UNIVERSITI PUTRA MALAYSIA

AGRONOMIC PROPERTIES AND NUTRITIVE VALUE OF ALEMAN GRASS (*Echinochloa Polystachya*) ESTABLISHED UNDER DIFFERENT SOIL TYPE AND DRAINAGE CONDITION

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FP 2015 206

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By

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A project report submitted to Faculty of agriculture,

University Putra Malaysia,

In fulfilment of requirements of SHW 4999 (Final Year Project)

For the award of degree

BACHELOR OF AGRICULTURE (ANIMAL SCIENCE)

FACULTY OF AGRICULTURE

UNIVERSITY PUTRA MALAYSIA

SERDANG, SELANGOR

2014

CERTIFICATION

The project entitled **"AGRONOMIC PROPERTIES AND NUTRITIVE VALUE OF ALEMAN GRASS (*Echinochloa Polystachya*) ESTABLISHED UNDER DIFFERENT SOIL TYPE AND DRAINAGE CONDITION"** was prepared by **NURFATEHA BINTI AHMAD ZABIDI** and submitted to Faculty of Agriculture in fulfilment of the requirements of the course SHW 4999 (Final Year Project) for the award of the degree Bachelor of Agriculture (Animal Science).

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ACKNOWLEDGEMENT

In the name of Allah S.W.T, the most merciful and compassionate, Alhamdulillah praise to Allah S.W.T because of his blessing gives me the strength to complete this project.

For first and importantly I would like to express my sincere gratitude to my supervisor, Dr. Shokri bin Jusoh, Department of Animal Science, Faculty of Agriculture, University Putra Malaysia, Serdang, Selangor, for providing me guidance, concerned advice and constructive comments from the beginning of the research until the final submission of the report.

Then, I also wish to thank to Mr Shuhaimi bin Abd Rahim, the agriculture officer at Taman Pertanian Universiti (TPU), all staff of field 15 and field 2, and the lab assistant at Nutritional Laboratory Department, University Putra Malaysia for all their help and cooperation during my experimental period. Also, not to forget my thankful to all my friends those help me doing this experimental.

Finally, my sincerely gratitude to my family especially my parents Ahmad Zabidi bin Ujang and Norsiah binti Mohd Juhan, and siblings who always support and be my side throughout the happiness and hardness until this project is done.

Thank you.

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LIST OF ABBREVIATION

N	Nitrogen
CRD	Completely Randomised Design
cm	Centimetre
ml	Milimetre
kg	Kilogram
◦C	Degree Celsius
DM	Dry Matter
OM	Organic Matter
CP	Crude Protein
NDF	Neutral Detergent Fiber
ADF	Acid Detergent Fiber
ADL	Acid Detergent Lignin
ANOVA	Analysis Of Variance
DMRT	Duncan Multiple Range Test
SAS	Statistical Analysis System
+/-	Plus/minus
C4	Composition of four carbon compound
SE	Standard Error

AGRONOMIC PROPERTIES AND NUTRITIVE VALUE OF ALEMAN GRASS (*Echinochloa Polystachya*) ESTABLISHED UNDER DIFFERENT SOIL TYPE AND DRAINAGE CONDITION

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ABSTRACT

The agronomic properties and nutritive value of Aleman grass (*Echinochloa polystachya*) under different types of soil and drainage condition were assessed in six month experiment from early April 2014 until September 2014 at Field 15, Universiti Putra Malaysia (UPM) using factorial experiment of completely randomised design (CRD). The treatments used was the drainage condition (dry and waterlogged) and types of soil (Munchong series, Malacca series, Serdang series, and ex-mining Alluvium soil) that were cultivated in pot sized 19 cm x 26 cm and arranged on 6 m x 5.4 m land area. The agronomic properties and the nutritive value were assessed and the grass was sample and was cut at 15 cm height above the ground level every 21 days. The chemical composition was analyzed for dry matter (% DM), ash (% OM), crude protein (% CP), neutral detergent fibre (% NDF), acid detergent fibre (% ADF), and acid detergent lignin (%ADL) at the Nutrition Laboratory, Department of Animal Science, Faculty of Agriculture, UPM. The agronomic properties assessed are plant height, tiller number per plant, dry matter production, and leaf to stem ratio and root to shoot ratio. Plant height was significantly different ($P>0.05$) in both treatments, but, other parameters show no significant difference between treatments. In terms of nutritive value, there were significance differences ($P<0.05$) on crude protein (% CP) and neutral detergent fibre (% NDF) under dry and waterlogged condition. Meanwhile, there was no significant effect on dry matter (% DM), ash (% OM), acid detergent fibre (% ADF), and acid detergent lignin (% ADL) content between treatments. There were also non significant differences on DM, OM, ADF and ADL under dry condition, but

