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Journal of Land Restoration

## Effect of Biourine on N Uptake and Cabbage (*Brassica oleraceae* L) Growth on Lowland Ultisol

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### ABSTRACT

Research on the effect of doses of cattle biourine on plant N levels and growth of cabbage (*Brassica oleraceae*, L) in lowland Ultisol was carried out by Desa Bakti in Marga Sakti Sebelat District, North Bengkulu Regency in October 2019 to January 2020. This study aimed to determine the dosage of cattle biourine optimal for N levels and cabbage growth in lowland ultisols. This study used a Randomized Complete Block Design (RCBD) of one factor consisting of 4 treatments and 4 replications, with the treatment dose 0 L ha<sup>-1</sup>, 1500 L ha<sup>-1</sup>, 3000 L ha<sup>-1</sup>, and 4500 L ha<sup>-1</sup>. Observation data were analyzed by Analysis of variance (ANOVA) at a level of 5% with the Orthogonal Polynomial Test. The results of the study showed that the optimum dosage was not obtained on the variable N levels of plants and soil pH, but had a very significant effect on both of these variables. The optimum dosage obtained on the variable growth and yield of plants includes the optimum dose of 2250 L ha<sup>-1</sup> biourine producing an average plant height of 36.14 cm age 45 dap, the optimum dose of 2200 L ha<sup>-1</sup> of biourine produces an average plant height of 37.87 cm age 60 dap, optimum dose of biourine 1250 L ha<sup>-1</sup> produces an average biomass fresh weigh 1.33 kg, the optimum dose of biourine 1666.67 L ha<sup>-1</sup> produces an average head weight of 0.83 kg, and optimum dose of biourine 2000 L ha<sup>-1</sup> produces average head diameter of 15.36 cm.

Keywords: cow biourine, Ultisol, cabbage, plant N content

### INTRODUCTION

Ultisol is a type of soil spread in Indonesia, with a spread of 45,794,000 ha or equal to 25% of the land area of Indonesia (Subagyo *et al.*, 2004). Ultisol generally has a base saturation of < 35%, sour reaction to very sour (pH 5-3.1), good drainage, fine to medium texture, low soil nutrient content, and Clay CEC < 12 me/100 g clay. (Hermawan *et al.*, 2014). The Ultisol has a cross-section of land in flat to the mountain, slope 1-40%, with an area of 706,000 ha which is the second widest type of land after Inceptisol in the province of Bengkulu.

The quality of soil fertility can be improved by adding organic ingredients. Organic matter can improve the nature of Ultisol and also able to improve crop yield. The addition of organic materials on the soil has a very important function in fertilizing the surface layer (topsoil), increase the population of microorganisms in the soil, increase water absorption by the soil and overall improve the quality of soil fertility and there are important supporting factors in organic farming is organic fertilizer, organic fertilization can mobilize existing

nutrients in the soil so easily absorbed by plant roots. (Mulyani, 2010).

Solid organic fertilizer is now more utilized in farming, while in the form of liquid, especially urine still not much utilized (Adijaya *et al.*, 2010). Judging from the nutrient aspect, the cow's urine fluid has a higher nutrient content compared to the density of impurities (Lingga, 1999). Cow urine can be utilized as a liquid organic fertilizer through the fermentation process by involving the role of microorganisms, so it can be a more beneficial agricultural product commonly referred to as Biourine (Sutari, 2010).

Biourine is a liquid organic fertilizer derived from the fermentation of anaerobic cow urine with additional nutrients using microorganisms (Wati *et al.*, 2014). The result of fermentation in addition to reducing the pungent odor is also better quality than fresh cow urine, nutrient levels in the cow urine before fermentation contains N (1.0%), P (0.5%) K (1.4%) and Ca (1.1%) And after being fermented into a cow biourine include element N (2.7%), P (2.4%) K (3.8%) and Ca (5.8%) (Affandi, 2008). While the solid cow manure contains elements N (0.3), P (0.2%), K (0.15%), as well as Ca (0.2%)

(Lingga, 1999). Liquid Organic fertilizer has several advantages namely contain certain substances such as microorganisms that are rare in solid organic fertilizer. Biourine can provide an increase in crop yield almost equivalent to plant-buried materials (Perdana, 2015).

Biourine is an alternative to increase the availability and efficiency of nutrient absorption for plants (Sofiana & Syaban, 2017). The cow biourine gives a noticeable effect on the N-total, the rising value of N-total land followed by a dose amount of cow biourine fertilizer added. 98% increase in N-total soil caused by an increase in the biourine dose of cows. The administration of cow Biourine gives a noticeable effect on the N plant concentration and absorption of N crops with followed by increasing the number of doses of cow biourine fertilizers added. Increased concentrations of N plants 80% caused by increasing the dose of cow's biourine fertilizer (Sari *et al.*, 2019). Fertilizer efficiency response N showed the treatment of fertilizer efficiency N by 25% or 50% with the addition of organic materials capable of producing a greater number of leaves.

