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Dry Matter Digestibility, Organic Matter and Digestibility in Vitro of Setaria Grass at Types and Different Dosage of Fertilizers

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Abstract

A study was conducted to determine the digestibility of dry matter, organic matter, and digestibility of the Setaria grass invitro at different types and dosages of fertilizers. This research was conducted in the experimental garden of the Faculty of Agriculture, Warmadewa University, which is located at Jalan Terompong Number 24 Tanjung Bungkak Denpasar Bali from May 29, 2020, to July 18, 2020. The analysis of dry matter and organic matter digestibility and in vitro digestibility was carried out at the Animal Nutrition and Forage Laboratory, Faculty of Animal Husbandry, Udayana University from July to August 2020. This study used a randomized block design (RAK) with a 2 x 4 factorial pattern. Factor A was 2 types of manure, and factor B had 4 levels of fertilizer. Factor A, namely: S = manure from cow, K = manure from goat. The dosages used are: D0 = without fertilizer (0 ton/ha), D1 = 10 ton/ha, D2 = 20 ton/ha, and D3 = 30 ton/ha. The variables observed were: dry matter digestibility, organic matter digestibility, and in vitro digestibility of Setaria grass grown at different types and doses of manure. From the results of research and statistical analysis, it was found that there was no interaction between the type and dose of fertilizer for all observed variables. Type of Fertilizer and Fertilizer Dosage partially (single) gave a very significant difference (P <0.01) on the digestibility of dry matter, organic matter, and In Vitro Digestibility of Setaria grass.

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Contents

1 Introduction

Forage is the main food that contains almost all the food substances needed by ruminants both for survival, growth, production, and reproduction. Factors that need to be considered in efforts to increase the production and quality of forage include the availability of nutrients needed by plants in the soil. For this reason, fertilization efforts are needed, especially since the land used for planting forage is generally non-productive land or lack nutrients, while productive land tends to be used for food crops. Seeing conditions like this, it is necessary to increase soil fertility both physically, chemically, and biologically, among others by using organic fertilizers. The availability of complete and balanced nutrients that can be absorbed by plants is a factor that determines plant growth and production (Nyanjang et al., 2003).

Organic fertilizer is the fertilizer that partly or entirely consists of organic material derived from plants or animals, can be in the form of solid or liquid which is used to supply organic material to improve the physical, chemical, and biological properties of soil (Rosmarkam & Yuwono, 2002). Furthermore, he said that sources of organic fertilizer can be compost, green manure, manure, crop residues, livestock waste, industrial waste that uses agricultural materials, and urban waste (Ladd et al., 1994).

Manure has an economic advantage because it is easy to obtain and cheap. Most farmers who raise livestock will have manure available. Manure contains not too high a nutrient content, but this type of fertilizer has other features, namely that it can improve soil physical properties such as: soil permeability, soil porosity, soil structure, water retention, and cations. Each tonne of manure contains 5 kg N, 3 kg P_2O_5, and 5 kg K_2O and other essential nutrients in relatively small amounts (Mansyur et al., 2005).

To get the right dose of fertilization with manure, it is necessary to conduct a study on the use of manure doses to produce optimum production. Another factor that is influenced by fertilization besides production is the nutritional quality of the plant. This quality will involve the nutritional content and digestibility of the livestock for the feed ingredients. Usually, if the nutritional content is good, it will be followed by good digestibility and digestibility (Muir et al., 2005).

2 Materials and Methods

Field research was carried out at the Experimental Station of Agriculture Faculty, Warmadewa University from 29th May 2020 to 18th July 2020. Analysis of Dry Matter Digestibility and Organic Ingredients Analysis of KCBK and KCBO in vitro was carried out at the Animal Nutrition and Forage Laboratory, Faculty of Animal Husbandry, Udayana University from July until August 2020. This research was conducted using a 2 x 4 factorial randomized block design (RAK). Two types of factor A (fertilizer type) and 4 levels of factor B (dose). The types of fertilizers used are: S = manure from cow dung, K = manure from goat manure. The dosages used are: D0 = without fertilizer, D1 = 10 ton/ha, D2 = 20 ton/ha, D3 = 30 ton/ha

