

Analysis of The Economic Potential of Organic Fertilizer from Biogas Digester Waste (Slurry)

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ABSTRACT

Fertilization is one of the important activities in cultivation to increase plant productivity. The application of fertilizers into the soil aims to increase and / or maintain soil inorganic fertility, where soil inorganic fertility is assessed based on the availability of nutrients in the soil, both macro nutrients and micro nutrients in biological waste that is easily obtained from the environment around us, recycled and overhauled with the help of decomposer microorganisms such as bacteria and fungi into nutrients that can be absorbed by plants, the decomposition of organic matter into organic fertilizer can take place naturally. The decline in soil organic matter content is thought to be caused by agricultural cultivation methods that pay less attention to organic matter content. One of them is the use of chemical fertilizers that are very intensive. Farmers pay more attention to the addition of chemical nutrients and do not pay attention to organic matter. Organic fertilizers play a role in increasing the physical, chemical and biological fertility of soil and making the use of inorganic fertilizers more efficient. The purpose of this research is to analyze the results of organic liquid fertilizer produced by the biogas digester (slurry), calculate the economic potential generated from the biogas digester. month.

INTRODUCTION

The utilization of waste and other organic materials as biogas producers can reduce the amount of organic waste transported to landfills and can reduce methane gas emissions while reducing the risk of global warming.[1] In addition, the residue from the biogas production process is an environmentally friendly material and can be used as organic fertilizer. One of the cheap and dominant sources of organic material found in Padang City and has the potential to be used as raw material for biogas is vegetable and fruit waste and cow rumen waste.

Organic fertilizers are fertilizers that are mostly or entirely composed of organic materials derived from plant residues, and or animals that have undergone engineering in the form of solid or liquid which are used to supply organic matter, improve the physical, chemical, and biological properties of soil (Regulation of the Minister of Agriculture, No.70/Permentan/SR.140/10/2011) [2].No.70/Permentan/SR.140/10/2011)[2].

Fertilization is one of the important activities in cultivation to increase plant productivity. The application of fertilizers into the soil aims to increase and / or maintain soil inorganic fertility, where soil inorganic fertility is assessed based on the availability of nutrients in the soil, both macro-nutrients and micro-nutrients in biological waste that is easily obtained from the environment around us, recycled and overhauled with the help of decomposer microorganisms such as bacteria and fungi into nutrients that can be absorbed by plants overhauling the type of organic matter into organic fertilizer can take place naturally or artificially [3].

The decline in soil organic matter content is thought to be caused by agricultural cultivation methods that pay little attention to organic matter content. One of them is the use of chemical fertilizers that are very intensive. Farmers pay more attention to the addition of chemical nutrients and do not pay attention to organic matter. For example: farmers use urea but always burn the straw after harvest which is a source of organic matter. One of the consequences of low soil organic matter is the increasing need for artificial fertilizers but production tends to decline . Fertilizers account for approximately 60% of all production costs in the plantation industry. For large plantations, the rising price of fertilizers is a huge burden on their fertilization budget. One alternative solution is to switch to organic fertilizers in droves [4].

Livestock manure is a valuable natural resource and can be used as fertilizer, because it contains macro and micro nutrients needed for plant growth. Even the remaining biogas in the form of thick liquid (sludge) can be used as organic fertilizer, but farmers have not utilized it as an added value to increase income. In general, biogas consists of methane gas (CH₄) around 55-80%, where methane gas produced from animal manure contains 4,800-6,700 Kcal/m³ energy, while pure methane gas contains 8,900 Kcal/m³. Sludge biogas can be used as organic fertilizer and can be an alternative fertilizer, namely a substitute for NPK fertilizer [5].

