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Dry Solid Sludge Residual Effect on Quality of Kate's Elephant Grass *(Pannisetum purpureum cv.mott)* on the Secound Cutting

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Abstract **Original Research Article**

The purpose of this study was to determine the effect of dry solid sludge residue on the quality of kate elephant grass (Pennisetum purpureum cv. Mott) in the second cutting. The design used was RAL (Completely Randomized Design) which consisted of 5 treatments and 5 replications, namely residual effect without dry solid Sludge on P1 (control), residual effect P2 (180 g dry solid Sludge), residual effect P3 (360 g dry solid Sludge), residual effect P4 (450 g Dry Solid Sludge), and residual effect P5 (720 g Dry Solid Sludge). Analysis of variance showed that the residual effect of dry solid sludge had a very significant effect (P<0.01) on the increase in the content of dry matter, organic matter, crude protein and the decrease in crude fiber of elephant grass kate in the second cutting. The results of this study can be concluded that the residual effect of dry solid sludge can increase the content of dry matter, organic matter, crude protein and decrease crude fiber of elephant grass kate in the second cutting. There is an increase in dry matter content ranging from 0.46% - 1.74%, organic matter 0.63% - 4.21%, crude protein 1.11% - 20, 55% and a decrease in crude fiber 8.11% - 0 ,94% kate elephant grass (Pennisetum purpureum cv. Mott).

Keywords: Grass, Elephant Kate, Sludge, Bio-Slurry, Biogas, Quality.

INTRODUCTION

Success in livestock business, especially ruminants is very dependent on the availability of forage feed, both quantity and quality. Forage is the main source of food that is needed for ruminants in order to survive, breed and produce well.

Forage is currently not guaranteed availability at any time. However, efforts are being made to fulfill this need, it is necessary to develop a type of grass that has high production and good quality. One of the superior types of forage that can be used as animal feed is the Kate Elephant Grass (Pennisetum purpureum cv. Mott).

Kate Elephant Grass (Pennisetum purpureum cv. Mott) is a superior type of grass that has high productivity and nutrient content and has high palatability (Sirait, 2015). According to Suarna (2003), several advantages of the Kate Elephant Grass species include a protein content of 10-15% depending on the age of harvest, high production annual plants and tropical grass plants suitable for grazing and cut and carry systems.

Efforts to increase the production and quality of forage plants can be achieved by means of fertilization, both using organic fertilizers and inorganic fertilizers. Organic fertilizers are fertilizers that partially or wholly consist of organic materials derived from plants or animals (Suriadikarta and Simanungkalit, 2006). One source of organic fertilizer that can be used is Bio-slurry fertilizer.

Bio-slurry fertilizer is an organic fertilizer sourced from livestock manure and water that has been fermented by microorganisms in a closed room containing various nutrients to support plant growth and production. The nutrient content includes Nitrogen, Phosphorus, Potassium, Magnesium, Sulfur, Iron, Manganese, Copper, and Zinc. Bio-slurry fertilizer contains micro-organisms to accelerate the decomposition process of organic matter in the soil, so that nutrients can be more quickly available and can be utilized by plants (BIRU Team, 2012).

The application of organic fertilizers can also increase and maintain land productivity because organic fertilizers have a residual effect where the nutrients

remain available to plants gradually. It is also in accordance with the opinion of Hakim *et al*., (1986) that this organic fertilizer has a residual effect where the nutrients gradually become free and available to plants, even in general the residual effect still affects 3 to 4 years after application.

The results of Sanjaya's research (2019), giving dry Sludge of biogas waste at a dose of 720 grams/polybag gave the best results on the quality of dry matter, organic matter and crude protein of Kate Elephant Grass (Pennisetum purpureum cv. Mott) in the first cutting. The results of Setyaningrum's research (2018), the use of manure at a dose of 45 tons / ha of land plots from cow, sheep and chicken manure can improve nutritional quality in terms of crude fat content, crude protein content and crude fiber content of Elephant Grass (Pennisteum purpureum) in the second defoliation.

West Sumatra BPTP Laboratory Analysis (2018) the content of solid Bio-Slurry of biogas waste is N (0.94%), P (1.76%), K (0.70%). Based on the above background, the authors are interested in conducting a second study following the research of Sanjaya (2019) with the title "Effect of Dry Solid Sludge Residual on the Quality of Kate's Elephant Grass (Pennisetum purpureum cv. Mott) in the Second Cutting".

