UNIVERSITI PUTRA MALAYSIA

GAS PRODUCTION OF NAPIER GRASS AND CORN STOVER IN *IN VITRO* RUMEN FERMENTATION

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CERTIFICATION

This project entitled "Gas Production of Napier Grass and Corn Stover In *In Vitro* Rumen Fermentation" is in prepared by Muezzudin bin Mohd Yahya and submitted to the Faculty of Agriculture in fulfilment of the requirements of the course SHW 4999 (Final Year Project) for award of the degree of Bachelor of Agriculture (Animal Science).

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LIST OF ABBREVIATIONS

DM	Dry Matter
CP	Crude Protein
NDF	Neutral Detergent Fiber
ADF	Acid Detergent Fiber
ADL	Acid Detergent Lignin
gm	Gram
ml	Mililiter
L	Liter
SPSS	Statistical Package for the Social Sciences

GAS PRODUCTION OF NAPIER GRASS AND CORN STOVER IN *IN VITRO* RUMEN FERMENTATION

BY

MUEZZUDIN BIN MOHD YAHYA

ABSTRACT

In Malaysia, sweet corn is one of the popular crops. The corn stover not being fully utilized by farmers. Napier grass has been used widely in Malaysia as livestock feeding. A study was undertaken to compare the Napier grass (*Pennisetum purpureum*) and corn stover (F1 Sweet Corn- Sh2) and their parts of plant for dry matter (DM), ash, crude protein (CP), neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL), and *in vitro* digestibility. 9 samples were collected randomly for each Napier grass and corn stover. Each plant were divided into three sampling parts which are leaf part (n=3), stem part (n=3) and whole plant (n=3). Corn stover sample was collected after the corn grain was harvested. The DM and ash of corn stover was higher ($P<0.05$) than Napier grass, while the content of CP, NDF and ADF was higher ($P<0.05$) in Napier grass compare to corn stover. Higher ADL reading was shown by, the corn stover. The DM, ash and CP content was higher ($P<0.05$) in Napier leaf compare to other parts of Napier grass, while the Napier stem have higher ($P<0.05$) in NDF, ADF and ADL contain., the DM, ash and CP content in corn leaf was higher ($P<0.05$) compared to the corn stem that have higher ($P<0.05$) NDF, ADF and ADL contain, vice versa. From gas

production analysis, corn stover showed higher digestibility ($P<0.05$) than Napier grass. Between Napier grass and corn stover, the leaf part showed higher digestibility ($P<0.05$) compare to other parts. Eventhough the corn stover was an agriculture by-product, it showed higher digestibility ($P<0.05$) compared to Napier grass that was meant only for animal feed. For the recommendation, the corn stover (agriculture by-product) can be used for livestock feeding with the great nutrient content compare to the Napier grass. Farmers need to mix well the fodder because the nutrient content in different part of plant is varies.

PENGELUARAN GAS DARI RUMPUT NAPIER DAN BATANG JAGUNG DALAM TEKNIK FERMENTASI RUMEN *IN VITRO*

OLEH

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ABSTRAK

Di Malaysia, jagung manis adalah salah satu tanaman yang popular. Batang jagung tidak digunakan sepenuhnya oleh petani. Rumput Napier telah digunakan secara meluas di Malaysia sebagai salah satu makanan haiwan ternakan. Satu kajian telah dijalankan untuk membandingkan rumput Napier (*Pennisetum purpureum*) dan batang jagung (F1 Sweet Corn- SH2) dan bahagian-bahagian tumbuhan untuk berat kering (DM), abu, protein kasar (CP), serat detergen neutral (NDF), serat asid detergen (ADF), lignin asid detergen (ADL), dan *in vitro* penghadaman. 9 sampel telah dikumpulkan secara rawak bagi setiap rumput Napier dan batang jagung. Setiap sampel tumbuhan dibahagikan kepada tiga bahagian iaitu untuk bahagian daun (n = 3), bahagian batang (n = 3) dan seluruh pokok (n = 3), sampel batang jagung dikumpulkan selepas bijirin jagung dituai. DM dan abu batang jagung adalah lebih tinggi ($P < 0.05$) daripada rumput Napier, manakala kandungan CP, NDF dan ADF adalah lebih tinggi ($P < 0.05$) dalam rumput Napier berbanding batang jagung. Hasil bacaan ADL lebih tinggi ditunjukkan oleh batang jagung. Kandungan DM, abu dan CP adalah lebih tinggi ($P < 0.05$) dalam daun Napier berbanding bahagian-bahagian lain di dalam rumput Napier, manakala batang Napier

