CUTTING AGE EFFECTS ON YIELD AND NUTRITIVE VALUES OF NAPIER PAKCHONG (*CENCHRUS PURPUREUS* CV. PAKCHONG)

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ABSTRACT. Napier Pakchong (*Cenchrus purpureus* cv. Pakchong) is another cultivar of Napier grass which was introduced from Thailand. This cultivar is mostly adapted for local soil conditions in Malaysia, has high yield and relatively high protein content making Napier Pakchong suitable for ruminant feeding. This experiment was carried out to determine the dry matter yield and nutritive values of Napier Pakchong at three different cutting ages (6th, 7th and 8th weeks old). All plots underwent a standard preparation and basal fertilizers during grass establishment. The cutting treatments were carried out 3 times at the 6th, 7th and 8th weeks. After each harvest, the rates of maintenance fertilizer used were NPK 150:60:100 (kg/ha/year). The harvested forage was weighed and sent for dry matter yield and proximate analysis. The data were analysed by one way analysis of variance (ANOVA) using the programme of SAS (Package Version 9.4). The difference between treatment means was measured by Duncan's Multiple Range Test (DMRT) at 5 % level of significance. The data showed that dry matter yield production increased in line with the cutting interval. Crude protein (CP) value declined as the harvesting interval increased. Even though the CP value declined, the CP percentage still fulfils the protein requirements for ruminants. It is suggested that Napier Pakchong harvested at 7th to 8th weeks due to optimum dry matter yield and nutritive value.

Keywords: Napier Pakchong, cutting age, dry matter yield, nutritive values

INTRODUCTION

Napier or Elephant grass (*Cenchrus purpureus*) is widely distributed in tropical region and is highly productive in areas with good soil fertility and high rainfall, growing well up to 2,000 masl (Wangchuk *et al.,* 2015). In Malaysia, Napier grass is the most popular fodder used in dairy and feedlot production because of its high biomass yield and ease of propagation (Halim *et al.,* 2013). Napier grass is fast-growing and has high annual productivity that depends on climatic and soil conditions (Rusdy, 2016). Appropriate cutting management is essential for the high production and quality of this species. Khairani et al. (2013) highlighted that the effects of cutting intervals on yield and quality vary with cultivars. Furthermore, according to Tudsri et al. (2002), growth and morphological characteristics are related with yield production and quality nutrients. The nutrient value of grasses decreased in advance of maturity. According to Manyawu et al. (2003), a significant effect of growth stage on yield and quality revealed a cutting interval of six to seven weeks for optimum yield and quality of Napier grass and Hybrid *Pennisetums*. Ansah et al. (2010) showed the highest crude protein concentration but the lowest dry matter yield when harvested at less than nine weeks cutting interval in local variety Napier grass. While according to Lounglawan *et al*. (2014) recommended age to harvest Napier grass (*Pennisetum purpureum x Pennisetum americanum*) is at six to eight weeks of growth to optimize the dry matter yield and nutritive value. These findings showed the importance of optimum cutting interval and its varying effects on yield and quality.

Napier grass was first introduced to Malaysia in the 1920s. Since then, many cultivars were introduced in Malaysia, namely as Common Napier, Red Napier, Taiwan Napier, Dwarf Napier, Dwarf "Mott", Australian Dwarf, Indian Napier, Uganda Napier, Zanzibar Napier, Kobe Napier, 3rd Generation Napier and King grass (Halim *et al.,* 2013; Haryani *et al.,* 2018). Several comparative studies on the effect of harvesting age were done to evaluate the agronomic performance and nutritive quality of these Napier grass and subsequently identify superior varieties based on those criteria to get some information to make a recommendation to farmers on the choice of the Napier varieties (Halim *et al.,* 2013).

The hybrid cultivar Pakchong was introduced from Thailand since 2015 and is well propagated and abundantly acquired in Thailand (Wangchuk *et al.,* 2015). Napier Pakchong grass is a cross of ordinary Napier (*Pennisetum purpureum*) and pearl millet (*Pennisetum americanum*). It is to be cultivated under many locations and performs best in high soil fertility (Siriporn *et al.,* 2016). Under good management, Pakchong is known for fast growth with high forage yield, high crude protein concentration (16 - 18 %), a wide range of adaptation and can be ratooned for up to eight years (Kiyothong, 2014). The fast regrowth period and high dry matter yield of Napier Pakchong may be advantageous in conserving soil and providing early fodder (Wangchuk *et al.,* 2015). Meanwhile, in terms of nutritive values, referring to Pitaksinsuk *et al.* (2010), Napier Pakchong provides nutritive and palatable green fodder all the year-round, which contains 10 - 12 % of crude protein, 14.9 % dry matter, 15.9 % protein, 35.8 % neutral detergent fibre, 14.5 % ash, and 36.5 % soluble carbohydrate at the harvest time of 45 days or 7 weeks.

