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THE EFFECT OF LIQUID ORGANIC FERTILIZER APPLICATION ON THE GROWTH OF BIOGRASS *(Pennisetum purpureum cv. Biograss)*

Teuku Muhammad Farhan Azizi [1], Media Agus Kurniawan[1*]
[1] Department of Animal Science, Faculty of Science and Technology, Universitas Panca Budi, Medan
* Corresponding author : mediaagus@dosen.pancabudi.ac.id

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ABSTRACT

One of the superior varieties developed by the Agricultural Biotechnology and Genetic Resources Research and Development Center (BBPSI Biogen) is the Biograss Agrinak elephant grass. This grass was released as a superior forage crop variety in 2021 and has an impressive yield potential of 319 tons/hectare/year. This study aims to analyze the effect of liquid organic fertilizer application on the growth and productivity of Biograss elephant (Pennisetum purpureum cv. biograss) as livestock feed. The research method used a Completely Randomized Design (CRD) with a non-factorial arrangement consisting of 4 treatments and 5 replications. The parameters observed in this study included leaf width, leaf length, plant height, and fresh yield of biograss elephant. The results showed that treatment P3 resulted in the highest increases in leaf width (3.44 cm), leaf length (62.10 cm), plant height (90.19 cm), and fresh yield of biograss elephant (687.5 grams), with significant differences compared to other treatments. Application of liquid organic fertilizer at a dose of 15 ml per 1 liter of water gave the best results and has the potential to be applied on a larger scale

Introduction

Feed plays a crucial role in livestock farming, especially for ruminants. Good-quality feed contains a balanced ratio of nutrients, including carbohydrates, fats, proteins, vitamins, water, and minerals (Plumstead et al., 2003). High-quality feed supports the government's livestock population improvement programs. There is a direct correlation between the quality of feed and the potential for increasing ruminant livestock populations. In addition, providing feed in sufficient quantity and on a continuous basis significantly contributes to the success of livestock productivity improvement.

One of the superior forage varieties developed by the Agricultural Instrument Standard Testing and Biotechnology and Genetic Resources Research Center (BBPSI Biogen) is *Biograss Agrinak elephant grass*. This grass was officially released as a superior forage crop variety in 2021 under the Decree of the Minister of Agriculture of the Republic of Indonesia

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No. 11726/KPTS/PK.120/F/08/2021. *Biograss* possesses several advantages, including a high yield potential of 319 tons/hectare/year. Moreover, it is highly beneficial for livestock health due to its nutrient content—76% moisture, 14% protein, and 25% crude fiber. *Biograss* also demonstrates strong drought tolerance, making it a reliable forage option even during dry seasons. Field trials and feedback from farmers who have adopted this variety show that *Biograss* can grow over two meters tall (BBPSI Biogen, 2023).

The growth and productivity of *Biograss elephant* can be optimized through fertilizer application. However, inorganic or chemical fertilizers have environmental drawbacks, such as degrading soil fertility over long-term use. Therefore, liquid organic fertilizer (LOF) is more highly recommended. LOF is defined as the extract obtained from the decomposition of organic materials such as plant residues, animal waste, and human waste, making it rich in nutrients (Ardiyanto et al., 2018).

The extraction process aims to draw out all nutrients from organic waste and absorb various microorganisms—such as bacteria, fungi, protozoa, and nematodes—which are essential for rumen digestion (Dwisvimiar et al., 2023). Based on this background, research on the effects of liquid organic fertilizer on the growth and productivity of *Biograss elephant* (*Pennisetum purpureum* cv. *biograss*) as livestock feed is necessary to support the increased productivity of ruminant populations in general.

Materials and Methods

This research was conducted from February to April 2025 in Kumbang Indah Village, Southeast Aceh, Aceh Province. The materials used in this study included *Biograss* cuttings (*Pennisetum purpureum* cv. *Biograss*) and liquid organic fertilizer (LOF) made from fermented cow manure at concentration levels of 5 ml, 10 ml, and 15 ml. The tools used included hoes, sickles, ropes, scales, wheelbarrows, measuring tapes, shovels, watering cans, and writing instruments.

The research method employed a Completely Randomized Design (CRD) with a non-factorial arrangement, consisting of 4 treatments and 5 replications. The treatments were as follows:

- ✓ P0 = No LOF application
- ✓ P1 = LOF application at 5 ml per 1 liter of water
- ✓ P2 = LOF application at 10 ml per 1 liter of water
- ✓ P3 = LOF application at 15 ml per 1 liter of water

The data will be analyzed using ANOVA and further tested according to the BNT test with a correction factor of 5%.

Land Preparation

The land used for the experiment was cleared of debris and weeds and prepared for planting *Biograss* (*Pennisetum purpureum* cv. *Biograss*). The process began with weeding and cleaning using tools such as hoes and sickles.