yang mempunyai lebih tinggi (P <0.05) dalam kandungan NDF, ADF dan ADL. Kandungan DM, abu dan CP dalam daun jagung adalah lebih tinggi (P <0.05) berbanding dengan tangkai jagung yang mempunyai lebih tinggi (P <0.05) kandungan NDF, ADF dan ADL dan begitu juga sebaliknya. Dari analisis pengeluaran gas, batang jagung menunjukkan penghadaman yang lebih tinggi (P <0.05) daripada rumput Napier. Dalam rumput Napier dan batang jagung, bahagian daun menunjukkan penghadaman yang lebih tinggi (P <0.05) berbanding dengan bahagian-bahagian lain. Walaupun batang jagung merupakan sisa produk pertanian, ia menunjukkan penghadaman yang lebih tinggi (P <0.05) berbanding dengan rumput Napier tua dimana ianya adalah makanan untuk haiwan. Untuk itu, batang jagung (sisa produk pertanian) boleh digunakan untuk pemberian makanan haiwan ternakan kerana ianya mempunyai kandungan nutrien yang besar berbanding dengan rumput Napier tua. Petani perlu gaul makanan itu kerana kandungan nutrien dalam setiap bahagian pokok berbeza.

CHAPTER 1

INTRODUCTION

Feeding plays an important role in livestock industry as operating cost in most livestock operations were made up around 50% to 70% from the feeding expense per total cost of production. To ensure the animal production yield valuable products, the knowledge about the quality of feed is worthwhile among the practitioner to apply on their animals. However, the ruminants should be fed, as far as possible, on roughages and others feeds that are not in competition with human food (Ørskov, 1998). Ruminant production systems throughout the world are based on forages, with grassland feeds being predominant (FAO, 1996).

Low quality and quantity of feeds are a major constraint limiting livestock productivity among smallholder farmers (Ayantunde *et al.*, 2005). This report reviews the role of Napier grass and corn (*Zea mays*) stover and their plant part structure to improve smallholders' livestock productivity, incomes and livelihoods. In Malaysia, post-harvest corn not fully used for livestock feeding. The agriculture residue of corn can be feed to the ruminant livestock too. This will minimize the cost of feedstuff and optimize the production of livestock. Mani (2006) reported that corn grain accounts for about 45% of the total dry matter yield of a corn field. Corn stover amounts would range from 3 to 4.5 dry tons per acre in fields ranging from 100 to 150 bushel of grain per acre. Agriculture residue represents an underutilized feed source, although physical or chemical treatment

may be necessary in order for fibrous by-products to make a major contribution to the energy requirements of productive livestock (Owen and Jayasuriya, 1989).

Napier grass is commonly grown in Malaysia to feed the ruminant animals. The grass has good nutritive value and can adapt in Malaysia's climate condition which is hot and humid. Napier grass can grow well and easy to manage and propagates easily. It has a soft stem that is easy to cut and fairly drought-resistant because of it deep roots feature. The tenderness of the young leaves and stems are palatable for livestock and grow very fast. Increased livestock production could be achieved through cultivation of high quality forages adapted to local conditions, and with high yield, such as *Pennisetum purpureum* variety (Tessema and Halima, 1998).

1.1 Objectives

1.1.1 The general objective:

- To compare the digestibility of common forages.

1.1.2 The specific objectives of this experiment are:

- To determine the difference of digestibility between Napier grass and corn stover.
- To determine the difference of digestibility of whole plant and plant part.

1.2 Significant of study

The digestibility of each part of plant is different. Therefore, this report aims to explain the digestibility between two forages and each part of plant using *in vitro* gas production. Utilization of corn stover which is abundant in Malaysia can minimize the input cost. The Napier grass deems worthwhile for ruminant feeding since considerable nutritive values was presence in Napier grass.

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