Hence, this study is designed to evaluate cutting age on dry matter yield and nutritive values in terms of percentage of dry matter (DM), crude protein (CP), crude fibre (CF), and metabolizable energy (ME) of Napier Pakchong. This information is required to select the best cutting age in optimizing the dry matter yield and nutritive value of Napier Pakchong in Malaysia.

MATERIALS AND METHODS

The experiment was conducted at Veterinary Institute Malaysia, Kluang, Johor. The experimental plot is located in a tropical humid zone, 2° 01′ North latitude and 103° 19′ East longitude with an average rainfall of 2246 mm per annum. The average minimum and maximum temperature are 23.3 °C and 31.5 °C, respectively and the average relative humidity is 78.1 % retrieved by M. Nurhisham (personal communication, November 18, 2020). Nine plots were established with three different cutting ages (three plots were at the 6th week cut, three plots were at the 7th week cut and three plots were at the 8th week cut). All forage plots were 7 m x 4 m. The planting materials of Napier were planted in rows with spacing 0.6 m x 0.6 m. The parent plant was cut with a minimum of 2-3 nodes per cutting and two stem cutting was placed 45° from the ground level with one of the nodes buried in the soil and other nodes left exposed for tiller emergence. Soil pH was 6.0. Basal fertilizers used were NPK 60:30:30 (kg/ha). The grasses were cut on day 70 after planting to get a uniform stand. Then the cutting treatments were carried out 3 times at the interval of 6th, 7th, and 8th weeks. The Napier plants were cut about 0 to 10 cm from the ground and were weighted. Random samples of Napier, representative of each plot, were sent for dry matter yield and proximate analysis (dry matter, crude protein, crude fibre, and metabolizable energy). After each harvest, the rates of maintenance fertilizer used were NPK 150:60:100 (kg/ha/year). The rate of basal

and maintenance fertilizer was as recommended by the Department of Veterinary Services (DVS, 2015) and University Putra Malaysia (UPM, 2013).

Dry Matter Yield

The Napier Pakchong grass was harvested by cutting in the whole plot from each treatment. The fresh samples harvested from each treatment were then weighed. The grass yield obtained from random samples of Napier, representative of every treatment on each plot, were pre-dried in a forced-air drying oven set at 60 °C overnight and then ground to pass 1-mm sieves. It was then forced-air dried in an oven at 103 ± 2 °C for over 4 hours to determine the dry matter value (Close *et al.,* 1986) and later dry matter yield per hectare was calculated.

Chemical Composition

The ground Napier Pakchong samples were then examined for crude protein (CP), crude fibre (CF) and finally, the metabolizable energy (ME) was calculated using the Manke equation (1986). The CP content (N x 6.25) was determined by the Kjeldahl method using Kjeltec™ methods (FOSS, 2003). The CF value was determined using Fibertec™ methods (FOSS, 2010).

Statistical Analysis

The data were analysed by one way analysis of variance (ANOVA) using the programme of SAS (Package Version 9.4). The difference between treatment means was measured by Duncan's Multiple Range Test (DMRT) at 5 % level of significance.

RESULTS AND DISCUSSION

The dry matter and dry matter yield production of Napier Pakchong are presented in Table 1. Results reveal that dry matter significantly increased in alignment with the increase of grass maturity. Dry matter (DM) is what remains such as proteins, fibres, water-soluble carbohydrates, ash, and lipids after all of the water is evaporated out of forages. Data recorded shows the increment percentage of DM from 6th week to 7th week is higher (14.5 %) compared with 7th week to 8th week (11.3 %). Meanwhile, dry matter yield production (DMYP) is also a critical parameter in forage management. It is defined as the yield of grass without the water content. As expected, DMYP is getting higher in line with grass maturity. The percentage of DMYP is higher at 7th week to 8th week (34.1 %) compared with 6th week to 7th week (18.3 %). The dry matter yield production of Napier Pakchong (6 048.9 kg/ha/harvest) in the 6th week is the highest compared to other six Napier varieties, with an average of 4 211.7 kg/ha/harvest (Haryani *et al.,* 2018).

Table 1. Dry Matter and Dry Matter Yield Production of Napier Pakchong.

