et al.* (2016) demonstrated that Napier grass's ADF content was lower from early to the intermediate growing stage and higher at the older growth stage. The present study suggested that the difference in ADF content of Taiwan Napier grass from this study with other studies much related to the variety used in the study.

Table 1: Proximate compositions of Taiwan Napier grass at different harvesting time

Composition (%)	Days after planting					
	15	30	45	60	75	90
Dry matter	13.82 ^b ±0.30	12.02 ^c ±0.17	14.40 ^b ±0.40	14.10 ^b ±0.44	17.58 ^a ±0.38	18.00 ^a ±0.25
Moisture	86.18 ^b ±0.30	87.98 ^a ±0.17	85.60 ^b ±0.40	85.90 ^b ±0.44	82.42 ^c ±0.38	82.00 ^c ±0.25
Ash	6.13 ^{ab} ±0.06	6.42 ^a ±0.46	6.82 ^a ±0.21	6.32 ^a ±0.20	5.07 ^b ±1.55	5.70 ^{ab} ±0.13
Crude fibre	28.17 ^b ±1.04	34.50 ^a ±0.50	34.83 ^a ±0.29	36.50 ^a ±1.80	34.17 ^a ±3.01	35.00 ^a ±1.32
Crude fat	3.28 ^a ±0.21	2.72 ^b ±0.20	1.79 ^c ±0.13	2.27 ^{bc} ±0.20	2.01 ^c ±0.12	1.00 ^d ±0.59
Crude protein	14.59 ^a ±2.53	18.24 ^a ±4.56	20.43 ^a ±9.11	21.89 ^a ±4.38	17.51 ^a ±4.38	15.32 ^a ±2.19
Acid detergent fibre	27.55 ^b ±2.26	32.64 ^a ±5.05	29.32 ^{ab} ±0.34	26.96 ^b ±0.13	22.54 ^c ±0.55	25.92 ^{bc} ±0.50

Different letters within the same row indicate a significant difference (LSD, $p < 0.05$) among different days. Value is the mean ± standard deviation.

The present study recommends that the best harvesting time was between 45 to 60 days after planting. The harvesting time was considerably similar in many research studies and practical recommendation at 42 days after planting (Turano *et al.*, 2016; Haryani *et al.*, 2018; Rahman *et al.*, 2019). Even though, at 75 days of growth gave better dry matter yield ($17.58 \pm 0.38\%$), the total minerals content (ash content) of Taiwan Napier grass significantly reduced. The minerals are essential for growth, physiology, and livestock metabolism and may create nutrients imbalance or under-nutrition if less (Masters *et al.*, 2020). Other important nutritional components, such as crude protein (necessary for growth and muscular development), crude fibre, and crude fat (both are an essential energy source), were standard. They may not affect the overall dietary requirement and balance for livestock growth.

CONCLUSION

In conclusion, the present study found that most of the nutritional compositions in Taiwan Napier grass grown up to 90 days are variable. However, crude protein was no difference at the same time of growth. The present study suggests that the best time harvesting of Taiwan Napier grass for livestock feeding was between 45 and 60 days after planting. This finding is useful as baseline data that provides information on Napier's nutritional composition grown at a particular cropping site. It helps plan and strategy for new planting activity, especially when determining the best time for harvesting.

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