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Utilization of Biogas Slurry from Cow Faces and Palm Oil Empty Fruit Bunches Soaking Water on *Indigofera Zollingeriana* Productivity

***A.Rizky*[1] *, N. Ginting1* , A.Sadeli*[1] *, U.Hasanah*[1]*, S.E. Sinulingga*[2]

[1]Animal Husbandry Study Program, Faculty of Agriculture, Universitas Sumatera Utara, Padang Bulan, Medan 20155, Indonesia [2]Animal Husbandry Research Center, Agricultural and Food Research Organization, National Research and Innovation Agency (BRIN)

Abstract. Biogas slurry, a byproduct of biogas technology, can be used as a source of soil organic matter such as manure. This study aimed to examine the effect of giving biogas slurry gas with the input of cow faeces and empty fruit bunches soaking water on the growth (plant height, number of leaves, number of branches, stem diameter and leaf width) of *Indigofera zollingeriana*. This study was conducted in the village Tadukan Raga, STM Hilir District, Deli Serdang Regency, using *Indigofera Zollingeriana* for three months. The design was completely randomized (CRD) with three treatments and six replications. The treatment consisted of P0 = control; P1 = 50% biogas slurry (180ml/polybag of plants) P2 = 100% biogas slurry (360ml/polybag of plants). Parameters observed were plant height, number of leaves, leaf width, branches, and stem diameter. The results showed that the administration of biogas slurry gas at a dose of 100% (360 ml/polybag plant) had a significant effect on the number of leaves, a significant effect on leaf width, had an effect which had a significant on the number of leaves, had an insignificant effect on the number of branches and had a significant effect on stem diameter. The best results were the administration of biogas slurry in the *Indigofera Zollingeriana* plant the administration of a 100% slurry dose (360 ml/polybag of plants) in all treatments, namely plant height, number of leaves, leaf width, number of branches, stem diameter. Based on this, it can be suggested that biogas slurry fertilizer can be used as liquid organic fertilizer to increase the productivity of *Indigofera Zollingeriana* plants.

Keyword: branches, number of leaves, liquid organic fertilizer, plant, stem diameter

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1 Introduction

Forage is one of the important factors in the ruminant livestock business. To increase ruminant livestock production, however, it is need to be supported by quantity and quality provision of adequate forage. One way that can be done to increase greenery is by applying liquid organic fertilizer.

*Corresponding author at: *[1]Animal Husbandry Study Program, Faculty of Agriculture, Universitas Sumatera Utara, Padang Bulan, Medan 20155, Indonesia*
E-mail address: nurzainah@usu.ac.id

Journal Homepage: http://jsi.usu.ac.id

Biogas slurry, a byproduct of biogas technology, can be used as a source of soil organic matter such as manure [1]. The slurry is useful for fertilizing vegetables, fruits and trees/perennials. Biogas slurry has an advantage over manure or compost: it contains nutrients that plants can immediately utilize. There are two kinds of biogas slurry fertilizers: liquid and solid slurry. Biogas slurry contains various nutrients which are very important for plant growth. Macronutrients such as Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulfur (S), and micronutrients such as Iron (Fe), Manganese (Mn), Copper (Cu), and Zinc (Zn). In addition to nutrients, liquid bio-slurry fertilizer contains amino acids, auxin hormones and cytokinins [2].

The liquid slurry can improve soil properties, produce safe agricultural products, and contain microorganisms that can fertilize the soil, add nutrients, and control soil diseases.[3]

Based on the description above, which explains the nutritional content of biogas slurry, the authors wish to research the use of biogas slurry with the input of cow faeces and empty fruit bunches soaking water on the productivity of *Indigofera zollingeriana* plants such as (plant height, number of leaves, number of branches, stem diameter and leaf width).

2 Material and Methods

2.1 Material

The material comprises *Indigofera Zollingeriana* plants, slurry, growing media (Inceptisol,roasted husks,cow feces),polybags, cameras, callipers, and gauges.

2.2 Methods

The research method used a completely randomized design (CRD) and consisted of 3 treatments and six replications:

P0 = Control
P1 = 50% slurry (180 ml/polybags)
P2 = 100% slurry (360 ml/polybags)

Indigofera seeds were planted in polybags with a capacity of 5 kg and watered every day according to the field capacity in this research, which was 360ml/polybags.

2.2 Making biogas slurry

Mixing cow dung with empty palm fruit bunches soaking water in a predetermined amount,then stirred so that a mud-like form with a ratio of 2:1.

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Flowing sludge to the digester inlet hole. For the first filling, you need much sludge to fill the volume in the digester.

