



## UTILIZATION OF SOLID ORGANICS FROM LARVAE *Oryctes rhinoceros* (Linn.) SCARABAEUS.: KOLARHINO AND LOCAL MICROORGANISMS FROM *Luffa acutangula* (L.) Roxb. ON THE SUSTAINABILITY OF HISTOSOL SOIL FERTILITY AND HEALTH

## PENGGUNAAN ORGANIK PADAT DARI LARVA *Oryctes rhinoceros* (Linn.) SCARABAEUS.: KOLARHINO DAN MIKROORGANISME LOKAL DARI *Luffa acutangula* (L.) Roxb. TENTANG KELANGSUNGAN KESUBURAN DAN KESEHATAN TANAH HISTOSOL

Erwin Junaidi Lubis<sup>1\*</sup>, Sartika Pakpahan<sup>2</sup>

<sup>1</sup>Darwan Ali University, Email: [lubiserwinjunaidi@gmail.com](mailto:lubiserwinjunaidi@gmail.com)

<sup>2</sup>Darwan Ali University

\*email koresponden: [lubiserwinjunaidi@gmail.com](mailto:lubiserwinjunaidi@gmail.com)

DOI: <https://doi.org/10.62567/micjo.v3i1.2298>

### Abstract

The excrement of horned beetle (*Oryctes rhinoceros* (Linn.) Scarabeus.) larvae, namely Kolarhino, in the soil of palm oil (*Elaeis guineensis* Jacq.) plants contains minerals that can and can improve soil fertility and health. These larvae contain minerals that can fertilize the soil, such as zinc (Zn), felium (Fe), potassium (K), and phosphorus (P) which are important for plant growth and soil health. *Luffa acutangula* (L.) Roxb. plants contain many carbohydrates and sources of nutrients needed by microbes to multiply. The mineral content of gambas in the process of local microorganisms for soil fertility is calcium (Ca), phosphorus (P), and felium (Fe) which are very supportive in the process of soil fertility. In this study, the mixture given to Histosol soil is the content of *Oryctes rhinoceros* (Linn.) Scarabaeus. larvae faeces: Kolarhino and Local Microorganisms (MoL) of *Luffa acutangula* (L.) Roxb. gave a positive impact on Histosol soil both physically and chemically.

**Keywords :** *Oryctes rhinoceros*, *Luffa acutangula*, Histosol, Local Microorganisms.

### Abstrak

Kotoran larva kumbang tanduk (*Oryctes rhinoceros* (Linn.) Scarabeus.), yaitu Kolarhino, dalam tanah tanaman kelapa sawit (*Elaeis guineensis* Jacq.) mengandung mineral yang dapat meningkatkan kesuburan dan kesehatan tanah. Larva ini mengandung mineral yang dapat menyuburkan tanah, seperti seng (Zn), besi (Fe), kalium (K), dan fosfor (P) yang penting untuk pertumbuhan tanaman dan kesehatan



tanah. Tanaman Luffa acutangula (L.) Roxb. mengandung banyak karbohidrat dan sumber nutrisi yang dibutuhkan mikroorganisme untuk berkembang biak. Kandungan mineral gambas dalam proses mikroorganisme lokal untuk kesuburan tanah adalah kalsium (Ca), fosfor (P), dan besi (Fe) yang sangat mendukung proses kesuburan tanah. Dalam penelitian ini, campuran yang diberikan ke tanah Histosol adalah kandungan kotoran larva *Oryctes rhinoceros* (Linn.) Scarabaeus: Kolarhino dan Mikroorganisme Lokal (MoL) dari Luffa acutangula (L.) Roxb., yang memberikan dampak positif pada tanah Histosol baik secara fisik maupun kimia.

**Kata Kunci :** *Oryctes rhinoceros*, Luffa acutangula, Histosol, Mikroorganisme Lokal.

## 1. INTRODUCTION

Gambas fruit (*Luffa acutangula* (L.) Roxb.) is rich in minerals that are excellent for human health. Gambas fruit also contains minerals that are good for soil health and improve soil fertility, namely calcium (Ca), phosphorus (P), and iron (Fe), which can support soil fertility and health. These minerals can have a positive impact on the growth of luffa plants (Saputra, 2021). The benefits of luffa fruit (*Luffa acutangula* (L.) Roxb.) include many nutrients needed for plant growth and soil fertility, as it contains macro and micro nutrients. Another benefit is that it can increase plant growth and fertilise the soil because it can adapt to plants and soil more quickly. The final benefit is that it improves soil structure and increases soil fertility and health (Harita et al., 2022).

