UNIVERSITI PUTRA MALAYSIA

CHANGES IN NUTRITIVE QUALITY OF
Setaria sphacelata var. splendida **WITH MATURITY**

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CHANGES IN NUTRITIVE QUALITY OF *Setaria sphacelata* var. splendida

WITH MATURITY

BY

SURIANI BT MD NOR

A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfillment of requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science

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This project paper attached here to, entitled "Changes in nutritive quality of *Setaria sphacelata* var. splendida with maturity." prepared by Suriani Bt Md Nor and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of Bachelor of Agricultural Science.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
RCBD	Randomized Complete Block Design
$^{\circ}$C	Degree Celsius
DF	Degree of Freedom
m	meter
m^2	Meter square
mm	Millimeter
cm	Centimeter
l	litre
ml	milliliter
R^2	R-square
SAS	Statistical Analysis System
Tukey's HSD	(Honest Significant Difference)
g	Gram
kg	Kilogram
ha	hectare
kg/ha	Kilogram/hectare
(%)	Percentage

ABSTRACT

The nutritive quality in feed is an important factor that can affect the production of milk and beef. The feed quality for livestock can be analyzed by using conventional chemical techniques or lately with the use of near infrared reflectance spectroscopy (NIRS). The study was conducted to determine the optimum harvest interval for *Setaria sphacelata* var. splendida (Setaria splendida) based on its nutritive quality and yield when cut at different cutting intervals. In addition, the project also looks at the differences in nutritive quality parameters when measured with NIRS against that obtained by conventional method. The objective was to determine whether the NIRS was a reliable method of measuring nutritive quality of pastures. The experiment used the Randomized Complete Block Design (RCBD) with 3 treatments and 4 replications. The treatments comprised of three cutting intervals: 3 (T1), 5(T2) and 7(T3) weeks. The measurements taken during harvest were the height of grasses and a number of tillers. Laboratory and NIRS analysis was conducted to determine the Crude Protein (CP), Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) as a measure of nutritive quality of the grass. There were significant differences in nutritive quality and yield among treatments ($P<0.05$). The fibre content (NDF and ADF) and Dry Matter Yield (DMY) increased with advancing plant maturity while its CP, Leaf to Stem Ratio (LSR) and cumulative DMY showed a decline. The proportion of plants with vegetative parts declined at the later stage of maturity. However the nutritive quality at week 3 and week 5 was not significantly different. Therefore it is recommended that the grass is harvested at 3 or 5 weeks to get higher vegetative growth and better quality forage.

Besides that, the measurement NIRS analysis in this experiment was not able to be used for estimation of forage nutritive quality as the values obtained from NIRS was not correlated with the values from the chemical analysis. The inability to use NIRS in this experiment was because of the improper calibration that was employed from a calibration which was previously done on other forage samples. Calibration with the current samples was not done because of some error of the software. This demonstrates the importance of using the correct samples for calibration if NIRS is to be effectively used.

ABSTRAK

Kualiti nutrient dalam makanan merupakan salah satu faktor yang penting dalam meningkatkan penghasilan susu dan daging ternakan lembu. Kualiti makanan ternakan boleh dianalisis dengan menggunakan teknik secara kimia atau menggunakan teknologi pembiasan spectra infra merah (NIRS). Kajian dilakukan untuk menentukan jarak tuaian yang optima untuk *Setaria sphacelata* var. splendida (Setaria splendida) berdasarkan kualiti nutrient dan hasilnya apabila ia dipotong pada jarak potongan yang berbeza. Tambahan pula, projek ini juga melihat kepada perbezaan dalam parameter kualiti nutrient apabila diukur melalui kaedah NIRS dan Konventional. Objektif eksperimen adalah untuk menentukan sama ada NIRS merupakan kaedah yang boleh di guna pakai dalam mengukur kualiti nutrient pastura. Eksperimen ini menggunakan reka bentuk blok rawak lengkap (RCBD) dengan 3 rawatan dan 4 replikasi. Rawatan terdiri daripada 3 jarak pomotongan : 3 (T1), 5(T2) and 7(T3) minggu. Pengukuran yang diambil semasa rumput dituai adalah ketinggian rumput dan bilangan anak rumput. Analisis makmal dan NIRS dilakukan untuk menentukan jumlah Protein Kasar (CP) , kandungan serat (NDF) dan kandungan bahan tidak cerna (ADF) sebagai pengukuran untuk menentukan nilai pemakanan rumput. Kandungan serat (NDF dan ADF) dan Hasil Bahan Kering (DMY) meningkat dengan peningkatan kematangan pokok sementara Kandungan protein kasar (CP), Nisbah daun dan batang (LSR) dan Hasil Bahan Kering Terkumpul menunjukan penurunan. Bahagian vegetative pokok akan menurun pada peringkat kematangan pokok yang akhir. Walaubagaimanapun, kualiti nutrient tumbuhan pada minggu ke- 3 dan ke -5 adalah tiada beza. Oleh itu, pemotongan rumput

