UNIVERSITI PUTRA MALAYSIA

EFFECTS OF LIGHT INTENSITY ON GROWTH AND NUTRITIVE VALUE OF *BRACHIARIA HUMIDICOLA*

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EFFECTS OF LIGHT INTENSITY ON GROWTH AND NUTRITIVE VALUE OF *BRACHIARIA HUMIDICOLA*

BY

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A Project Report Submitted in Partial Fulfilment of the Requirement for the Degree of Bachelor of Agriculture (Animal Science) in the Faculty of Agriculture Universiti Putra Malaysia

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CERTIFICATION

This project entitled '**The effects of light intensity on growth and nutritive value of *Brachiaria humidicola***' is prepared by **Syahirah Binti Omar** and submitted to the Faculty of Agriculture in partial fulfilment of the requirement of SHW 4999 for the award of a degree in Bachelor of Agriculture (Animal Science)**.**

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ABSTRACT

Koronivia grass is a common name for *Brachiaria humidicola* sp. and it is a leafy, procumbent, creeping, stoloniferous perennial tropical grass. *Brachiaria humidicola* is tolerant of poor drainage and can withstand short term flooding in valley bottoms. It has been shown that decreasing light intensities may affect the arrangements of plant leaf tissues such as mesophyll cell volume (Chabot and Chabot 1977), amount of vascular and support tissues, and cuticle thickness (Wilkinson and Beard 1975). General objective for this research was to investigate the nutritive value and growth response of *Brachiaria humidicola* (koronivia grass) towards light intensity. The research hypothesis was light intensity have significant effects on the growth and nutritive value of *Brachiaria humidicola*, while the specific objectives were to determine the dry matter production per hectare of koronivia grass towards different light intensity, to determine the nutritive value of koronivia grass towards different light intensity and to determine the botanical composition and leaf-stem ratio of koronivia grass towards different light intensity. The response of koronivia grass to sunlight intensity were assessed in two month of experiment from early August until September 2016 at the Field 15, Universiti Putra Malaysia using randomized complete block design (RCBD). The treatment was the intensity of light (100% (full sunlight), (50% sunlight (partial shade)) and (30% sunlight (70% shade)) that were manipulated by black shading net imposed on wood frame with 5 feet height x 3m wide and was arranged in the 2 x 3 plotting system. The production, morphological aspects and nutritive value were assessed in this project. The grass was sampled and cut 3 inches height above the ground level at 18 days for each cycle. There were significant different ($P<0.05$) on

ADF%, CP%, and dry matter yield among treatments towards different light intensity. The dry matter production decrease as the light intensity decreased. The dry matter production decreased from 37.63 tan/ha at 100 % light intensity, 27.20 tan/ha and 25.86 tan/ha at 50 % and 30 % light intensity. However, crude protein % increased as light intensity decreased among the treatments. The crude protein % increased from 6.6 % at 100 % light intensity to 8.5 % and 9.8 % at 50 % and 30 % light intensity respectively. There were no significant different on Neutral Detergent Fiber (NDF %) and leaf to stem ratio. There was no significant different among treatment in leaf to stem ratio and ADF %. The leaf to stem ratio was higher at 100 % light intensity and the ADL % was higher at 30 % light intensity.

It is concluded that the grass that was grown under 30 % and 50 % light intensity gave the best result with the total production of dry matter similar to the control and had high protein content. However, the increase in N-content of shaded plants may improve the feeding value of herbage.

