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Research Paper

Effect of Biourine and Fungi *Mycorrhiza arbuscular* on Production and *In-vitro*Nutrient Digestibility of Kumpai grass (*Hymenachneamplexicaulis*(Rudge) *Nees)* planted at Ex-coal Mine Land as Animal feed.

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ABSTRACT
The aim of this study is to show the effect of biourine and fungi Mycorrhiza arbuskula (FMA) on production and in-vitro nutrient digestibilityof Kumpai grass (Hymenachneamplexicaulis (Rudge) Nees) planted at ex-coal mine land as animal feeds. The experimental design was completely randomized with 4 treatments and 5 replications per treatment. The treatment consists of: A, concentration of 0% Biourine + FMA 20 g/pot, B, 15% Biourine + FMA 20 g/pot, C, 30% Biourine+ FMA 20 g/pot and D, 45% Biourine + FMA 20 g/pot. Variables observed are grass production, dry matter and crude protein content, percentage of root infections by Mycorrhiza arbuscula, and in-vitro dry and organic matter digestibility. The results of the experiment indicated that the treatments had a very significant effect (P<0.01) on all observed parameters. Treatment D, 45% biourin + FMA 20 g/pot gave the best result, followed by the treatment C, 30% biourine + FMA 20 g/pot, and treatment B, 15% biourine + FMA 20 g/pot and the lowest value was in treatment A, 0% biourine + FMA 20 g/pot. From the results, it can be concluded that the treatment D, 45% biourine + FMA 20 g/pot was the best treatment;it produced the highest value for all observed variables.
KEYWORD: Biourin, Mycorrhiza, Kumpai grass, digestibility, ex-coal land.

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I. INTRODUCTION

Kumpai grass (Hymenachneamplexicaulis (Rudge) Ness), is a natural resource of high biological value in Indonesia especially in Jambi province. It has the potential to support the availability of adequate forage for ruminant feeds based on local resources [1]. Available land for forage planting usually decreased with time, because fertile land is mainly used for food crops, plantations and even non-agricultural needs [2. The ex-coal mine area in Jambi province is advancing further, due to the increased mining activities. Hundreds or even thousands of hectares of land have been rendered unproductive due to structural damage and degradation of soil nutrients. Therefore, use of land productively is very necessary. The utilization of biourin and *Mycorrhizae arbuscula* as an agent of biotechnology for increasing productivity of ex-coal mine land is a viable alternative that requires research. Therefore, this study aims to find the effect of utilization of biourin and *Mycorrhizae arbuscula* fungi on the production, *in-vitro* nutrient digestibility, and nutrient composition of kumpai grass (*Hymenachneamplexicaulis*(Rudge) *Nees)* planted in ex-coal mine land as animal feed.

II. MATERIALS AND METHODS

The study was conducted in Kotabaru city, District of Jambi for 5 (five) months. Forages were analyzed at the laboratory of Animal Nutrition, Faculty of Animal Husbandry University of Jambi, and in-vitro nutrient digestibility analyzed at Ruminant Nutrition Laboratory, Faculty of Animal Science, Andalas University.

Material and Equipment

The ex-coal mine land was used as a planting medium, 5 kg / pot each, kumpai grass, fungi of *Mycorrhiza arbuscular* of multiple spore types (***Glomus sp, Acaulosporasp and Scutellosporasp**,.),* and

biourine. The equipment used include tillage tools, lawn mowers, rule, sprinklers, plastic bags, scales, and apparatus for analyzing forage.

Research methods

The experiment applied a completely randomized design (CRD), with four treatments and five replications per treatment. Each treatment consists of: A, Concentration of 0% biourine+ FMA 20 g/pot, B, Concentration of 15% biourine+ FMA 20 g/pot, C, Concentration of 30% biourine+ FMA 20 g/pot, and D, Concentration of 45% biourine+ FMA 20 g/pot.

Observed variables

Variables observed include dry matter production and content, crude protein, *in-vitro* digestibility of both dry and organic matter and percentage of roots infections from *Mycorrhiza arbuscula* fungi.

Research Implementation

Before the kumpai grass (*Hymenachneamplexicaulis*(Rudge) *Nees)* were planted, the planting soil was placed into a composite medium of depth of 0-20 cm. Next, it was air-dried and cleaned, with unneeded materials such as plant roots removed. The use of *Mycorrhiza arbuscular* fungi as a treatment was based on results of [3] research, which used 20 g/pot. Biourin, used in the experiment was aerated for 6 hours and then fermented for 21 days. Two weeks before planting, a polybag was prepared and filled with soil at 5 kg/pot. *Mycorrhizae arbuscula* was then released into the grass within the pot, by inserting an inoculum into each planting hole, while Biourine was administered when the grasses reached two weeks old.

Data processing

Data was processed in a completely randomized design and analysis of variance (ANOVA) was used to determine the effect of treatment on the measured parameters. The ANOVA results and the Duncant's Test were used to observe for any significant effects.

III. RESULTS AND DISCUSSION

Dry Matter Production

The results of the experiment on dry matter production at first and second cutting of Kumpai grass (*Hymenachneamplexicaulis*(Rudge) *Nees)* plantedat ex-coal mine landare shown in Table 1.

Table1. Effect of application of Biourine and Fungi of *Mycorrhizae arbuscular* on dry matter production at first and second cutting of Kumpai grass (g/pot).

Treatments	Dry matter production	
	First cutting	Second cutting
A	50.60 d	56.60 d
B	65.10 c	70.25 c
C	72.40 b	75.60 b
D	78.10 a	82.34 a

The numbers in the same row followed by different letters are significantly different (P<0.05).