show a significant difference in waterlogged condition. The grass grown under waterlogged condition exhibit higher growth, well develop and better production in four different types of soil. There is only significantly difference of plant height on both condition, but other parameters show a significant difference under different types of soil. However, there were some effects at dry condition under different types of soils in the study. The result shows a lower production and performance at dry condition. All parameters show non significant difference in dry condition except for plant height, %CP and %NDF content. It is concluded that the grass grown under waterlogged condition gave the best result for agronomic properties and nutritional content under difference types of soil. Besides that, the Aleman grass show a positively impact to grown under ex-mining Alluvium soil as compared to other types of soil. Then, it is strongly recommended that the Aleman grass should be planted in waterlogged condition and under ex-mining Alluvium soil to produce higher production that is useful to replace Napier and Guinea grass in the future.

ABSTRAK

Respon pertumbuhan rumput Aleman (*Echinochloa polystachya*) terhadap jenis tanah dan keadaan pengairan yang berbeza telah dinilai selama enam bulan bermula dari awal April 2014 sehingga September 2014 di ladang 15, Universiti Putra Malaysia dengan menggunakan eksperimen berfaktorial dari reka bentuk rawak penuh (CRD). Rawatan yang digunakan ialah keadaan pengairan yang berbeza (keadaan kering dan banjir) dan jenis tanah yang berbeza (Munchong siri, Melaka siri, Serdang siri dan tanah Alluvium bekas lombong) yang ditanam menggunakan pasu berukuran 19 cm x 26 cm dan disusun dalam kawasan seluas 6 m x 5.4 m. Aspek agronomik dan kandungan nutrient pemakanan telah dinilai dan sampel rumput dipotong pada 15 cm di atas paras tanah setiap 21 hari. Komposisi kimia untuk mengetahui kandungan bahan kering (% DM), peratusan abu (% ASH), protein kasar (% CP), gentian neutral detergen (% NDF), gentian asid detergen (% ADF) dan gentian asid lignin (% ADL) yang dijalankan di makmal pemakanan, Jabatan Sains Haiwan, Fakulti Pertanian, Universiti Putra Malaysia. Tinggi pokok, jumlah anak tunas setiap pokok, jumlah pengeluaran, nisbah daun kepada batang dan nisbah batang kepada akar dikaji. Dalam aspek agronomik, tinggi pokok terdapat perbezaan yang signifikan ($P<0.05$) kepada kedua-dua rawatan, tetapi kriteria yang lain tidak memberi perbezaan bererti antara rawatan. Dalam kandungan nutrien, terdapat perbezaan signifikan ($P<0.05$) pada protein kasar (% CP) dan gentian neutral detergen (% NDF). Tidak terdapat keseragaman terhadap kesan rawatan kepada bahan kering (% DM), peratusan abu (% OM), gentian asid detergen (% ADF) dan gentian asid lignin (% ADL). Perbezaan tidak bererti pada DM, ASH, ADF dan ADL berada di bawah keadaan kering, tetapi keadaan yang signifikasi pada keadaan banjir. Rumput yang telah ditanam di dalam keadaan banjir telah menyebabkan pertumbuhan yang tinggi, pembesaran yang baik dan pengeluaran yang banyak pada empat jenis tanah yang berbeza. Hanya terdapat sedikit perbezaan pada tinggi pokok dalam kedua-dua keadaan, tetapi parameter lain menunjukkan perbezaan bererti pada jenis tanah yang berbeza. Walaubagaimanapun, tidak ada kesan rawatan pada keadaan yang kering pada semua jenis tanah yang digunakan di dalam pembelajaran ini. Terdapat pengeluaran yang rendah dan pembesaran yang rendah dalam keadaan yang kering. Kesemua parameter menunjukka perbezaan tidak bererti di dalam

keadaan kering kecuali untuk tinggi pokok, kandungan % CP dan kandungan % NDF. Hal ini dapat dirumuskan bahawa rumput yang ditanam pada keadaan banjir memberikan keputusan yang terbaik untuk agronomik aspek dan kandungan nutrient pada semua jenis tanah.