Cabbage (*Brassica oleracea* L) is a type of horticultural plant. Cabbage wants unflooded, loose, fertile, containing many organic ingredients and has a pH of about 5.5 to 6.5. The high nutritional content is owned so that the plant is very potential to be cultivated. Production in cabbage plant cultivation can be increased with one of the efforts to provide nutrients for plants. Plant needs of the main nutrients N, P, K is quite high. The main nutrient is much needed in plants, especially in the vegetative phase. The plant needs higher N than other nutrients, but N is a limiting factor for crop productivity. N deficiency will cause plants not to grow optimally, while N excess in addition to inhibit plant growth will also cause pollution to the environment (Duan *et al.*, 2007).

The N levels in the soil are generally classified as low, in certain conditions and situations N easy loss is transported through yields, drainage, and evaporation into the atmosphere. N is an inseparable part of the chlorophyll molecule and with the N administration in sufficient quantities will affect the vegetative growth of the optimal plant. Cabbage is one of the plant-producing leaves that require N whose role is very large in the metabolic process of plants. To overcome these problems can be done by the provision of organic materials, one of the potential organic materials at the moment is the cow Biourine. Thus research on the influence of cow biourine on absorption N plants and the growth of cabbage plants need to be done to answer these questions.

The purpose of this research is to determine the interaction of several biourine-dose cows against the uptake of N-nutrient plants and the growth of cabbage in the lowland ultisol.

## MATERIAL AND METHOD

The research took place from October 2019 to January 2020 in the village of Karya Bakti, Marga Sakti Sebelat District, North Bengkulu Regency. At a place height of  $\pm 59$  m from above sea level, with the Ultisol soil type.

The experimental unit is based on a Randomized Complete Block Design (RCBD) single factor consisting of 4 treatments and 4 repeats, with a dose treatment of  $0 \text{ L ha}^{-1}$ ,  $500 \text{ L ha}^{-1}$ ,  $3000 \text{ L ha}^{-1}$ , and  $4500 \text{ L ha}^{-1}$ . The implementation of research includes the manufacture of biourine, preparation of planting media, planting, fertilization, maintenance, sampling of soil and plants, as well as laboratory analysis.

The observation variables include the content of N plant using Kjeldahl method, soil pH using electrometry Method (Balai Penelitian Tanah, 2005), plant height (cm), number of leaves (strands), head diameter (cm), biomass fresh weight (kg) and head weight (kg) measured using a scale. The collected observation variable Data is analyzed by variant analysis (ANOVA) at a 5%  $\alpha$  level and the polynomials Orthogonal method to determine the relationship model between dependent and independent variables.

## RESULT AND DISCUSSION

### *N Uptake*

The relationship between the cow biourine dose and the N uptake as seen in Figure 1. Increased N uptake aligned with increasing doses of biourine, each dose of  $1 \text{ L ha}^{-1}$  will be followed by an increasing rate of N uptake of 0.00004%. The contribution of biourine dose to the addition of the average N uptake rate is 79%. These results are lower than the results of the research of Sari *et al.* (2019) which indicates that the concentration of N plant 95% caused by increasing the dose of biourine in peanut plants on Entisol.

The ground ability in providing N is strictly determined by the condition and amount of soil organic matter (Cookson *et al.*, 2005). Plants absorb N in the form of ammonium and nitrate, these ions are derived from fertilization and decomposition of organic matter (Benbi *et al.*, 2002)..

### *Soil pH*

An increase in the amount of biourine given is always followed by an increase in soil pH, with a coefficient  $R^2 = 73\%$  (Figure 2). The provision of organic fertilizer can increase soil pH, presumably because organic anions produced by organic acids through the decomposition process can neutralize Al (Idaryani & Sahardi, 2016). In acid soils, organic fertilizers

can increase soil pH, because organic fertilizers can neutralize organic Al through the humic acid contained in every organic fertilizer that acts as a soil buffer (Hardjowigeno, 1995). These conditions can provide flexibility to change the reaction of the soil, while the  $H^+$  contained in the soil remains so that the measured soil pH increases. The research of Siburian *et al.* (2016) shows that the application of liquid organic fertilizer significantly influences soil acidity. Increasing the dose is always followed by an increase in soil pH. The higher the dose of liquid organic fertilizer given, the OH<sup>-</sup> released by organic acids is higher than the lower dose of liquid organic fertilizer.