The application of liquid organic materials in the form of Local Microorganisms (MoL) to soil, particularly in relation to soil fertility and health, has significant benefits. Solid Compost, Liquid Compost, Local Microorganisms, Solid Green Fertilizer, Liquid Green Fertilizer can improve soil fertility and health physically, biologically, and chemically, namely by improving soil structure, drainage, water retention capacity, and the availability of mineral nutrients in the soil for plants. Organic materials can also repair physical damage to the soil caused by excessive use of chemical fertilizers (Harita et al., 2022).

The application of Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. fruit is an effective measure in improving soil fertility and sustaining soil health for plant growth. By improving soil structure, enhancing drainage and nutrient availability, and promoting the presence of soil microorganisms, MoL (Local Microorganisms) can help fertilise Histosol soil.

*Oryctes rhinoceros* (Linn.) Scarabaeus larva faeces: Kolarhino contains mineral nutrients that can fertilise the soil, namely phosphorus (P), potassium (K) and iron (Fe). In addition to the mineral nutrients contained in the faeces of *Oryctes rhinoceros* (Linn.) Scarabaeus larvae, the faeces also contain sources of amino acids and fatty acids. In the mineral content of *Oryctes rhinoceros* (Linn.) Scarabaeus larvae excrement, phosphorus (P) nutrients help increase the availability of P mineral nutrients in the soil through mineralisation, which is the formation of compounds from organic matter.

Potassium (K) nutrients increase availability in the soil and improve plant quality and resistance to pests and diseases. Iron (Fe) nutrients play a role in photosynthesis and the formation of chlorophyll in plants, while amino acids and fatty acids play a role in



microorganisms that help break down organic matter and form humus that can be used by plants for soil fertility (Pulungan et al., 2018).

The faeces of *Oryctes rhinoceros* (Linn.) Scarabaeus larvae are a source of nutrients for plants and soil that are deficient in organic matter. These faeces contain various nutrients that are beneficial to the soil and plants, especially oil palm plants during their growth. In general, the faeces or excrement of *Oryctes rhinoceros* (Linn.) Scarabaeus can increase the nutrient content in the soil, especially soil that is deficient in phosphorus and potassium, which are very important for plant growth. Thus, the faeces of *Oryctes rhinoceros* (Linn.) Scarabaeus can help improve soil fertility and health (Fauzana et al., 2023).

Histosol soil, better known as peat soil or organic soil, is a type of soil that contains 25% to 100% organic matter and has a thickness of up to 40 cm. The organic matter contained in Histosol soil is the remains of plants and organisms that have accumulated over a long period of time. Histosol soil has hydrophilic properties, meaning it is soluble, absorbs and mixes with water, but it also has hydrophobic properties, meaning it does not require water (when dry, it does not become wet again), so it easily dries out to 100% dryness and will not become wet again.

In terms of the physical properties of Histosol soil, this soil has water content with Fibrist (organic matter not yet fully decomposed), Hemist (organic matter partially decomposed), and Saprist (organic matter highly decomposed) characteristics. This supports low particle mass and density, as well as high porosity, which results in compaction and subsidence effects (Sihite et al., 2013). Organosol or Histosol soil is referred to as peat soil if the peat thickness exceeds 50% (Najiyati et al., 2005).

## 2. RESEARCH METHOD

This research was conducted on the agricultural experimental land of PT. Surya Intisari Raya (PT. SIR) Riau, Tualang Subdistrict, Siak Regency, Riau Province. The research lasted for 4 months, from December 2024 to April 2025.