CHAPTER 1

INTRODUCTION

1.1 Livestock Industry

Nowadays, the livestock industry in Malaysia is seen to be the promising sector that triggers economy development of the country. Since before our country become independent, the agriculture industry was recognised as an economic industry that strategic which can increase profit and provide balanced growth between urban and rural area. Just like in last 6th October 2014, when the Malaysia budget for 2015 was announced, total amount of RM6 billion was allocated to Ministry of Agriculture and Agro-industry (MOA) that can be used to improve food supply in Malaysia. These initiatives eventually will increase economy and increase sustainability of agriculture and livestock in our country. Besides that, the increasing population of Malaysians from 23.3 million in 2000 to 30 million in 2014 prove that the sustainability of the agriculture industry is a major factor that's needed for survival and development of the country **(Department of Statistic, Malaysia, 2014).**

Starting from 9th National Plan (2006-2010), the government start to recognise the importance of agriculture industry in Malaysia. Then, it leads to introducing of Northern Corridor Economic Region (NCER) that involves states of Perlis, Kedah, Penang and northern Perak, which are the major producer of most agricultural product like paddy and sugar. The NCER was targeted to modernize food zone with efficient technology-driven food production, commercial scale farming, farming of new crops, livestock and downstream agriculture activity and also to move up the manufacturing value chain into high value added activities like food design and biotechnology. Another growth corridor that involved in livestock industry is Sabah Development Corridor (SDC) which is used to generate economic growth while ensuring optimum resources allocation for oil, gas, agricultural, livestock and biodiversity in Sabah **(Malaysia Economic Corridors, 2007).**

Therefore, livestock industry in Malaysia is an integral component of agriculture sector which can provide gainful employment and also to play vital role for producing useful animal protein food for the population **(Loh, 2004).** Moreover, the increasing demand of livestock product like meat, milk and eggs as well as the increasing demand of meat (beef, mutton and poultry) will eventually lead to increase of livestock population to satisfy the demand. According to **Maimunah (1998)**, where the amount of feed produced increase with the increasing population of the animal.

1.2 Shortage of Feed Production

According to **Department of Veterinary Services (2013)**, the total annual ex-farm value of livestock industry in 2013 is about 14,100.38 million. However, the demand for the livestock product like meat and milk was far higher than the production of the animal. **Maria Divina (2006)** stated that, the consumption of meat, poultry and milk in 1961-2002 increased from 108,219 to 1,162,937 metric tons per year. In fact, the domestic production of ruminant has continuously declined in recent years in spite of a small improvement in cattle and sheep population in early 1990s. Nowadays, Malaysia is only having 29.77% self-sufficiency level of beef, 13.45% mutton and about 9.30% in milk **(DVS, 2013).**

The consumption of animal protein has increased steadily meanwhile the plant protein intake was declining. Since a few decades ago, the shortage of feeds is the major problem that livestock industry needs to be faced. In 2008, Malaysia spends about RM4, 426,935 billion in animal feed importation **(Ministry of Agriculture and Agro-industry, Malaysia, 2009).** In addition, alternative feed formulation using locally available raw materials are poorly developed. Raw material such as palm kernel cake (PKC) from palm oil product contain about 17% crude fibre and 20-30ppm copper that can be toxic to ruminant and too much fibre

in non-ruminant animal **(PKC, 2001)**. Other than that, it has been suggested that by developing forage resources for intensive ruminant production and growing the major feedstuff or fully utilize of agricultural waste can reduced the importation bill of feedstuffs. Therefore, forage resources like Napier, Guinea and other grass that are commonly used in livestock animal must be provided and reserved for the animals to improve an animal health and also to increase the production of the animal.