RESEARCH MATERIALS AND METHODS

Research Material

The materials used in this study were: 25 polybags of Kate's Elephant Grass (Pennisetum purpureum cv.Mott) in the first cutting, and the tools used were: a dipper, gembor, camera, technical scales, and a set of laboratory equipment for proximate analysis.

Research Methods

Research Design

This study used an experimental method using a completely randomized design (CRD) with 5 treatments and 5 replications applied as follows:

P1 = Residual effect without dry solid Sludge/polybag, (control)
P2 = Residual effect of dry solid Sludge 500 grams/m2 (5 tons/ha) = 180 grams/polybag.
P3 = Residual effect of dry solid Sludge 1000 grams/m2 (10 tons/ha) = 360 grams/polybag.
P4 = Residual effect of dry solid sludge 1500 grams/m2 (15 tons/ha) = 540 grams/polybag.
P5 = Residual effect of dry solid sludge 2000 grams/m2 (20 tons/ha) = 720 grams/polybag.

Research Implementation

Plant Maintenance

1. Sprinkling: Watering the plants is carried out 2 times a day, namely in the morning between 07.00 - 08.00 WIB and in the afternoon between 17.00 - 17.30 WIB with a dose of 1 liter of water or according to plant needs per polybag, except when it rains no watering is carried out.
2. Weeding: Weeding is done by pulling weeds that grow around the plant, so that plant growth is not disturbed.
3. Soil Loosening: Soil loosening is done so that the soil is not too dense and facilitates the absorption of water in polybags.

Measured Variables

The variables measured in this study are: 1. Kate Elephant Grass Dry Ingredients., 2. Kate's Elephant Grass Organic Ingredients. 3. Kate Elephant Grass Crude Protein Content. 4. Kate Elephant Grass Crude Fiber Content.

RESULTS AND DISCUSSION

A. Kate Elephant Grass Dry Ingredients

Based on the results of the following research, it can be seen that the average dry matter content of Gajah Kate grass (Pennisetum purpurium cv. Mott) from the residual effect of dry solid sludge is presented in Table 1 below:

Table 1: Average content of dry matter, organic matter, crude protein, and crude fiber of Kate's elephant grass from the residual effect of dry solid sludge

Treatment	Average Content (%)			
	Dry matter	Organic matter	Crude Protein	Crude Fiber
P1 (Kontrol)	21,41^{d}	81,89^{e}	8,89^{e}	26,36^{a}
P2 (180g/polybag)	21,51^{d}	82,41^{d}	8,99^{d}	25,12^{b}
P3 (360g/polybag)	21,63^{bc}	83,50^{c}	9,79^{c}	24,58^{c}
P4 (540g/polybag	21,69^{ab}	84,00^{b}	10,06^{b}	24,45^{d}
P5 (720g/polybag)	21,79^{a}	85,49^{a}	11,19^{a}	24,22^{e}

Note: Different superscripts in the same column show very significant different effects (P<0.01)

Analysis of variance showed that the residual dry solid sludge had a very significant effect (P<0.01) on the dry matter content of Gajah Kate grass. In general, it can be seen that there is an increase in the dry matter content with the increasing application of dry solid Sludge at the first cutting, thereby increasing the remaining dry solid Sludge in each treatment that acts as a fertilizer. Dry solid sludge contains nutrients,

especially N (0.94%), P (1.76%), K (0.70%) West Sumatra AIAT (2018), which are still remaining and are easily absorbed by plants for vegetative growth, especially stems and leaves so that they can stimulate growth shoots and tillers. According to the Blue Team (2013), Bio-Slurry contains nutrients, especially nitrogen, which is better than manure/compost or fresh manure and the nitrogen in Bio-Slurry is more and is easily absorbed. Nursyamsu and Saladin, (1978) said that if fertilization was carried out with sufficient N, the dry matter production and protein content would increase.

The higher the residual dry solid sludge, the higher the availability of nutrients in the treatment, up to the absorbable (balanced) limit, the dry matter content will increase. This is in accordance with the opinion of Tisdale and Nelson (1971) which states that increasing nitrogen content allows lower water content of plants which results in higher dry matter content of grass plants. Added by Klock *et al*., (1975) that increasing the provision of element N to a certain extent can improve the quality of dry matter and crude protein.