In this study, a Randomised Factorial Design (RGD) was used, consisting of an analysis of the initial Histosol soil, namely Factor 1 Application of N.P.K 16.16.16 fertilizer at a dose of 15 g.polybag-1.week-1, Factor 2: Application of *Oryctes rhinoceros* (Linn.) Scarabaeus Larvae Manure. Larvae Manure: Kolarhino at a dose of 70 g.polybag-1.week-1, Factor 3: Application of Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. fruit at a dose of 100 ml.polybag-1.week-1, Factor 4: mixture of N.P.K 16.16.16 fertilizer and *Oryctes rhinoceros* (Linn.) Scarabaeus larva manure: Kolarhino at a dose of 15 g.polybag-1 + 70 g.polybag-1 applied once.week-1, Factor 5 Mixture of N.P.K 16.16.16 fertilizer and Local Microorganisms (MoL) *Luffa acutangula* (L.) Roxb. at a dose of 15 g.polybag-1 + 100 ml.polybag-1, applied once per week, Factor 6: *Oryctes rhinoceros* (Linn.) Scarabaeus mixture. Larvae Manure: Kolarhino and Local Microorganisms (MoL) *Luffa acutangula* (L.) Roxb. at a dose of 70 g.polybag-1 + 100 ml.polybag-1, applied once.week-1.



Histosol soil or Organosol soil (peat) was taken from the palm oil plantation owned by PT. Surya Intisari Raya (PT SIR) in Riau, Tualang Subdistrict, Siak Regency, with a ratio of Histosol soil taken in the field being 65% soil to 35% peat. The Histosol soil taken was then analysed in the laboratory.

Soil analysis and experiments were conducted at the Soil Laboratory, Indonesian Oil Palm Research Institute (IOPRI or PPKS) in Medan, and the Soil, Plant, Fertilizer and Water Laboratory at the Agricultural Technology Institute (IAT or BPTP) in Johor, Medan, North Sumatra.

Initial soil analysis was conducted in a soil laboratory, covering nutrient levels of Total N (%), Total P<sub>2</sub>O<sub>5</sub> (me.100 g<sup>-1</sup>), Total K<sub>2</sub>O -Total (%), Organic Carbon (%), Cation Exchange Capacity (CEC) (me.100 g<sup>-1</sup>), Soil Acidity (pH) with a 1:1 H<sub>2</sub>O ratio, Soil Texture (%), CaO Ex. HCl 25% (%), MgO Ex. HCl 25% (%) and MnO Ex. HCl 25% (%).

Final soil analysis in the soil laboratory includes the levels of N-Total (%), P<sub>2</sub>O<sub>5</sub>-Total Ex. HCl 25% (me.100 g<sup>-1</sup>), Total K<sub>2</sub>O (%), Organic C (%), Cation Exchange Capacity (CEC) (me.100 g<sup>-1</sup>), Soil Acidity (pH) with a 1:1 H<sub>2</sub>O ratio.

### 3. RESULT AND DISCUSSION

#### a. Initial Soil Analysis – Histosol Soil

From the Initial Soil Analysis of Histosol soil, the results obtained from the soil laboratory can be seen in Table 1 as follows:

**Table 1. Initial Soil Analysis Results – Histosol Soil**

Texture	Analysis Method	Units	Results	Description
Sand	Hydrometer	%	71,10	<i>Loamy Sand</i>
Dust			29,00	
Clay			13,70	
Texture	Analysis Method	Units	Results	Description
C-Organic	Spectrofotometry	%	8,97	vh
N-Total	Kjedhal	%	0,79	h
P <sub>2</sub> O <sub>5</sub> -Total Ex. HCl 25%	Spectrofotometry	me.100 g <sup>-1</sup>	19,25	l
K <sub>2</sub> O-Total	AAS/Asam Acetat 1 N	%	0,29	vl
CEC	Volumetry/NaCl 10%	me.100 g <sup>-1</sup>	27,18	h



pH H <sub>2</sub> O	Elektrometry	----	2,70	<i>Very Sour</i>
CaO Ex. HCl 25%	Spectrofotometry	%	0,07	1
MgO Ex HCl 25%	Spectrofotometry	%	0,08	1
MnO Ex. HCl 25%	Spectrofotometry	%	0,05	1

Description : Criteria for Planting Media, h = High, l = Low, m = Medium, sl = Slightly Low, vl = Very Low, vh = Very High, nm = Not Measurable

Laboratory analysis of Histosol soil, commonly known as Organosol (peat), shows that the organic carbon (C-Organic) content reaches 8.97% with a high criterion, resulting in a cation exchange capacity (CEC) of 27.18 me.100 g<sup>-1</sup> with a high criterion. Meanwhile, for macro nutrients such as Total N, the content reached 0.79%, which is considered high. The levels of phosphorus (P) and potassium (K) nutrients are relatively low, with Total P<sub>2</sub>O<sub>5</sub> Ex. HCl 25% at 19.25 me.100 g<sup>-1</sup> (low criteria), and Total K<sub>2</sub>O nutrients (%) at 0.29% (very low criteria).