Planting Medium Preparation

The soil used was taken from an area near a cornfield, assumed to be highly fertile and loose, making it suitable for planting.

LOF Preparation

The liquid organic fertilizer was prepared using 5 kg of vegetable/fruit waste, 1 liter of water, 500 ml of molasses, 5 liters of rice-washing water, and 1 liter of EM-4 as a

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microorganism source. The organic waste was finely chopped and ground into a pulp, then placed in a jerry can. Molasses, rice-washing water, EM-4, and water were added, and the mixture was stirred until homogeneous. The jerry can was then sealed and fermented for 3 weeks.

Planting Process

Before planting, the soil was loosened. The *Biograss* seedlings used had four nodes—two of which were planted below the soil surface, while the remaining two stayed above ground at an angle of about 30 degrees. The total plot size was 800 x 750 cm. Each plot was planted with four evenly spaced seedlings on a 100 cm^2 area, with 50 cm spacing between plants and 50 cm between plots.

Fertilization

LOF was applied weekly in 200 ml doses for each treatment over six weeks (until harvest time).

Maintenance

Watering was done as needed when the soil began to dry but care was taken not to overwater to prevent seedling root. Weed control was carried out manually and regularly during the growing period by carefully pulling out weeds by hand to avoid damaging the grass roots.

Research Parameters

- ✓ **Leaf Length (cm):** Measured from the base to the tip of the leaf using a measuring tape.
- ✓ **Leaf Width (cm):** Measured across the center of the leaf from right to left.
- ✓ **Plant Height (cm):** Measured from the soil surface to the tip of the tallest leaf using a measuring tape.
- ✓ **Fresh Production (g):** Measured by cutting and weighing all grass within the plot after the plants were ready for harvest.

Data Analysis

The data obtained were analyzed using a Completely Randomized Design (CRD) non-factorial model as follows:

$$Yij=\mu+\tau i+\varepsilon ij$$

Yij = Observation value on the i-th treatment and j-th replication

μ = General mean

τi = Effect of the i-th treatment

εij = Experimental error

This design is commonly used in a factorial environment, so grouping of experimental units is necessary to ensure a homogeneous setting. The main goal of grouping is to minimize variation among the experimental units (Hasdar et al., 2021).

Results and Discussion

Effect of LOF Application on the Growth of Biograss (*Pennisetum purpureum cv. Biograss*)

The results of the study on the effect of liquid organic fertilizer (LOF) application on the growth and productivity of biograss elephant grass (*Pennisetum purpureum cv. Biograss*) are presented in Table 1.

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Table 1. Effect of LOF Application on the Growth (*Pennisetum purpureum cv. Biograss)*

No	Treatment	Average Growth and Productivity			
		Leaf width (cm)	Leaf length (cm)	Plant height (cm)	Fresh production (g)
1	P0	3,04[a]	56,38[a]	82,88[a]	531,25[b]
2	P1	3,35[b]	56,60[a]	83,04[a]	505[a]
3	P2	3,36[b]	60,21[b]	87,20[b]	543,75[b]
4	P3	3,44[c]	62,10[c]	90,19[c]	687,5[c]

a,ab,b Different superscripts in the same column indicate a significant difference (P<0.05).

Based on Table 1, the highest increase in leaf width was observed in P3 with 3.44 cm, which was significantly different from all treatments, while P1 and P2 showed no significant difference with leaf width increases of 3.35 cm and 3.36 cm, respectively. The highest increase in leaf length was found in P3 with 62.10 cm, showing a significant difference with all treatments, while P0 and P1 had no significant difference in leaf length increases of 56.38 cm and 56.60 cm, respectively. The highest increase in plant height was observed in P3 with 90.19 cm, significantly different from all treatments, while P0 and P1 showed no significant difference with plant height increases of 82.88 cm and 83.04 cm, respectively. The highest fresh yield of biograss elephant was found in P3 with 687.5 g, significantly different from all treatments, while P0 and P2 had no significant difference in fresh yield, with values of 531.25 g and 543.75 g, respectively.

Leaf Width

The increase in leaf width at a concentration of 15 ml/1 liter of water (P3) had the most optimal effect, which was 3.44 cm. The rapid leaf growth is due to the fermentation of organic materials found in vegetable and fruit waste, which contain various elements beneficial for plant growth and development, such as Nitrogen, Phosphorus, and Potassium. The Potassium (K) in the fertilizer plays a role in enhancing the absorption of nutrients or hormones, which in turn regulates stomatal activity and accelerates leaf development (Arianti et al., 2018). Another study by Damayanti et al. (2023) added POC at a concentration of 10 ml and showed a significant correlation between treatments, enhancing leaf growth. Additionally, the increase in leaf width in a plant can be influenced by the availability of sufficient nitrogen (Sarido and Junia, 2017).