ABSTRAK

Rumput Koronivia adalah nama umum untuk *Brachiaria humidicola sp.* dan ia adalah berdaun satu, procumbent, menjalar, rumput tropika saka stoloniferous. *Brachiaria humidicola* toleran terhadap sistem saliran yang lemah dan boleh menahan banjir bagi jangka masa pendek di kawasan lembah. Ia telah terbukti dengan mengurangkan keamatan cahaya ke atas tanaman ini boleh menjejaskan persiapan tisu daun tumbuhan seperti jumlah sel mesofil (Chabot dan Chabot 1977), jumlah vaskular dan sokongan tisu dan ketebalan kulit luar (Wilkinson dan Beard 1975). Objektif umum bagi kajian ini adalah untuk mengkaji nilai kandungan nutrien dan tindak balas pertumbuhan *Brachiaria humidicola* (rumput koronivia) terhadap keamatan cahaya. Hipotesis kajian ini adalah keamatan cahaya mempunyai kesan yang besar ke atas pertumbuhan dan nilai kandungan nutrien *Brachiaria humidicola*, manakala objektif khusus pula adalah untuk menentukan pengeluaran bahan kering sehektar rumput koronivia (DM) terhadap keamatan cahaya yang berbeza, untuk menentukan nilai pemakanan rumput koronivia ke arah yang berbeza keamatan cahaya dan untuk menentukan komposisi dan nisbah daun-stem dan sifat botani rumput koronivia terhadap keamatan cahaya yang berbeza. Respon rumput koronivia dengan keamatan cahaya matahari telah dinilai dalam dua bulan eksperimen dari awal bulan Ogos hingga September 2016 di Ladang 15, Universiti Putra Malaysia menggunakan reka bentuk blok rawak lengkap (RCBD). Rawatan ini terdiri daripada keamatan cahaya (100% (cahaya matahari penuh), (50% cahaya matahari (naungan separa)) dan (30% cahaya matahari (70% naungan)) yang telah dimanipulasikan oleh teduhan hitam bersih yang dikenakan ke atas rangka kayu dengan ketinggian 5 kaki x 3m lebar dan telah disusun keluasan 2m x 3m. Aspek pengeluaran, aspek morfologi dan kandungan nilai pemakanan telah

dinilai dalam projek ini. Sampel rumput telah dipotong 3 inci ketinggian di atas paras tanah pada 18 hari bagi setiap kitaran. Terdapat perbezaan secara bererti ($P < 0.05$) pada ADF%, CP%, dan pengeluaran bahan kering di antara rawatan terhadap keamatan cahaya yang berbeza. Penurunan pengeluaran bahan kering akan berkurang sepertimana keamatan cahaya berkurangan. Pengeluaran bahan kering itu menurun daripada 37,63 tan / ha pada 100% keamatan cahaya, 27.20 tan / ha dan 25.86 tan / ha pada 50% dan 30% keamatan cahaya. Bagaimanapun, kandungan protin kasar (%) meningkat dengan keamatan cahaya yang menurun di antara setiap rawatan. Kandungan protin mentah (%) meningkat daripada 6.6% pada keamatan cahaya 100% kepada 8.5% dan 9.8% masing-masing pada 50% dan 30% keamatan cahaya. Tidak ada perbezaan yang signifikan di Neutral Detergent Fiber (NDF%). Tidak ada perbezaan yang signifikan antara rawatan untuk ADF% juga. ADL% lebih tinggi pada 30% keamatan cahaya berbanding rawatan lain. Kesimpulannya rumput yang ditanam di bawah 30% dan 50% keamatan cahaya memberikan hasil yang terbaik dengan jumlah pengeluaran bahan kering sama dengan kawalan dan mempunyai kandungan kasar protein yang tinggi. Walau bagaimanapun, peningkatan dalam N-kandungan tumbuhan di bawah teduh boleh meningkatkan nilai tambah kepada rumput.

CHAPTER 1

INTRODUCTION

The livestock industry in Malaysia is seen to be the promising sector that triggers the national economic growth. With the estimate total population of 31.7 million in 2016, increasing from 31.2 million in 2015, Malaysia is one of the progressive developing country in the world (Department of Statistic Malaysia, 2016). Recently, in the 10th National Plan (2011-2015) reported that the economic developments of regions will be accelerated by focusing on a limited number of high-density cluster in the corridors that have sector and geographical advantages.

The Northern Corridor Economic Region (NCER) is the key outcomes targeted to main sectors which become a modern food zone with efficient technology-driven food production, commercial scale farming, farming of new crops, livestock and downstream agriculture activities; to move up the manufacturing value chain into high value-added activities like wafer fabrication, chip design and biotechnology. Another growth corridor that involved in livestock industry in Sabah Development Corridor (SDC) that focused on Agrobio Innovation Zone Sandakan Education Hub, livestock and food at the Brunei Bay Integrated Development Area.

Thus, the Malaysian livestock industry is an integral component of the agriculture sector, providing gainful employment and play vital role for producing useful animal protein food for the population (Loh, 2004). Furthermore, as human population and per capita income increase, the demand for ruminant population must increase to satisfy the demand. Consequently, the amount of feed produced for them must also increase (Maimunah, 1998).

The annual ex-farm value of livestock industry for year 2014 in Malaysia was RM16,766.08 million (DVS, 2015), with the poultry and swine industries over the past few decades had achieved excellent success in many aspects of production including exporting its produce to neighboring countries. However, the demand of red meat and dairy products, were far higher than the local production (MOSTE, 2001). In fact, domestic production of ruminants has declined in recent years in spite of a small improvement in cattle and sheep population in the early 1990s and Malaysia is now only 28.84% self-sufficient in beef, 13.10% mutton and 12.93% in milk (DVS, 2014).