In soil acidity (pH) tests with a 1:1 ratio of H<sub>2</sub>O solution on Histosol soil, the soil was classified as highly acidic with a soil pH test result of 2.70. The high acidity of Histosol soil makes it very rarely cultivated, due to the carbon content in organic matter or the high acid content in organic matter, which causes the acidity level of Histosol soil to be very acidic. In soil acidity tests on Histosol soil with a very acidic pH level, this can be caused by the accumulation of decomposed organic matter in the soil, but under anaerobic conditions (without oxygen), resulting in humic acid and fulvic acid content becoming the main sources of soil acidity.

According to Lubis (2025), soil acidity also occurs due to the decomposition of organic matter in the soil that occurs in anaerobic conditions (anaerobic process), causing soil acidity to range from slightly acidic to highly acidic. Meanwhile, Hanafiah *et al.* (2009) state that organic acids such as humic acid and fulvic acid cause soil acidity, as these organic acids have reactive carboxylate and phenol groups that cause soil acidity.

In the Histosol soil texture test, the sand fraction was 71.10%, the silt fraction was 29.00%, and the clay fraction was 13.70% with loamy sand criteria. These criteria were tested based on soil samples taken in the field with a composition of 65% soil and 35% peat.

The CaO nutrient content of 0.07% is classified as low, as are the MgO nutrient content of 0.08% and the MnO nutrient content of 0.05%.

Soil nutrient level testing of Histosol was conducted to determine whether the nutrient level of Histosol soil is fertile for plants or not. The organic matter content in Histosol soil is relatively high, resulting in a relatively high organic carbon (C-Organic) content due to the abundance of organic matter in peat soil. In addition to the high organic carbon content, the cation exchange capacity (CEC) is also relatively high due to the large amount of organic matter



in Histosol soil, resulting in good cation exchange capacity in Histosol soil for potassium, magnesium, and calcium (Hanafiah *et al.*, 2009).

Testing of mineral nutrient levels in macro-nutrient soils shows that nitrogen nutrients have relatively high nutrient levels, enabling photosynthesis in plants to occur, and nutrient cation processes in the soil also take place. Meanwhile, phosphorus and potassium nutrients have relatively low levels, due to the nature of Histosol soil, which has low water retention capacity, as Histosol soil has large pores that allow water to enter and flow throughout the soil area. The soft texture of Histosol soil results in a clayey texture that makes porosity low and soil pores large. This results in the soil's ability to absorb water.

## b. Final Soil Analysis – Histosol Soil

### 1) N-Total Content of Soil

From the Final Soil analysis of Histosol soil, the results obtained from the soil laboratory can be seen in Table 2 as follows:

**Table 2. Results of N-Total Soil Analysis – Histosol Soil**

Analysis	N-Total (%)			
	Dosage	Units	Results	Description
N.P.K Fertilizer 16.16.16	15	g.polybag <sup>-1</sup>	0,79	h
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	70	g.polybag <sup>-1</sup>	0,80	h
<i>Luffa acutangula</i> (L.) Roxb.	100	ml.polybag <sup>-1</sup>	0,80	h
N.P.K 16.16.16 + <i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	15 +	g.polybag <sup>-1</sup>	0,82	vh
N.P.K 16.16.16 + <i>Luffa acutangula</i> (L.) Roxb.	15 +	g.polybag <sup>-1</sup> +	0,83	vh
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino + <i>Luffa acutangula</i> (L.) Roxb.	70 +	g.polybag <sup>-1</sup> +	0,83	vh
<i>Luffa acutangula</i> (L.) Roxb.	100	ml.polybag <sup>-1</sup>		

Description : Criteria for Planting Media, h = High, l = Low, m = Medium, sl = Slightly Low, vl = Very Low, vh = Very High, nm = Not Measurable

Based on Table 2, there is an impact on the increase in total soil nitrogen (N-Total) levels after application. In the table, the application of solid organic matter from *Oryctes rhinoceros* (Linn.) Scarabaeus: Kolarhino larvae mixed with Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. fruit at a normal dose of 70 g.polybag<sup>-1</sup> + 100 ml.polybag<sup>-1</sup> produced a soil N-Total analysis result of 0.83% with a very high criterion, but this was not significantly different from the mixture of N nutrient fertilizer. P.K 16.16.16 and Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. fruit at a normal dose of 15 g.polybag<sup>-1</sup> + 100 ml.polybag<sup>-1</sup> showed 0.83% with a very high criterion.