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After the digester is filled with sludge, the gas valve on the digester must be closed so that the fermentation process occurs.

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↓

Discard the first gas produced from day 1 to day 8. From day 10 to day 14, methane gas (CH4) and CO2 gas will form and have begun to decrease in the fermentation

↓

On the 14th day, gas will form, which can ignite a fire on the gas stove and produce a slurry used as fertilizer.

Chart 1. The process og making biogas slurry

2.4 Parameter observed

2.4.1 Plant Heigh

Measured from the soil surface to the highest part of the Indigofera plant in units of centimetres. Measured once every 14 days.

2.4.2 the number of leaves

Counted all leaves in each treatment. Counted every 14 days.

2.4.3 the number of branches

Calculated by counting all branches that appear on each plant from each treatment. Counted every 14 days.

2.4.4 Stem diameters

Measured rod diameter 10 cm above the ground using a calliper. Measured every 14 days.

2.4.5 Leaf width

Measured leaf width using a tape measure or ruler, measured on the widest leaf in each treatment. Measured once every 14 days.

3 Result and Discussion

3.1. Plant high

The effect of slurry dilution on the plant high of *Indigofera Zollingeriana*

Table 1. Plant height (cm) *Indigofera Zollingeriana* by application biogas slurry

Treatments	Replications						Average
	U1	U2	U3	U4	U5	U6	
P0	91	64	86	65	81	71	83,67[a]
P1	71	64	99	63	91	71	141,89[a]
P2	91	106	131	91	86	84	174,58[b]
Total	253	234	316	219	258	226	251

Description: Numbers followed by different letters in the same row or column show significant differences on Duncan's test ($p<0.05$)

Table 1 shows that the results of administering Slurry Biogas at a dose of 360 ml to *Indigofera Zollingeriana* plants resulted significant growth in plant height. As can be seen in Table 1, P0 (360 ml of water/plot) without treatment resulted in an average of 83.67cm, while in treatment P2 (360 ml of biogas slurry/plot) produced an average growth in plant height of 174.58 cm. Samples of biogas slurry on this study had been test at The North Sumatra Agricultural Technology Assessment Center (BPTP) laboratory. The result showed that biogas slurry contains chemical properties including N (1.31%), P (0.20%), K (0.29%), and C-Organic (5.76%). This causes the nitrogen content in the slurry have significant results compared to no slurry treatment, which was only given 360 ml/plot of water. Nitrogen (N) is the main nutrient for plant growth which is generally needed for the formation and growth of vegetative parts of plants, such as leaves, stems and roots [4]. The function of nitrogen for plants includes increasing plant growth, increasing protein levels in plant bodies, maximizing leaf-producing plants' quality, and increasing soil microorganisms.

3.2 Number of leaves

The effect of slurry application on the number of leaves of *Indigofera Zollinegrianna*

Table 2 Number of leaves (sheets) of *Indigofera Zolingerianna* by application of slurry

Treatments	Replications						Average
	1	2	3	4	5	6	
P0	421	323	299	271	221	249	$297,33^{a} \pm 70,44$
P1	251	325	481	271	391	296	$335,83^{a} \pm 86,28$
P2	529	476	1261	509	421	361	$592,83^{b} \pm 333,01$

Description: Numbers followed by different letters in the same row or column show significant differences on Duncan's test ($p<0.05$)

It can be seen in Table 2 that P2 shows the highest average number of leaves compared to P0 and P1, with an average number of leaves of 592,83. It can be seen from the plant height data (Table 1), and compared with the average number of leaf blades, that taller plants have more leaves. This is presumably due to the nutrient content contained in the soil and the influence of the fertilizer application used to meet plant needs. The process of photosynthesis also depends on the availability of nutrients that can help grow plants; as seen in Table 3, the results of the P0 treatment showed an average number of leaves of 297,33 fewer leaves than in P1 and P2; this was due to the lack of nutrients contained in the soil and there was no effect from the treatment given, because at P0 only given 360 ml/plot water treatment and no slu fertilizer ry biogas.[5] states that the number of leaves shows an increase along with an increase in the concentration of foliar fertilizer. This is related to the role of nitrogen as a component of chlorophyll. Increasing the element of N in plants is associated with the formation of chlorophyll in the leaves, thereby increasing the process of photosynthesis, which spurs the growth of the number of leaves in plants [6].