pada minggu ke- 3 dan ke -5 adalah di syorkan untuk mendapatkan pertumbuhan vegetatif yang tinggi dan kualiti yang lebih baik bagi foraj.

Selain itu, pengukuran bagi analisis NIRS dalam eksperimen ini tidak boleh di gunakan untuk pengukuran kualiti nutrient sebagaimana data yang diperolehi daripada NIRS tidak mempunyai hubungan dengan data yang diperolehi daripada analisis kimia. Penggunaan NIRS dalam eksperimen ini tidak boleh digunakan disebabkan kalibrasi yang tidak bersesuaian dan sudah lama digunakan oleh sampel foraj yang lain. Kalibrasi dengan sampel terkini tidak dapat dilakukan disebabkan oleh ralat perisian. Ini menunjukkan kepentingan penggunaan sampel yang betul untuk pengukuran jika mahu NIRS digunakan dengan berkesan.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The nutritive quality of feeds is an important factor that affects the production of milk and beef. Animal performance is affected by the quality of forage that will be given to the livestock (Lazzarini *et al.,* 2009). In order to increase the production of milk and beef, the nutritive quality analysis must be done to know the content of nutritional value within it.

Plant maturity greatly influences the nutritional quality of grasses. Generally, the pasture quality declines with advancing maturity when the plants change from being leafy and vegetative to a stemmy and reproductive (Blaser, 1964). Hanson *et al*., (1988) explained that the nutritive quality begins to decrease slowly at the first growth stage. Then it will decline rapidly when the plant starts reproductive growth (when the plant develops a seed head). As the grasses approaches full maturity (form hard seed), the quality decline is less rapid, but the nutritive value is extremely poor.

With increasing plant maturity the Crude Protein (CP) and digestibility will also decrease. On the other hand, Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF), Dry Matter Yield (DMY), and fiber content will be increase (Cecava, 1995). Short intervals between cuttings will result in high quality forages but total yield will be lower.

Generally, most laboratories use chemical methods to determine the NDF, ADF and CP content of feed. NDF is a component of the plant comprising of the plant cell wall, while ADF is the cell wall after removal of hemicellulose. Then CP is measured by analyzing the nitrogen content in the pasture and multiplying by 6.25.

The quality of feed for livestock can be analyzed by using a conventional chemical technique or with indirect methods that are more rapid such as the Near Infrared Reflectance Spectroscopy (NIRS). The NIRS is used for analysis of the content of organic components, protein, fiber, and others in animal foods. The NIRS can give accurate results of protein content and other constituents when it is calibrated properly (Dryden, 2003).

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The NIRS is also useful for estimating the nutritional value of forage and can give faster results than conventional methods (Norris *et al*., 1976). At the same time, the result obtained from research showed that NIRS was the one of alternative techniques to the conventional chemical analysis because the result obtained from NIRS was closely related to chemical analysis (Lobos *et al*., 2013). The desire to increase the production of milk and beef has made the analysis of feed quality as a main factor especially in analyzing the nutritional content in foodstuff.

1.2   Objectives of study

The objectives of this research were:

1) To determine the optimum harvest interval of *Setaria sphacelata* var. splendida (Setaria splendida) based on the nutritive quality and yield.
2) To compare the changes in nutritive quality of Setaria splendida with maturity using two methods of analysis: conventional laboratory techniques and NIRS.

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