Nutritive Value	6th weeks	7th week	8th week
Dry matter (%)	12.4_a	14.2_b	15.8_c
DM yield production (kg/ha/harvest)	$6\,048.9_a$	$7\,161.0_b$	$9\,602.8_c$

$_{a, b, c}$ Means with common subscripts are not significantly different (P>0.05)

Proximate analyses show that there is no significant difference in CP content at 6th and 7th week but the CP content of Napier Pakchong declined significantly with an increase in cutting age from 14.9 % in 7th week to 13.3 % at 8th week ($P<0.05$). Siriporn *et al.* (2016) analysis showed Napier Pakchong at 45 days with 23.72 % DM contained only 6.65 % CP content. Another study by Thayalini *et al.* (2019) found that at age 6th week, 7th week, and 8th week, CP content is 13.3 %, 11.4 %, and 9.9 % respectively. The variations of CP content obtained from this study compared to other studies may be due to different levels of soil N at the study site, which may have affected CP content. It is because according to Singh *et al.* (2000), CP content in forages is positively correlated with soil N. Haryani *et al.* (2018) conducted a study in comparing 3rd Generation Napier and Kobe Napier which revealed similar CP values as Pakchong Napier (15.6 %), with the former at 15.03 % and the latter at 15.27 %. Meanwhile, when comparing Pakchong Napier to Merah (Red) Napier (13.47 %), Taiwan Napier (13.97 %), and Zanzibar Napier (13.97 %), the content of CP in Pakchong Napier was found to be slightly high at 15.6 %. Age at harvest is the most critical factor affecting CP content in Napier grass because as the grass ages, although dry matter yield increases, CP content declines (Wadi *et al.,* 2004). If the CP content is below the critical level of 7 % in ruminant diet such as in cattle, it will reduce voluntary feed intake in ruminants and also decrease the digestion (Nori *et al.,* 2009). The CP requirement for adult cows and heifers is a minimum of 10 % while a higher percentage is necessary for other growing cows and during the lactation stage (Thayalini *et al.,* 2019). The result of this study found that in Napier Pakchong at 7th and 8th week's, the percentage of CP content still fulfils the requirement for cattle for every stage of growth.

The CF content of grass tends to increase in advancing maturity (Lounglawan *et al.,* 2014). Analyses from this study showed that CF content was significantly increased from 6th week to 7th week and from 7th week to 8th week. Data recorded show that the increment percentage of CF at 6th week to 7th week is higher (5.9 %) compared with 7th week to 8th week (3.4 %). The CF content of Napier Pakchong in 6th week (30.6 %) is low compared to other six Napier varieties studied previously by Haryani *et al.* (2018), which is 33.0 % in India Napier, 33.1 % in Taiwan Napier, 33.2 % in Merah (Red) Napier, 34.2 % in 3rd Generation Napier, 34.6 % in Kobe Napier and 35.0 % in Zanzibar Napier. Apart from high CP content, the CF content also should be low to ensure higher digestibility (Kumar *et al.,* 2016). Metabolizable energy of Napier Pakchong did not significantly decrease from 6th week to 7th week, and from 7th week to 8th week. However, ME

Table 2. Chemical Compositions of Napier Pakchong.

Nutritive Value	6th week	7th week	8th week
Crude protein (%)	15.6_{a}	14.9_{a}	13.3_{b}
Crude fibre (%)	30.6_{a}	32.4_{b}	33.5_{c}
Metabolizable energy (MJ/kg)	9.04_{a}	8.97_{ab}	8.85_{b}

$_{a, b, c}$ Means with common subscrip ts are not significantly different ($P>0.05$)

is significantly decreased between the 6th week and 8th week because of increasing amounts of CF content. According to Nolan and Savage (2009), the ME content of the diet decreases with increasing amounts of fibre content in the form of roughage.

The present study clearly shows that the cutting interval has a marked effect on the dry matter yield and forage quality of Napier Pakchong grass. The best harvesting age as suggested by Manyawu *et al.* (2003) should be 6th to 7th week for optimum yield when the nutrients are also at the optimum concentration. However, cutting at the 7th to 8th week will achieve a much higher dry matter yield than cutting every 6th week. The ME is also not significantly different between the 7th week and 8th week. Napier Pakchong grass at the age of 7th and 8th week can be given to bulls and cows because the protein content is still more than the required recommended protein which is at 10 % (Thayalini *et al.,* 2019). Van Man and Wiktorsson's (2003) study also achieved the best balance between dry matter yield and forage quality of Napier grass at the 8th week cutting interval.

CONCLUSION

Optimum field management is aimed at getting the highest dry matter yield production to satisfy the animal's needs and also contains high nutritive value. The present data proved that cutting management strongly affects the yield and quality of grasses. Dry matter yield production increased, and forage quality decreased with the maturation of the grasses. Although the nutritional content of Pakchong Napier is not much different compared with other varieties, the advantage is it produces the highest dry matter yield. Finally, this study also suggests the optimum harvest age for Malaysia's fodder production of Pakchong Napier is at 7th week to 8th week after taking into account the nutrient content and yield of dry weight per hectare.

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