3.3 Number of branches

The effect of slurry dilution on the number of branches of *Indigofera Zollinegrianna*

Table 3 Number of branches of *Indigofera Zolingerianna* by application of slurry

Treatments	Replications						Average
	1	2	3	4	5	6	
P0	25	6	21	6	0	14	$12 \pm 9,70$
P1	18	8	11	0	11	0	$8 \pm 7,01$
P2	24	8	69	9	15	7	$22 \pm 23,88$

Description: Numbers followed by different letters in the same row or column show significant differences on Duncan's test ($p<0.05$)

The results of biogas slurry application *Indigofera zollingeriana* that there is no significant effect ($P > 0.05$) of the biogas slurry fertilizer on the number of branches. The number of branches with the highest average was the plants that were given a dose of 100% biogas slurry or 360 ml/polybag of plants with a total of 22 branches, then in P1 with a dose of 50% biogas slurry or 180 ml/polybag the plants had an average number of branch average of 8 and P0 (control) not given slurry has an average of 12 branches. Observation of the number of branches shows no significant

effect; this can presumably be due to the plant's genetic nature. Internal (genetic) factors include the direct influence of genes, differentiation, enzyme activity, photosynthetic rate, respiration, distribution of assimilation products and N nutrients, type and location of meristems and capacity to store food reserves. Moreover, other factors that affect plant growth are external (environmental) factors: climate, temperature and soil availability [7], [8].

3.4 Stem diameters

The effect of slurry dilution on the stem diameters of *Indigofera Zollinegrianna*

Table 4 Stem diameters (mm) *Indigofera Zolingerianna* by application of slurry

Treatments	Replications						Average
	1	2	3	4	5	6	
P0	9,8	8,2	8	6,2	7	7	$7,70^{a} \pm 1,26$
P1	7	7,7	9,8	5,8	8,8	7	$7,68^{a} \pm 1,43$
P2	10	9,9	13,2	10	9	8	$10,01^{b} \pm 1,75$

Description: Numbers followed by different letters in the same row or column show significant differences on Duncan's test ($p>0.05$)

Table 4 shows that the largest diameter growth was in treatment P2, namely the treatment of biogas slurry fertilizer with a dose of 360 ml/plot, 10,01mm, significantly different from other treatments. The smallest stem diameter in this treatment was found in P0, namely of 7,70 mm, namely the treatment that was only given the control or 360 ml/plot of water; there was no significant difference with other treatments. Thus, it can be concluded that the application of 360 ml/plot biogas slurry fertilizer can significantly affect the diameter growth of Indigofera Zollingeriana stems. The increase in stem diameter is caused by the presence of N, P, and K nutrients contained in the bio-gas slurry fertilizer. N, P, and K nutrients are absorbed by plants, especially in the vegetative phase. According to [9], N, P, and K fertilizers are needed for plant growth, especially in stimulating plant height formation and stem diameter enlargement.

3.5 Leaf width

The effect of slurry dilution on the leaf width of *Indigofera Zollinegrianna*

Table 5. Leaf width (cm) *Indigofera Zolingerianna* by application of slurry

Treatments	Replications						Average
	1	2	3	4	5	6	
P0	0,6	0,7	0,9	0,5	0,8	0,6	$0,68^{a} \pm 0,15$
P1	1	0,9	1	0,6	1	0,9	$0,90^{ab} \pm 0,16$
P2	0,9	0,8	1,6	1,2	0,9	1	$1,07^{b} \pm 0,29$

Description: Numbers followed by different letters in the same row or column show significant differences on Duncan's test ($p<0.05$)

The results showed that administering a biogas slurry dose of 360 ml/plot or in the P2 treatment resulted in a greater increase in leaf width compared to P0 and P1. The application of biogas slurry fertilizer at a dose of 360 ml/plot significantly affected the P2 treatment. It can be seen in Table 4 that the largest leaf widths were found in P2 with an average leaf width of 1,07 cm; in P1, the average leaf width was 0,90 cm and in P0, the average leaf width was 0,68 cm.

Leaf width increases because leaf growth is quite good and faster. Plants with wider leaf width at the beginning of growth will grow faster because of the ability to produce higher photosynthate compared to plants with lower leaf area. The more leaves, the more photosynthesis occurs. An increase in photosynthesis will produce more and more photosynthate so that the dry weight of the plant will increase by the photosynthate, and the energy produced is used to form and maintain the quality of the leaves [10], [11].

4 Conclusion

Based on the research that has been done, it can be concluded that treatment with a concentration of 360 ml of biogas slurry/plant plot gave the best effect on plant height, number of leaves, leaf width, number of branches and stem diameter. The higher the dose given, the better the results produced because, the higher the biogas slurry given, the more N content it contains.

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