The remaining dry solid sludge contained in P2, P3, P4 and P5, still contains nutrients that can provide a good response to increasing the dry matter quality of elephant grass kate. International Training Workshop in 2010, at Yunnan Normal University which stated that bio-slurry contains amino acids, micronutrients, B vitamins, various hydrolase enzymes, organic acids, plant hormones, antibiotics and humic acids. At P5 the remaining dry solid Sludge is most likely more than P2, P3 and P4, because the application of dry solid Sludge in the first cutting treatment is greater so that the nutrient content of N is also available which is higher which can be absorbed by the grass to grow and produce, resulting in retain the dry matter content. Nurhayati, (1984) that the effect of nitrogen on plant growth and nutrient content is clear and fast.

The results of the DMRT test showed that the dry matter content in P5 had a significantly higher effect ($P<0.01$) with P3, P2, P1 and significantly different ($P<0.05$) with P4. The dry matter content of Gajah Kate grass in the second cutting of each treatment was in line with the dry matter content of the first cutting. It can be assumed that the remaining dry solid sludge for each treatment is directly proportional to the amount of dry solid sludge given at the first cutting. It can be seen that the dry matter content in the first cutting is directly proportional to the dry matter content in the second cutting for each treatment. The more amount of dry solid Sludge given in the first cutting, the higher the dry matter content of the kate elephant grass as well as the remaining dry solid Sludge for the second cutting will be able to expand the root system, so that growth and production increase and eventually will increase the dry matter content in the second cutting. Haryati (2006) that Sludge from Bio-Slurry solid biogas waste is an organic fertilizer which is very rich in elements needed by plants such as N, P and K.

There was an increase in dry matter content of Gajah Kate grass in the second cutting at P5 = 1.74%, P4 = 1.29%, P3 = 1.01% and P2 = 0.46% compared to P1 (control). This is due to the remaining solid dry Sludge which can still provide nutrients for the growth of the Kate Elephant grass plant. The results of the average dry matter content of Gajah Kate grass (Pennisetum purpureum cv. Moot) in the first cutting obtained P1 = 20.84%, P2 = 21.40%, P3 = 21.86%, P4 = 22.08%, and P5 = 22.65%.

The dry matter content of Gajah Kate grass (Pennisetum purpureum cv. Moot) as a result of this study was 21.79%, higher than Sirait's (2014) opinion of 13.94%, but lower than the results of Sanjaya's (2019) study which was 22.65 %. This is probably due to the different harvest ages.

B. Kate's Elephant Grass Organic Ingredients

Analysis of variance showed that the dry solid sludge residue showed a very significant effect ($P<0.01$) on the organic matter content of Gajah Kate grass. The organic matter content obtained is directly proportional to the dry matter content, when the dry matter increases, the organic matter also increases because the organic matter is in the dry matter. Organic matter is substances contained in feed ingredients other than minerals (ash), which is obtained by reducing dry matter with ash content after kiln- ing (Tillman and Soebarinoto, 1989).

The high content of organic matter obtained in this study was in line with the nutrients added to each treatment in the first cutting, thus indicating that the organic matter content in the second cutting still showed the presence of residual nutrients that had not been decomposed, especially N (0.94%), P (1.76). %), K (0.70%) which is a macro element needed by plants for growth and production. In general, it can be seen that there is an increase in the organic matter content with the increasing application of dry solid Sludge at the first cutting, thereby increasing the remaining dry solid Sludge in each treatment that acts as a fertilizer.

The results of the DMRT test showed that the organic matter content in P5 had a very significant effect ($P<0.01$) higher than P4, P3, P2, and P1, while P4 had a very significant effect ($P<0.01$) higher than P3, P2, and P1. For P3 the content of organic matter had a very significant effect ($P<0.01$) higher than P2 and P1, and the P2 treatment had a very significant effect ($P<0.01$) higher than P1. According to Isroi (2008) that the increased efficiency of plant growth is the result of organic fertilization and increased production of plant organic matter at harvest.

There was an increase in organic matter content of Gajah Kate grass, at P5 = 4.21%, P4 = 2.51%, P3 = 1.92% and P2 = 0.63% compared to P1 (control). This is because the use of dry solid sludge residues in organic fertilizers will add macro and micro nutrients needed by plants so that the efficiency of plant nutrients increases which can increase the organic matter content of plants. The organic matter content of elephant grass kate in the second cutting in each treatment was in line with the organic matter content in the second cutting. It can be assumed that the remaining dry solid sludge for each treatment is directly proportional to the amount of dry solid sludge given in the first cutting in line with the organic matter content in the second cut for each treatment. The higher the amount of dry solid Sludge given to the treatment for the first cutting, the higher the organic matter content of the Kate Elephant grass as well as the remaining dry solid Sludge for the second cutting.