Nitrogen plays a role in enhancing leaf growth and strengthening the green color of leaves, indicating a high chlorophyll content. Moreover, nitrogen can also increase the protein content in plants, which impacts the improvement of leaf quality, both in terms of quantity and characteristics (Lasamadi et al., 2013). Light availability also influences leaf width development. Biograss elephant is closely related to odot grass, and this plant is capable of optimal growth under full sunlight, showing good productivity even in limited light conditions. Other factors such as planting distance can also affect leaf growth in the Pennisetum genus, with a range of 2.7 to 3.9 cm (Sirait et al., 2015).

The presence of amylase enzymes in multifunctional fertilizers significantly boosts leaf growth, which in turn supports overall plant growth. This enzyme works

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by accelerating the activity of gibberellin hormones, allowing gibberellin's role as a growth regulator in biograss elephant to function optimally (Damayanti et al., 2023). Furthermore, gibberellin enzymes also contribute to stimulating the growth and development of plant leaf organs (Das et al., 2014).

Leaf Length

The application of fertilizer based on vegetable/fruit waste at a concentration of 15 ml/1 liter of water (P3) had the most optimal effect on leaf length, which was 62.10 cm. This can occur because of nutrients like Potassium (K) that stimulate plant vegetative growth and regulate stomatal function, making photosynthesis more efficient and promoting leaf growth (Mahdiannoor et al., 2016). High plant growth is heavily influenced by the availability of nutrients in the soil, especially nitrogen and organic matter, which directly affect plant physiological processes. These elements can accelerate respiration and stimulate plant growth. The increase in leaf length also impacts the expansion of leaf area and the number of stomata, supporting efficient photosynthesis and ultimately boosting overall plant growth (Aryanto and Polakitan, 2009).

One external factor influencing leaf length is light intensity. The size of the leaf length and width is greatly affected by shading, as plants rely heavily on light. Leaves growing in areas with abundant light (without shade) tend to have larger lengths and widths (Karyati et al., 2017).

Plant Height

The application of POC based on vegetable and fruit waste at a concentration of 15 ml in 1 liter of water (P3) had the most optimal effect with 90.19 cm. Several previous studies have stated that faster plant height growth is influenced by the nitrogen (N) content in POC or multifunctional fertilizers. This fertilizer plays a role in increasing nutrient levels, especially nitrogen derived from organic waste fermentation, which has a positive impact on the growth of biograss elephant and can also potentially occur in biograss elephant (Larasati et al., 2020). Moreover, nitrogen also functions to optimize the photosynthesis process and accelerate the increase in plant height of biograss elephant (Ginting et al., 2021). Nitrogen can also transform into nitrate, which plays a crucial role in enhancing plant height. The nitrate content in multifunctional fertilizers contributes to the synthesis of proteins needed to support plant growth (Sembiring et al., 2021). This indicates that optimal nitrate content can increase protein production, which has a positive effect on plant height growth, including leaf growth in the Pennisetum genus.

The application of POC with a dose of 5 ml proved to have a significant impact on increasing plant height, making its growth more optimal. These findings are in line with the results of the study by Lingga & Marsono (2005), which emphasized that the correct fertilizer dosage is a crucial factor in supporting plant growth, particularly in terms of height increase. Meanwhile, research by Mappanganro et al. (2018) showed that grass plants are quite responsive to the application of liquid fertilizer, where doses between 100 ml and 200 ml effectively promote plant height growth.

Another factor that can affect grass height growth is the planting distance between individuals. Ainun et al. (2021) stated that grass planted with a distance of 50 x 75 cm gives optimal results, reaching a height of 45.94 cm.

Fresh Production

The highest fresh production of elephant grass was found in treatment P3

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with 687.5 g, which was significantly different from each treatment. This could be due to the nitrogen content in POC, which plays a role in increasing the chlorophyll content in leaves, accelerating the photosynthesis rate, and supporting optimal plant growth, thus increasing the fresh weight of biograss elephant (Adil et al., 2005). Moreover, other factors that influence the increase in fresh production, such as the increase in plant height and leaf width, as well as plant height, also contribute to more optimal results. The fresh weight of plants produced has a direct correlation with plant height and leaf area. Gardner et al. (1991) also mentioned that the application of nitrogen fertilizer significantly impacts leaf area, which in turn affects the fresh weight and total dry weight of the plant.

Conclusion

The addition of POC based on vegetable and fruit waste at a concentration of 15 ml in 1 liter of water provided optimal results in terms of leaf width, leaf length, plant height, and fresh production of biograss elephant (Pennisetum purpureum cv. Biograss). The results of this study have the potential to be applied on a larger scale with higher production and minimal production costs.

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