1.3 Background of Study

Echinochloa polystachya (Aleman grass) is a perennial grass that commonly grows in swampy areas. These species can be found widespread in warm, temperate and subtropical regions of the world and extending into the tropics. Besides, it can grow either in humid or flooded areas, as it can be terrestrial or aquatic **(Pompeo *et al.,* 2001)** and its leaves can reach up to 60 cm in length while its root is up to 2.5 cm in depth **(Beetle *et al.,* 1991).** Earlier, the grass can be found n North America to Florida, Louisiana and Texas and then has been widely introduced to Africa, Mexico, Argentina and Asia. It is commonly called as Aleman Grass, Carib Grass, Creeping River Grass, German Grass, Mudflat-millet or River Grass **(Stutzenbaker 1999; USDA NRCS 2006).**

In the early establishment of this grass, it is commonly known as a weed to the paddy plantation area, but prior to 1993 this plant was established as a forage grass and known locally as Perennial Baryngrass,Water Bermuda or Habetz Grass **(Thomas and Allen, 1993)**. During the first establishment period of this grass, the weed problems created by pasture plants had received little attention. In 1991, a major Federal Government report **(Humphries *et al.*, 1991)** warned that weeds pose dire threats to native habitats an

concluded that some serious and very serious environmental weeds are intentionally planted; among the country's most easily dispersed and damaging species are several grasses presently being promoted and planted for pasture. Due to these, **Humphries (1991)** presented a list of Australian tropical pasture grasses, and 2 are woody legumes, planted in the past as shade and fodder trees (Table 1).

Table 1. Tropical pasture grasses, and shade and fodder trees, listed by Humpshire *et al.* (1991) as among Australia's worst weeds.

Pasture grasses
Buffel grass *(Cenchrus ciliaris)*
Aleman grass *(Echinochloa polystachya)*
Hymanechne *(hymenachne amplexicaulis)*
Mission grass *(Pennisetum polystachion)*
Para grass *(Brachiaria mutica)*
Shade and fodder trees
Prickly acacia *(Acacia nilotica)*
Mesquite (*Prosopis* spp.)

Aleman Grass is a semi aquatic macrophyte that grows in the littoral sediments of water bodies and forms dense meadows with prolific perennial growth **(Pizzaro 1999).** This grass is regulated by a seasonal flooding and receding water cycle. According to **Piedade (1991)**, the new plants of this grass will grow upwards, at more than 1 m per month, forming reboots stems that are able to withstand significant currents. As the floodwaters rise, the internodes do not elongate, so successive nodes and their leaves are submerged into the turbid waters. The new nodes and leaves are formed at a rate sufficient to maintain leaves above the water surface **(Piadade *et al.*, 1992).**

However, the distribution of the Aleman Grass in Malaysia is still new and started when the grass is brought to the buffalo farmers in Sabah. Then, it when further introduced to the University Putra Malaysia (UPM) by Y.Bhg. Professor Dr. Abd Wahid bin Haron, Director of the Taman Pertanian Universiti (TPU). However, these grasses were established

only in a small plot in Field 15 and not much information or study was done to know their performance especially in Malaysian environmental condition. On the other hand, based on this experiment, the grass was planted in Malacca series, Munchong series, Serdang series and ex-mined Alluvium series which are the most abundant soil series in UPM campus. These different types of soils were used to ensure which type of soil will allow the plant to grow faster and more spread. Therefore, this study was proposed to evaluate the agronomic properties and nutritive value of the Aleman Grass under different soil type and drainage condition.

1.4 Research Problem

Aleman Grass or commonly known as creeping river grass is new to our country. The production of the grass was not yet established by any researcher due to unavailability of the grass and the tropical condition in Malaysia. Commonly, this grass was grown under cold climate. Thus, this study was done to identify the effect of the grass in different types of soils that can be found in UPM and later can be used to improve the quality of livestock industry.

1.5 Hypothesis

Different soil type and different drainage condition affects the agronomic properties and nutritive value of Aleman Grass (*Echinochloa Poystachya*). Normally, the loamy soil type with waterlogged condition will provide better performance for the grass as compared to other soil types in dry condition.

1.6 Objectives

The general objective of this study is to evaluate the agronomic properties and nutritive value of Aleman Grass under different soil types and drainage conditions.

The specific objectives of this study are:

1. To identify the agronomic properties of Aleman Grass under different soil types and drainage conditions.
2. To determine the nutritional quality of Aleman Grass under different soil types and drainage conditions.

1.6 Significance of Study

Malacca series, Munchong series, Serdang series and ex-mining Alluvium series are the most abundant soil series in UPM campus that are used to determine the growth of the Aleman grass. Each different characteristic of the soil will provide result that's useful in this study. Meanwhile, drainage conditions that are dry and water logged condition are used to determine which condition is preferable for this grass to grow. Thus, accurate soil type and drainage condition will contribute towards Aleman grass production.

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