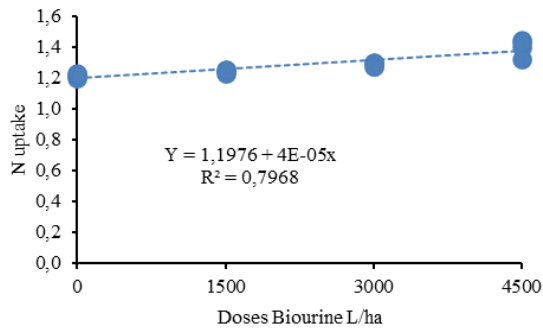


Fig 1. Correlation between biourine and N uptake

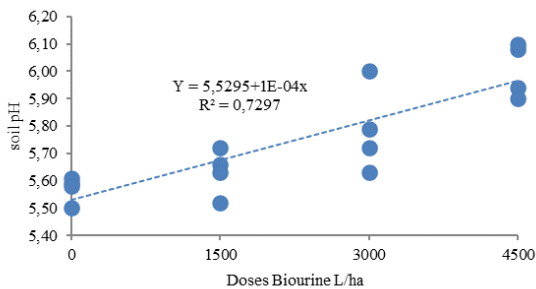


Fig 2. Correlation between biourine and soil pH

### Plant Height

The optimum dose of biourine of 2250 L ha<sup>-1</sup> yields an average plant height of 36.14 cm at 45 dap plant age. At the age of 60 days, the optimum dose of biourine was obtained at 2200 L ha<sup>-1</sup> which produced an average plant height of 37.87 cm (Figure 3). Yuliarta *et al.* (2014) showed that at plant age 42 and 56 daps there was a significant effect on the height of lettuce. Likewise the research results of Amanda *et al.* (2020) showed that biourine treatment had a significant effect on plant height. This is presumably because in this treatment the soil has the availability of organic fertilizer derived from cow urine so that it has a good impact on plant growth and development. Organic matter is a complete source of macro and micro essential nutrients, although in relatively small quantities

(Simanungkalit *et al.*, 2006). In addition, organic fertilizer also contains many microorganisms, so that it can trigger the development of microorganisms that are already in the soil.

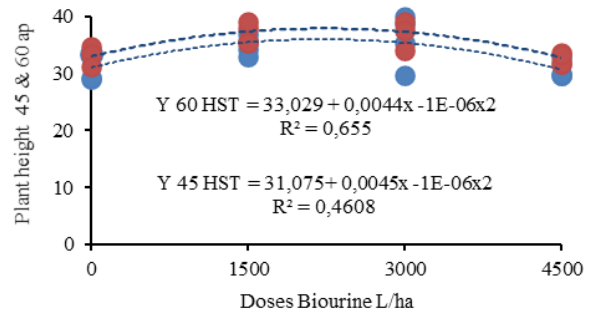


Fig 3. Correlation between biourine and plant height 45 and 60 after planting

### Biomass Fresh Weight

The optimum dose of biourine is 1250 L ha<sup>-1</sup> which produces an average biomass fresh weight of 1.44 kg (Figure 4). Biourine has fast working properties and can stimulate plant development and increase crop production so that it gives a real influence on the fresh weight of plants (Amanda *et al.*, 2020). The results of research by Nuraini *et al.* (2017) show that the application of biourine has a significant influence on the fresh weight of Pakchoi plants. The best treatment was able to increase the fresh weight of pakchoi plants to 26.06 g of plant<sup>-1</sup> or an increase of 405% compared without biourine. The results of the research Rizki *et al.* (2014) also showed that administering a dose of 400 mL L<sup>-1</sup> fertilizer could increase the total fresh weight of green mustard plants by 380% compared without the administration of cow biourin. Increased fresh weight of plants can achieve optimal results because the plants get enough nutrients so that an increase in the number and size of cells can reach optimal levels and allow for an increase in plant water content (Arinong & Lasiwua, 2011).

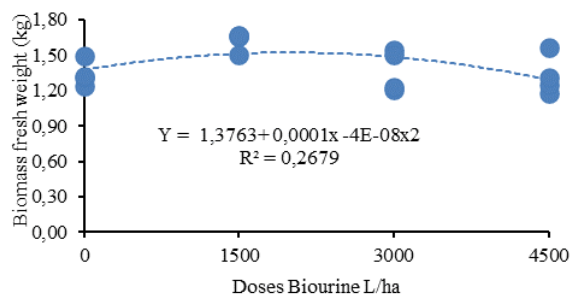


Fig 4. Correlation between biourine and biomass fresh weight

### Head Weight

Based on the regression equation, the optimum dosage of biourine is 1666.67 L ha<sup>-1</sup> which results in an average head weight of 0.83 kg (Figure 5). These results are higher than the results of Yeshiwas research (2015) that obtained the highest crop weight of 0.771 kg plant<sup>-1</sup> by giving fertilizer N of 150 kg ha<sup>-1</sup>. It is suspected that the efficiency factor of adding biourine can provide the nutrient requirements needed by cabbage. According to Subhan (1994), crop net weight is strongly influenced by the availability of nutrients in the soil and the balance of soil nutrients can affect yield. Also, according to Sulastris (2010), head weight is influenced by how much photosynthetic results are distributed to the crop area. This statement was also expressed by Wahyuni *et al.* (2004) that crop yield does not depend on how much photosynthate is given and produced but is also influenced by how much photosynthate is distributed to the plant parts.