The results of the average organic matter content of Gajah Kate grass (Pennisetum purpureum cv. Moot) in the first cutting obtained P1 = 85.36%, P2 = 85.61%, P3 = 85.76%, P4 = 85.98%, and P5 = 86.46%. The result of the highest organic matter content from this study was 85.49%, slightly lower than the statement, Sirait (2015) that the organic matter content of Gajah Kate grass was 85.55% and the results of Sanjaya's research (2019) that the organic matter content of Gajah Kate grass was in the first cut that is 86.46%. Dicka (2018), conducted a variety of cuttings of kate elephant grass, with different cutting ages in shaded areas, 60 days of cutting resulted in 84.18% organic matter content.

C. The Crude Protein Content of Kate Elephant Grass

Analysis of variance showed that the crude protein quality of Gajah Kate grass from the dry solid sludge residue showed a very significant difference ($P<0.01$). In general, it can be seen that there is an increase in the crude protein content with the increasing application of dry solid Sludge in each treatment at the first cutting, thereby increasing the remaining dry solid Sludge in each treatment that acts as a fertilizer. This will increase the growth and production of the grass, as a result of nitrogen deposition, the content of food substances, especially protein, will increase, thereby increasing the protein content of grass plants. According to the Blue Team (2013) that dry sludge from solid Bio-Slurry biogas waste contains macro nutrients, namely Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulfur (S).) as well as micro nutrients such as Iron (Fe), Manganese (Mn), Copper (Cu), and Zinc (Zn). In accordance with the opinion of Hakim, et al (1986) that the nutrients obtained by plants from the soil and the environment are needed by plants in the process of forming tubers, especially potassium. Potassium is needed by plants in nutrient absorption, regulation of respiration, transpiration, enzyme work and carbohydrate translocation.

The results of the DMRT test showed that P5 was significantly different ($P<0.01$) higher than P4, P3, P2, and P1 on the crude protein content of Gajah Kate grass. The results of this study showed that the use of dry solid sludge residue at P5 gave the best results for the crude protein content of Gajah Kate grass while the lowest protein content was achieved in the treatment without fertilization (P1) control. This is because the dry solid sludge residue is still able to provide macro nutrients, especially N (0.94%), P (1.76%), K (0.70%) which can increase plant protein content when compared to treatment without fertilization. It is also in accordance with the opinion of Hakim et al., (1986) that this organic fertilizer has a residual effect where the nutrients gradually become free and available to plants, even in general the residual effect still affects 3 to 4 years after application.

There was an increase in crude protein content of Gajah Kate grass at P5 = 20.55%, P4 = 11.63%, P3 = 9.19% and P2 = 1.11% compared to P1 (control). This is because the residual solid sludge is still able to provide macro nutrients such as nitrogen (N) which can increase plant protein levels when compared to treatment without the use of fertilizer. The crude protein content of kate elephant grass in the second cutting in each treatment was in line with the crude protein content in the first cutting. It can be assumed that the remaining dry solid Sludge for each treatment is directly proportional to the amount of dry solid Sludge added at the first cutting. It can be seen that the crude protein content in the first cutting is in line with the crude protein content in the second cutting for each treatment. The more amount of dry solid Sludge given in the first cutting, the higher the crude protein content of the Kate Elephant grass as well as the remaining dry solid Sludge for the second cutting. So that the crude protein content obtained in the second cut is in line with the crude protein content in the first cut. According to Marliani (2010) that the content and composition of crude protein in forage forage is influenced by the availability of nitrogen in the soil, if it is not enough it can inhibit the synthesis process in plants.

The results of the average crude protein content of Gajah Kate grass (Pennisetum purpureum cv. Moot) in the first cutting obtained P1 = 6.82%, P2 = 7.59%, P3 = 10.25%, P4 = 11.88%, and P5 = 12.61%. The crude protein content of elephant grass kate in the second cutting of the highest dry solid sludge residue in this study was 11.19%, the results of this study were almost close to the best of the results of Sanjaya's research (2019), which was 12.61%. Setyaningrum (2018) showed the crude protein content of elephant grass (Pannisetum purpureum) fed cow, sheep and chicken dung can increase protein levels, namely 10.96%. According to Lingga (1998) nutrient N plays a

role in forming proteins, fats and various other organic compounds, as well as P acts as an ingredient for the formation of certain proteins.