Before planting, first, select grass seeds of the same size on each block. Seedlings are planted in the prepared plots with a depth of one segment in the soil. The plots used are 1 m x 1 m in size. After the grass is planted, it is thoroughly watered. The overall dosage of fertilizers was 6 tons/ha, to obtain fertilizer following the respective treatments: 0, 10, 20, 30 kg/plot. Plant maintenance is carried out from the time the grass seeds are planted until the grass plants are harvested. Plant maintenance includes: watering and weeding the plants

After the plants were cut, ± 300 g were taken as samples to find DW/fresh base, DM / fresh base, DM / DW, moisture content, and physical quality. Furthermore, it was dried in the sun after that the sample was put in an envelope that had been prepared and the oven at a temperature of 70^0 c until it reached a constant weight (Tillman et al., 1998). The dried sample was then ground using a blender and then sieved with a sieve. Samples that have been milled and sieved are then put into a plastic bag for nutritional quality analysis purposes. The variables observed in the study are as follows:

1) Dry matter digestibility is food substances from feed consumption in the form of dry matter which is not excreted into feces, measured by the method (Tilley & Terry, 1963) with the following calculations:
   KCBK = (initial BK - (final BK-blank)) x 100
   Initial BK
2) Organic matter digestibility is food substances from feed consumption in the form of organic material which is not excreted into feces, measured by the method (Tilley & Terry, 1963) with the following calculations:
   KCBO = (initial BO - (final BO - blank BO)) x 100%
   Early BO
3) In vitro digestibility: the amount or percentage of food substances contained in food ingredients, after being digested is not wasted into waste using artificial digestion techniques.

The data obtained from the results of this study were analyzed using an analysis of variance, if there were significantly different results (P <0.05) between treatments then it was continued with Duncan's Least Real Distance Test (Steel & Torrie, 1995).

3 Results and Discussions

Feed ingredients contain nutrients consisting of water and dry matter. Dry matter consists of organic and inorganic materials. Livestock requires organic materials and inorganic materials but more organic materials are needed (Tillman et al., 1989). Dry matter digestibility is one of the most important indicators of feed quality. The high dry matter digestibility value indicates the high amount of food substances that can be utilized by livestock through rumen microbes (Aganga & Mosase, 2001).

In this study, the results showed that the dose and type of fertilization had a highly significant effect (P <0.01) on the dry matter digestibility of Setaria grass. The average dry matter digestibility of the treatment ranged from 64.14 to 73.83%. The highest dry matter digestibility was obtained in Setaria grass given a fertilizer dose of 30 ton/ha (D3), where these results were significantly different (P <0.05) compared to D2, D1, and D0 (Table 1). Furthermore, the Setaria grass which was given cow manure had significantly higher dry matter digestibility compared to that which was given goat manure (Table 2). The dry matter digestibility was significantly increased with increasing doses and types of fertilization (McLeod & Minson, 1978). This situation shows that the higher the fertilizer dose, the higher the dry matter digestibility of Setaria grass. This shows that fertilization can help increase crop production which in turn will also have an impact on the digestibility of dry matter (Kapoor et al., 2004). As stated by Purbajanti et al. (2007), fertilization can give a higher fresh weight production of a plant because fertilization means adding food substances to plants that are useful for plant growth itself. The availability of high nutrient content (N, P, K) in the soil will affect the dry matter content and digestibility this is due to the ability of the roots to absorb mineral nutrients from the soil.

Table 1
Average digestibility of setaria grass given different doses of fertilizer

No.	Variable	Fertilizer Dose			
		D0	D1	D2	D3
1	Dry Matter Digestibility (%)	64,14^{c}	67,08^{bc}	70,07^{ab}	73,83^{a}
2	Organic Matter Digestibility (%)	64,84^{c}	68,04^{bc}	70,23^{b}	74,61^{a}
3	In Vitro Digestibility (%)	64,49^{c}	67,56^{b}	70,15^{b}	74,22^{a}

Note: Different letters after numbers on the same row indicate a highly significant difference (P <0.01)

Table 2
Average digestibility of setaria grass given different types of fertilizer

No.	Variable	Type of Fertilizer	
		Cow (S)	Goat (K)
1	Dry Matter Digestibility (%)	70,32[b]	67,23[a]
2	Organic Matter Digestibility (%)	71,09[b]	67,77[a]
3	In Vitro Digestibility (%)	70,71[b]	67,50[a]