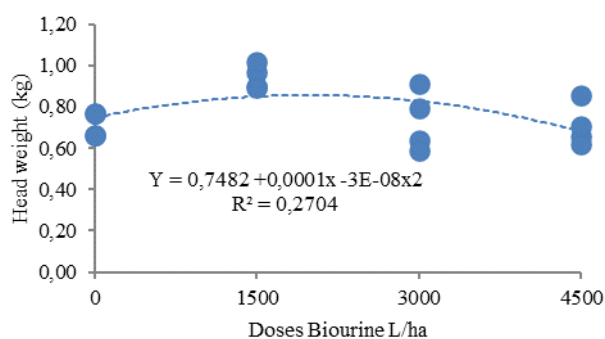


Fig 5. Correlation between biourine and head weight

### Head Diameter

Increasing doses of biourine tend to increase the cabbage diameter of the cabbage plants with an optimum biourine dose of 2000 L ha<sup>-1</sup> which results in an average head diameter of 15.36 cm (Figure 6). This shows that the application of biourine at the optimum dose significantly affects the head diameter. The provision of liquid organic fertilizer is very instrumental in the growth of cabbage plants. Organic fertilizers contain macronutrients and micronutrients needed by plants for their growth which greatly affect the physical, chemical, and biological nature of the soil (Sutanto, 2002) as plant growing media. In excess doses tend to cause damage to the leaves as a result the leaves are inhibited in the formation of crop and so it can affect the amount of crop that is formed. Plants have certain limits on nutrient concentrations (Humadi *et al.*, 2007).

Several variables have positive and negative relationships (Table 1). The results of the analysis indicated that the correlation between the growth variable and

the plant yield includes the height of the plant, the biomass fresh weight, the head weight of the crop, and the positively correlated head diameter. This is suspected because the better the growth variables then also the better the crop results. Relationships between variables are expressed positively if the value of a variable is increased, it will increase the value of other variables (Zaynudin, 2010).

Analysis of the correlation between absorption N tissues with soil pH showed positive value, an increase in soil pH is closely related to element N so that increased soil pH also followed increased levels of N soil and plants. Soil packaging has a very important role because the soil solution contains essential elements that are useful for plants. If the pH of the soil solution is increased to above 5.5 then N becomes available to the plant in the form of nitrate (Patti *et al.*, 2013).

According to Sunarjono (2011) that the most important condition to be fulfilled so that the cabbage grows well, namely the loose soil contains organic material, moist and low air temperature. Generally on lowland and high temperature cabbage plant is difficult to form crop, the other requirement is pH between 6-7 because cabbage is a plant very sensitive to low soil pH. Following the results of the final soil analysis only gained increased soil pH from 5.6 – 6.0, so on average has not reached the optimal growing requirement for cabbage plants.

Tabel 1. Correlation among experiment attributes

	Plant Height 45 a.p.	Plant Height 60 a.p.	N uptake (%)	Biomass Fresh Weight (kg)	Head Weight (kg)	Head Diameter (cm)	Soil pH
Plant Height 45	1						
Plant Height 60	0,929852	1					
N uptake (%)	-0,23454	-0,232	1				
Biomass Fresh	0,210804	0,37717	-0,204	1			
Head Weight (kg)	0,331764	0,44837	-0,197	0,923805	1		
Head Diameter (cm)	0,466929	0,60801	-0,286	0,915336	0,93696	1	
Soil pH	-0,02179	-0,0565	0,8091	-0,21726	-0,2547	-0,22861	1

### CONCLUSION

The results of the study showed that the optimum dosage was not obtained on the variable N levels of plants and soil pH, but had a very significant effect on both of these variables. The optimum dosage obtained on the variable growth and yield of plants includes the

optimum dose of 2250 L ha<sup>-1</sup> biourine producing an average plant height of 36.14 cm age 45 dap, the optimum dose of 2200 L ha<sup>-1</sup> of biourine produces an average plant height of 37.87 cm age 60 dap, optimum dose of biourine 1250 L ha<sup>-1</sup> produces an average biomass fresh weight 1.33 kg, the optimum dose of biourine 1666.67 L ha<sup>-1</sup> produces an average head weight of 0.83 kg, and optimum dose of biourine 2000 L ha<sup>-1</sup> produces average head diameter of 15.36 cm.

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