The consumption of animal protein is increasing steadily while vegetable protein intake is declining. On the other hand, since a few decades ago, the shortage of feed is one of the major problem that the ruminant industry is facing in Malaysia. In 2008, the country spend more than RM 2.14 billion (USD 621 million) in animal feeds importation (Ministry of Agriculture and Agro-Industry, Malaysia, 2009). Moreover, the price of imported feed ingredients often subjected to price instability. In addition, alternative feed formulations using locally available raw materials are poorly developed. It has been suggested that by developing forage resources for intensive ruminant production and growing the major feedstuffs or fully utilize agricultural waste, the importation bill of feedstuffs could be reduced.

There are many opportunities for improvement of pasture resources for intensive ruminant production and commercialization of the livestock industry in the near future.

These include commercial production of hay and chaff, livestock production based on undergrowth forages and integration of oil palm and agro-forestry to improve pastures. In Malaysia, 1.8 million and 2.8 million ha of land are cultivated with rubber and oil palm, respectively. With this vast expanse of land of rubber and oil palm plantation, under storey vegetation serves as a useful forage resource for the feeding of ruminant livestock. The feeding value of the ground vegetation has been reported as comparable to the improved grass cultivated locally, has good potential forage resources.

In addition, the use of rotational grazing system with single line electric fencing, a suitable stocking rate, and selective weeding of non-edible or noxious species, the vegetation under mature rubber and oil palm can be modified to increase the proportion of high quality, shade tolerant, graminae species such as koronivia grass *(Brachiaria humidicola).* The potential of the undergrowth forages in plantation areas as an economic forage resource has already been taken advantage by the Federal Land Development Authority (FELDA) for the commercial rearing of beef cattle. The cattle serve as biological lawn mowers and because of this, an integrated enterprise includes saving from reduced costs of weeding, both in terms of material and labour, as an added cost benefit.

There is evidence indicating that low intensities may adversely affect the nutritive value of forage species and most of this evidence comes from laboratory experiments. Low light intensity reduces the *in vitro* digestibility of grass said by several workers (Deinum 1984; Masuda 1977; Wilson and Wong 1982), an effect which may be pronounced in stem than leaf tissue (Deinum 1984; Masuda 1977) and is attributes by some workers to reduce digestibility of cell wall constituents (Wilson and Wong 1982;

Deinum 1984). Low light intensities may also be associates with higher ash (Deinum and Dirven 1972), crude fiber (Masuda 1977; Deinum 1984) and lignin contents as well as with lower total soluble carbohydrate in plant tissues (High *et al.* 1968; Wilson and Wong 1982).

It has also been shown that decreasing light intensities may affect the arrangements of plant leaf tissues such as mesophyll cell volume (Chabot and Chabot 1977), amount of vascular and support tissues, and cuticle thickness (Wilkinson and Beard 1975). Wilson said (1984) that the relative proportions of digestible mesophyll tissue and indigestible vascular tissue affect the digestibility of herbage.

Koronivia grass is common name for *Brachiaria humidicola* sp. and it is a tropical grass from East and South-East Africa and was introduced to Australia, the Pacific Island and South America. It is important pasture in humid tropics (Cook *et al.* 2005; Schultze-Kraft *et al.* 1992). *Brachiaria humidicola* sp. is a leafy, procumbent, creeping, stoloniferous perennial grass. Furthermore, *Brachiaria humidicola* sp. is tolerant of poor drainage and can withstand short term flooding in valley bottoms.

1.1 Significance of Study

It is clear that light intensities effect is the major thing to monitor because of the growth performance of plants depends on light intensities during photosynthesis process. Thomas (1988) said that the photosynthetic energy capture provides green plants with almost all of their chemical energy, and is central to their ability to compete and reproduce. The amount of lights striking plant's leaves is influenced directly and dramatically of photosynthesis.

Therefore, in such situations, this experiment is very important to study about the effects of light intensity on nutritive value and its growth response. Moreover, botanical composition of pasture grass is crucial in the context of integration farming system. Farmers are engaged in learning that involves them in management for animal performance and farm productivity as well.

1.2 Objectives

General objective:

1) To investigate the nutritive value and growth response of koronivia grass towards light intensity.

The specific objectives are:

i. To determine the dry matter production per hectare of koronivia grass towards different light intensity.

ii. To determine the nutritive value of koronivia grass towards different light intensity

iii. To determine the botanical composition and leaf-stem ratio of koronivia grass of every plot towards different light intensity.

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