The Production of Kumpai grass at the first and second cutting periods with application of 45% biourine + FMA 20 g/pot (treatment D) showed the highest production (P <0.05), compared to the other treatments. The average dry matter production during the second cutting period went higher than the first (for all treatments). Treatment D (45% Biourine + FMA 20 g / pot) showed a better plant growth compared with the others, in both first and second cutting periods. This is because *Mycorrhizae arbuscula*requires an organic fertilizer for nutrition and energy. Also, oxygen consumption was increased, enabling the plants to absorb more mineral salts and hydrogen ions which can be exchanged. [4] stated that Fungi *Mycorrhiza arbuscula* increases the absorption of nutrients and water from the soil, thus enabling these plants to reproduce new cells and hormones to improve plant growth and soil aggregates. It also speeds up the process of mass flow. In the same climatic conditions, soil fertility exerts more influence on growth and development of plant cells [5]. [6] indicated that application of FMA and organic fertilizer (compost, cow dung, etc) in ultisol soil can increase production of grass dry matter.

***In-vitro* Dry Matter and Organic Matter digestibility.**

The average *in-vitro* digestibility of dry matter and of organic matter of *Kumpai grass (Hymenachneamplexicaulis* (Rudge) Ness) in this study are shown in Table 2.

Table2.Effect of application Biourine and FMA on *in-vitro* dry matter and organic matter digestibility of Kumpai grass (*Hymenachneamplexicaulis*(Rudge) *Nees).*

Treatment	***In-vitro* digestibility (%)**	
	Dry matter	**Organic matter**
A	50.43 c	48.43 c
B	51.54 c	49.15 c
C	54.58 b	51.14 b
D	57.13 a	55.24 a

The numbers in the same row followed by different letters are significantly different (P<0.05)

Increasing *in-vitro* dry and organic matter digestibility of *Kumpai grass (Hymenachneamplexicaulis* (Rudge) Ness) occur due to the ability of *Mycorrhizae arbuscula* to increase the absorption of nutrients and water from the soil. This results in increased plant growth and in turn, affects the digestibility of dry and organic matter. Dry matter contains organic matter, therefore if dry matter digestibility increases, the same occurs for that of organic matter. [7] states that *in-vitro* digestibility of dry matter is directly proportional to that of organic matter; Increased digestibility of dry matter indicates increased digestibility of organic matter. Another factor that helps to boost digestibility is the growth and development of soil microorganisms; this usually begins the process of nitrogen transformation. In the soil, nitrogen transformation effects the conversion of organic nitrogen into inorganic forms that are absorbable by plants [8].

Crude protein content.

The results of the analysis of variance showed that the treatment had a significant effect (P<0.01) on crude protein content of Kumpai grass *(Hymenachneamplexicaulis* (Rudge) Ness). The average forage protein content in the study is listed in Table 3.

Table 3. Effect of application of Biourine and Fungi of *Mycorrhizae arbuscular* on Crude Protein content of Kumpai grass (*Hymenachneamplexicaulis*(Rudge) *Nees).*

Treatment	Crude Protein (%)
A	12,10 c
B	13,65 b
C	15,20 a
D	15,35 a

The numbers in the same row followed by different letters are significantly different (P<0.01)

Increasing the addition of Biouring increases the crude protein content of Kumpai grass (*Hymenachneamplexicaulis*(Rudge) *Nees).*This is because the hypha from *Mycorrhiza arbuscula* associated with plant roots help in the absoprtion of water and nutrient from soil pores. *Mycorrhiza arbuskula* infects the root system by forming hyphae intensively to increase nutrient uptake, especially phosphorus mineral for carbohydrate metabolism. Also, it improves soil structure which enhances the development of plant roots, thus affecting the quality or crude protein of the Kumpai grass. Spores of *Mycorrhizae arbuskula* contain nitrate reductase, therefore its external hyphae contain a nitrate absorption capacity [9](Bago et al., 1996). External hyphae of the fungi can also increase the absorption of N, Ca and Mg from the soil [10], including that of micro minerals such as Zn, Cu, and B [11].

Kumpai Roots Infection by *Mycorrhizae arbuscula*.

Results of the analysis of variance showed that the treatments had an effect (P <0.01) on the percentage of root infection of Kumpai grass by *Mycorrhizae arbuscula as* shown. in Table 4.

Table 4. Effect of application of Biourine and Fungi *Mycorrhizae arbusculae* on roots infection of Kumpai grass (*Hymenachneamplexicaulis*(Rudge) *Nees).*

Treatment	Roots Infection (%)
A	20 c
B	32 b
C	47 a
D	50 a

The numbers in the same row followed by different letters are significantly different (P<0.05)

The increasing root infections of Kumpai grass *(Hymenachneamplexicaulis* (Rudge) Ness) at treatment D occurred due to increased administration of Biourin which enhanced the availability of carbohydrate and phosphorus in supporting the optimal root infection process. It was discovered that the roots structure contained vesicles, spores and hyphae which characterizes root infection by *mycorrhiza*. Fungi of *Mycorrhiza arbusculae* infect plant root systems by forming external hyphal braids, thereby increasing root capacity and rate of absorption from the soil [12]. *Mycorrhizae* roots, when bound with hyphae (knownas root hairs; rhizomorf) absorb available nutrients and water from the soil. However, hyphae are widely spread in the soil, which boosts and enhances absorption.

IV. CONCLUSION

The treatment of D (concentration of 45% biourine and FMA 20 g/pot) was successful, as it showed the highest dry matter production, and *in-vitro* dry and organic matter digestibility of kumpai grass (*Hymenachneamplexicaulis*(Rudge) *Nees)* compared to the others treatments.

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