D. The Crude Fiber Content of Kate Elephant Grass

Analysis of variance showed that the residual effect of dry solid sludge showed a very significant effect (P<0.01) on the crude fiber content of Gajah Kate grass in the second cutting. The crude fiber content in grass is influenced by the dry matter of the grass produced. The dry matter and crude fiber content tends to increase in line with the increasing age of the plant and the decreasing level of fertilization, it is estimated that the N element can facilitate the roots to absorb water in the soil, causing plants to contain more water so that it can inhibit the occurrence of lignification in plant parts (Keraf *et al*., 2015). As revealed by Tillman *et al*., (1998) that the crude fiber content of forage will increase with the age of the plant.

The results of the DMRT test showed that the highest crude fiber content was obtained at P1 (control) or without fertilization, showing a very significantly different effect (P<0.05) higher than the level of dry solid sludge fertilization at P2, P3, P4 and P5. The crude fiber content of the plant was negatively correlated with the crude protein content of the plant. This means that the higher the dose of fertilization, the higher the crude protein content of the plant but the crude fiber content will decrease. Added by Syarif (1985) that if the absorbed N content is low, it will result in a decrease in protein levels, but if the absorbed nitrogen content is high, the quality of crude fiber produced forage will decrease or be low.

There was a decrease in the crude fiber content of Gajah Kate grass at P1 = 8.11%, P2 = 3.58%, P3 = 1.46%, and P2 = 0.94 compared to P5 (treatment). This is because the low residual effect of crude fiber content obtained in this study is inversely proportional to the nutrients added to the first cutting of each treatment, especially the elements N (0.94%), P (1.76%), K (0.70%). which is a macro element needed by plants for growth and production. According to the Blue Team (2013) that dry sludge from solid Bio-Slurry biogas waste contains macro nutrients, namely Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulfur (S).) as well as micro nutrients such as Iron (Fe), Manganese (Mn), Copper (Cu), and Zinc (Zn).

The average crude fiber content of Gajah Kate grass in this study was 26.36%. This is lower than the results of Langi's research (2014) that using mini elephant grass added mycorrhizal fertilizer with an average crude fiber value of 33.58%. This shows that the use of Bio-Slurry fertilizer can reduce the crude fiber content of mini elephant grass. According to Savitri (2018), grass grown on land without shade tends to have a higher crude fiber content than grass grown under oil palm shade, because in conditions without shade the plants tend to have a higher dry matter content so that the crude fiber content is higher higher yield. Based on Savitri's research (2018), the crude protein and crude fiber content of mini elephant grass under the shade of oil palm were 13.79% and 24.63%, respectively, while without shade they were 13.24% and 30.32, respectively. %. Setyaningrum (2018) showed that the crude fiber content of elephant grass (Pannisetum purpureum) fed cow, sheep and chicken dung can increase crude fiber by 33.94%.

E. The Crude Fiber Content of Kate Elephant Grass

Analysis of variance showed that the residual effect of dry solid sludge showed a very significant effect (P<0.01) on the crude fiber content of Gajah Kate grass in the second cutting. The crude fiber content in grass is influenced by the dry matter of the grass produced. The dry matter and crude fiber content tends to increase in line with the increasing age of the plant and the decreasing level of fertilization, it is estimated that the N element can facilitate the roots to absorb water in the soil, causing plants to contain more water so that it can inhibit the occurrence of lignification in plant parts (Keraf *et al*., 2015). As revealed by Tillman *et al*., (1998) that the crude fiber content of forage will increase with the age of the plant.

The results of the DMRT test showed that the highest crude fiber content was obtained at P1 (control) or without fertilization, showing a very significantly different effect (P<0.05) higher than the level of dry solid sludge fertilization at P2, P3, P4 and P5. The crude fiber content of the plant was negatively correlated with the crude protein content of the plant. This means that the higher the fertilization dose, the higher the crude protein content of the plant but the crude fiber content will decrease. Added by Syarif (1985) that if the absorbed N content is low, it will result in a decrease in protein content, but if the absorbed nitrogen content is high, the quality of the crude fiber produced will decrease.

CONCLUSION

Based on the results of this study, it can be concluded that the residual effect of dry solid sludge can increase the content of dry matter, organic matter, crude protein and decrease crude fiber of elephant grass kate in the second cutting. There is an increase in dry matter content ranging from 0.46% - 1.74%, organic matter 0.63% - 4.21%, crude protein 1.11% - 20, 55% and a decrease in crude fiber 8.11% - 0 ,94% kate elephant grass (Pennisetum purpureum cv. Mott).

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