The application of the use of biogas sludge has been carried out on spinach plants (*Amaranthus tricolor*), namely by giving 2.5 gr of NPK at the beginning of planting has a fresh weight that is not significantly different from giving 250 ml of sludge every day. Biogas sludge contains a variety of chemical elements, some of which can be harmful. Some biogas sludge contains chemical elements (Cu, Zn, Cd) at concentrations that are harmful to plants. The negative impact of heavy metals on plants is to reduce the activity of organisms and reduce soil fertility. Furthermore, some heavy metals are reported to be able to reduce the quantity and quality of crop production or even toxic, including Cd, Zn, Cu, Ni, Pb, Co, Cr, Mn, Mo, Zn, As, Cd, Hg, Ti and Cu. The results of research by Podlesakova et al. (2002) which showed that the critical threshold levels of Cu metal for moderately tolerant plants generally ranged from 15 - 20 p [6].

In the process of making biogas, in addition to methane gas produced from the fermentation process, solid waste from fermentation is also produced. As the amount of biogas production increases, the amount of solid waste also increases. Based on the survey results at the Sekar Sari "Setia Kawan" Nongkojajar Dairy Farm and Environmental Management Training Center, the manager does not know the utilization of this biogas residual waste. This solid waste is only stockpiled in the farm area, and cannot be used as fertilizer due to its low Nitrogen (N) content. The increasing amount of solid waste causes storage problems. Currently, the remaining biogas waste is just a pile of garbage that takes up most of the farm's land." [7]

Table 1. Gas Production Capacity of Cow Manure Processing Model [8].

No.	Processing capacity (m ³)	Gas production per day (m ³)	Animal manure required per day (kg)	Water required daily (liters)	Number of livestock required
1	4	0,8 - 1,6	20 - 40	20 - 40	3 - 4
2	6	1,6 - 2,4	40 - 60	40 - 60	5 - 6
3	8	2,4 - 3,2	60 - 80	60 - 80	7 - 8
4	10	3,2 - 4,2	80 - 100	80 - 100	9 - 10
5	12	4,2 - 4,8	100 - 120	100 - 120	11 - 12

Source: Model Biogas Installation Indonesia 2014

Table 2. Capacity of Biogas Reactor to be implemented based on Availability of Cow Manure Feedstock.

No.	Quantity of raw materials available every day (kg)	Recommended processing bin size (m ³)	Quantity of fuel wood saved per day (kg)
1	20 - 40	0,8 - 1,6	20 - 40
2	41 - 60	1,6 - 2,4	40 - 60
3	61 - 80	2,4 - 3,2	60 - 80
4	81 - 100	3,2 - 4,2	80 - 100
5	101 - 120	4,2 - 4,8	100 - 120

Source: Model Biogas Installation Indonesia 2014

METHODOLOGY

The main ingredient for making organic fertilizer is the solid and liquid waste of the biogas digester. Biogas waste as the main raw material for making solid and liquid organic fertilizers is obtained from the biogas digester installation.

RESEARCH RESULT

2.1 Process method for making organic fertilizer

Waste output from the biogas digester is a mixture of solids and liquids, the output is separated in different places. After being separated, both are fermented (specifically what we studied was only the liquid waste, fermentation was carried out for 2 months. The resulting biogas waste or dregs is called Bio-slurry. Bioslurry has excellent potential to be used as a solid organic fertilizer. This nutrient content is very important for plant growth. The content of macro elements needed by plants in large quantities includes Nitrogen (N), Phosphor (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulfur (S). As well as micro nutrients required in small amounts such as Iron (Fe), Manganese (Mn), Copper (Cu), and Zinc (Zn). Besides being rich in complete nutritious organic matter, bio-slurry also contains probiotic microbes that help fertilize the land and control diseases in the soil. The impact is of course the soil will become more fertile and healthy so that production increases. The microbes contained in bio slurry include 1) cellulitic microbes which are useful for composting, (2) nitrogen-fixing microbes which are useful for capturing and providing nitrogen, (3) Phosphate solubilizing microbes which are useful for dissolving and providing ready-to-absorb Phosphor, and (4) *Lactobacillus* sp microbes which play a role in controlling the attack of soil-borne diseases [8].