Note: Different letters after numbers on the same row indicate a highly significant difference (P <0.01)

The digestibility of dry matter of Setaria grass treated with cow manure was higher than that of dry matter of Setaria grass treated with goat manure (Hassen et al., 2007). This occurs because the content of the elements N, P, and K in the soil is higher. These elements play an important role in plant growth, especially to increase forage production (Wang et al., 2008). The higher availability of nutrients in the soil in Setaria grass which is given cow manure is suspected to be influenced by the rate of fertilizer decomposition, where cow manure decomposes faster than goat manure. This is confirmed by the opinion Marpaung et al. (2018), that more dense manure, decomposes the elements more slowly, so it is also absorbed by plants more slowly. A good/fast decomposition rate will be able to provide nutrients in the soil (N, P, K, and other nutrients) and better soil structure improvement. Thus the plant roots will develop well and the roots can absorb more nutrients, especially the N nutrient which will increase the formation of chlorophyll for plant photosynthetic activity. Furthermore, Prasetya (2014), stated that the advantages of cow manure are that it can change the soil structure for the better for root development, increase the holding power and absorption of soil to water, improve the life of organisms in the soil and add nutrients in the soil. Sulaiman et al. (2018), stated that giving complete nutrients to plants affects the productivity and growth of a plant. Soil fertility can determine plant production capacity because soil fertility has an important role in determining the level of plant productivity including digestibility (Sulaiman et al., 2018).

Sutardi (1980), stated that dry matter digestibility is influenced by the protein content of the feed because each protein source has different solubility and degradation resistance. High dry matter digestibility indicates high levels of nutrients that are digested, especially those digested by rumen microbes. The higher the dry matter digestibility value, the better the quality. Factors that affect the digestibility of dry matter include the amount of ration consumed, the rate at which food travels in the digestive tract, and the type of nutritional content contained in the ration/forage (Tonga et al., 2017).

The digestibility of organic matter in the digestive tract of livestock includes the digestibility of food substances in the form of organic material components such as carbohydrates, proteins, fats, and vitamins. Organic materials contained in the feed are also available in an insoluble form, therefore it is necessary to have a process of breaking these substances into soluble substances (Barber et al., 1990; Noblet & Jaguelin-Peyraud, 2007). The digestibility of organic matter is closely related to the digestibility of dry matter because most of the dry matter is organic matter (Ismail, 2011). Organic material consists of crude protein, crude fat, crude fiber, and BETN. A decrease in the digestibility of dry matter will cause a decrease in the digestibility of organic matter or vice versa. The average digestibility of organic matter in Setaria grass with different doses and types of fertilization ranged from 64.84% - 74.61% which statistically showed a very significant effect (P <0.05). Setaria grass-fed with cow manure and a fertilizer dose of 30 tons/ ha produced the highest digestibility of organic matter. This happens because of the relatively better availability of food substances. According to [6] the digestibility of organic matter is related to the chemical composition of the forage, namely N, Ash, Ether Extract, Cell Wall, ADF, ADL, and Silica where the increase in cell wall presentation, ADL, silica, and EE will reduce the digestibility of organic matter.

The higher digestibility of organic matter in Setaria grass which was treated with a dose of 30 ton/ha and cow manure was thought to be due to different fertilizers so that the fertility rate was different which affected the value of minerals in the plant, besides the speed of the fertilizer in supplying nutrients to the soil as well. make an impact. According to Zhao et al. (2009), the ash content in mineral content is influenced by soil conditions, fertilization, and irrigation. Mineral or ash content is strongly influenced by groundwater

conditions where water adequacy will reduce dissolved carbohydrates and increase mineral concentration, on the other hand, in dry conditions, dissolved carbohydrate content increases and mineral concentrations decrease. Bogale & Tesfaye (2011), stated that the ash content is significantly related to climatic conditions, as is the effect of water deficits. Heavy water stress significantly reduces ash content in the vegetative phase.

4 Conclusion

From the research results, it can be concluded that there is no interaction between the type and dose of fertilizer for all observed variables. Type of Fertilizer and Fertilizer Dosage partially (single) had a highly significant effect (P <0.01) on the digestibility of dry matter, organic matter, and In Vitro Digestibility of Setaria grass.

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