DISCUSSION

Bioslurry is a waste / discharge produced from a biogas digester, which is taken from Tompobalang hamlet, Manuju Village, Gowa Regency which is used as the main raw material for making liquid organic fertilizer. In this study, the test analysis was carried out only the liquid that came out of the biogas digister and then carried out permentation (stored for one month) the results were as in the graph below.

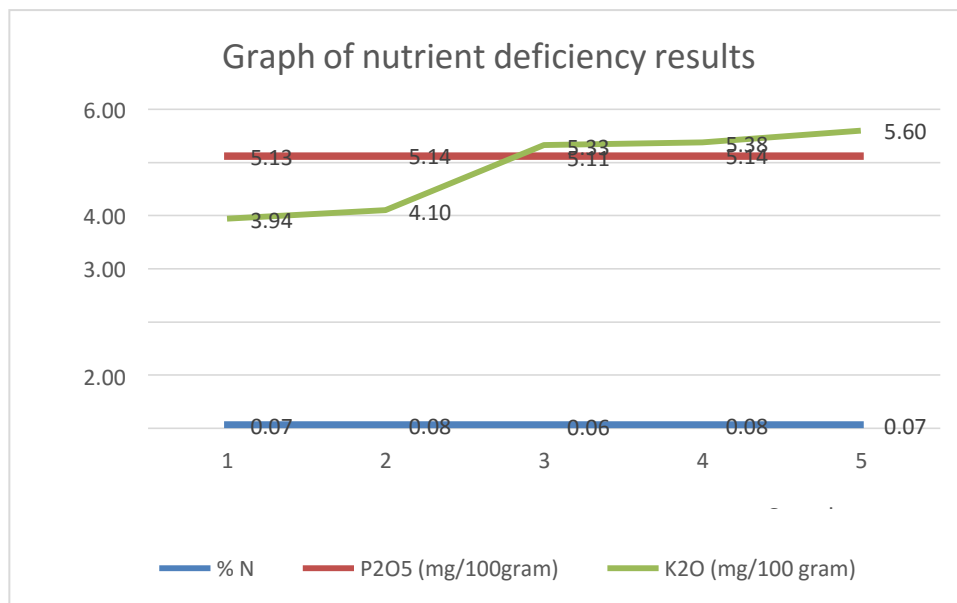


Figure 1. Graph of Nitrogen-Pospor and Potassium Analysis Results

From the graph 1 above, it shows that the nitrogen obtained is still low, which is an average of 0.072%, for phosphorus 5.13 mg/100g and potassium is 4.87 mg/100 gram. From the results of this analysis for nitrogen fluctuates while for phosphorus and potassium there is an increasing trend.

3.1 Fertilizer and gas produced

In the graph below, data for 10 days were obtained, liquid fertilizer, gas and solid fertilizer.

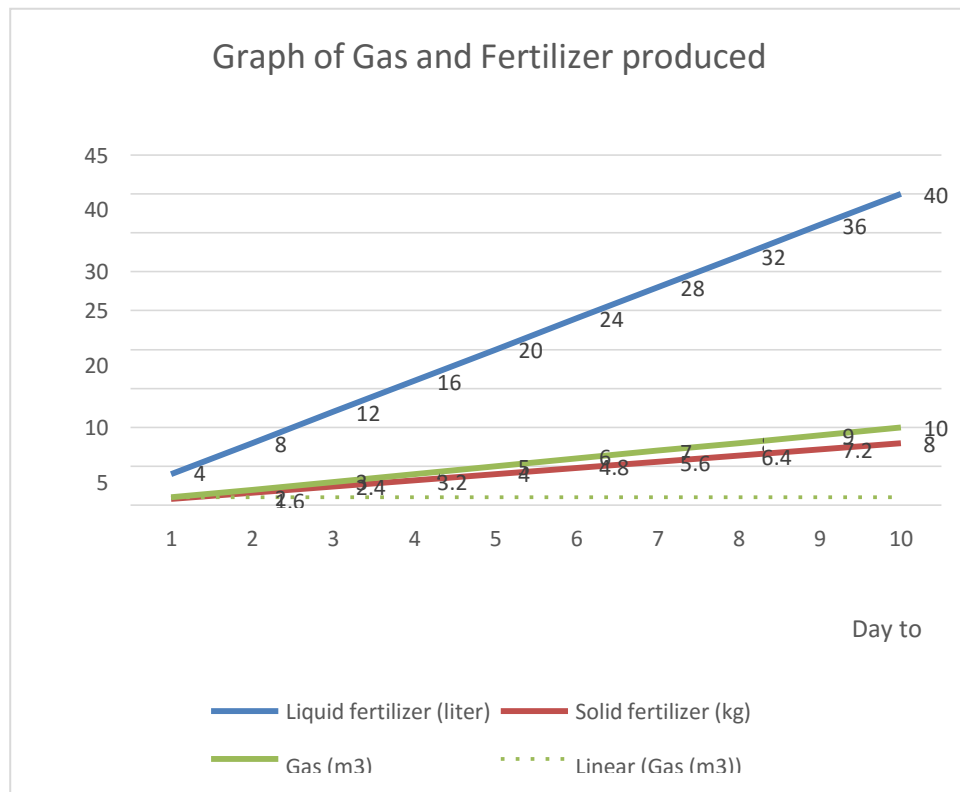


Figure 2 Graph of Gas and Fertilizer produced

Shows a continuous increase starting from the first day of data collection, this is because the biogas digester is also always filled every day so that gas, liquid and solid fertilizers also always come out. If it is assumed that the price or selling value of the three outputs of the biogas digester tool, namely Gas (Rp 500/m³), Liquid fertilizer (Rp 500/liter) and solid fertilizer (Rp 500/kg), as in the table below:

Table 3. Estimated income from the Biogas digester device
For 10 days with raw material supply 4 liters of water 1 liter of cow dung

Day	9 Liter Liquid Fertilizer)	Solid Fertilizer (kg)	Gas (m ³)	9 Liter Liquid Fertilizer Price) Rp	Solid Fertilizer Price (kg) IDR	Gas Price (m ³) RP
1	4	0.8	1	2000	400	500
2	8	1.6	2	4000	800	1000
3	12	2.4	3	6000	1200	1500
4	16	3.2	4	8000	1600	2000
5	20	4	5	10000	2000	2500
6	24	4.8	6	12000	2400	3000

Day	9 Liter Liquid Fertilizer)	Solid Fertilizer (kg)	Gas (m) ³	9 Liter Liquid Fertilizer Price) Rp	Solid Fertilizer Price (kg) IDR	Gas Price (m3) RP
7	28	5.6	7	14000	2800	3500
8	32	6.4	8	16000	3200	4000
9	36	7.2	9	18000	3600	4500
10	40	8	10	20000	4000	5000
Total	220	44	55	110000	22000	27500

From the table above, the potential income is Rp 159.500,- for 10 days with an input of one liter of cow dung with four liters of water, if one month is assumed to be 30 days then $3 \times \text{Rp } 159.500,- = \text{Rp } 478\ 500,-$ per month. However, if the input capacity is increased to ten times, the potential income is IDR 4,785,000 per month.

CONCLUSIONS AND RECOMMENDATIONS

From the results obtained, it can be concluded as follows:

1. The waste from the biogas digister produces an average N of 0.072%, for phosphorus 5.13 mg/100g and potassium is 4.87 mg/100 grams.
2. Liquid bioslurry has a Corganic element content of 4.76%, N of 0.11%, P of 0.17% and K of 0.04%. So it can be said that bioslurry liquid organic fertilizer - cow urine is better than the composition of bioslurry - water, with a bioslurry - cow urine nutrient value of C-organic elements of 8.37%, Nitrogen of 0.56%, Phospor of 3.86% and Potassium of 0.59%. In addition, liquid organic fertilizer from bioslurry C-organic and Phospor (P) values have met the quality standards of liquid organic fertilizer according to the Minister of Agriculture Regulation No. 70 / permentan / SR.140/10 / 2011. While the value of Nitrogen (N) and Potassium (K) still does not meet the quality standards of liquid organic fertilizer quality.

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