This is due to the effect of using Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. The fruit is added to Histosol soil, as MoL *Luffa acutangula* (L.) Roxb. contains macronutrients such as N, P, K that can improve soil fertility and health and increase the nitrogen (N) content needed by plants for growth and green leaf formation in the soil. In addition to the role of MoL *Luffa acutangula* (L.) Roxb., the role of *Oryctes rhinoceros* (Linn.) Scarabaeus larva manure is also very important for soil fertility and health, because larva manure can help increase and raise the level of total nitrogen (N) in the soil. According to Agustina (1990) in Pulungan *et al.* (2018), nitrogen (N) is a major component in plant organ formation, thus playing a role in improving plant fertility, health, and vegetative growth.

This indicates that nutrient absorption can occur in Histosol (Organosol or Peat) soils, resulting in a fairly good increase in nitrogen nutrients. This allows Histosol or Organosol soils to be considered fairly good based on the soil nutrient status index graph. According to Lubis *et al.* (2023), the total nitrogen level in soils with acidic to highly acidic conditions is quite good at a level of 0.83% N-Total or below, because soil N-Total refers to the total amount of nitrogen contained in the soil in both organic and inorganic forms.

## 2) P<sub>2</sub>O<sub>5</sub> – Total Ex. HCl 25% Content of Soil

From the initial soil analysis of Histosol soil, the results obtained from the soil laboratory can be seen in Table 3 as follows:

**Table 3. Results of Analysis P<sub>2</sub>O<sub>5</sub> – Total Ex. HCl 25% - Histosol Soil**

Analysis	P <sub>2</sub> O <sub>5</sub> -Total Ex. HCl 25% (me.100 g <sup>-1</sup> )			
	Dosage	Units	Results	Description
N.P.K Fertilizer 16.16.16	15	g.polybag <sup>-1</sup>	29,67	m
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	70	g.polybag <sup>-1</sup>	32,10	m
<i>Luffa acutangula</i> (L.) Roxb.	100	ml.polybag <sup>-1</sup>	32,15	m
N.P.K 16.16.16 + <i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	15 +	g.polybag <sup>-1</sup>	35,29	m
N.P.K 16.16.16 + <i>Luffa acutangula</i> (L.) Roxb.	15 +	g.polybag <sup>-1</sup> +	35,42	m
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino + <i>Luffa acutangula</i> (L.) Roxb.	70 +	g.polybag <sup>-1</sup> +	38,76	m
	100	ml.polybag <sup>-1</sup>		

Description : Criteria for Planting Media, h = High, l = Low, m = Medium, sl = Slightly Low, vl = Very Low, vh = Very High, nm = Not Measurable

Based on Table 3, the analysis of Histosol soil in the P<sub>2</sub>O<sub>5</sub>-Total nutrient test with 25% HCl showed an increase. The application of a mixture of solid organic matter from *Oryctes rhinoceros* (Linn.) Scarabaeus: Kolarhino larvae manure and Local Microorganisms (MoL)



from *Luffa acutangula* (L.) Roxb. fruit at a dose of 70 g per polybag + 100 ml per polybag showed the highest increase in Histosol soil, amounting to 38.76 me per 100 g. Meanwhile, the application of a mixture of organic N.P.K 16.16.16 + *Luffa acutangula* (L.) Roxb. fruit at a dose of 15 g.polybag<sup>-1</sup> + 100 ml. polybag<sup>-1</sup>, the increase in phosphorus in Histosol soil of 35.42 me.100 g<sup>-1</sup> was not significantly different from the application of a mixture of organic N.P.K 16.16 and *Oryctes rhinoceros* (Linn.) larvae manure and Scarabaeus larvae manure. Kolarhino at a dose of 15 g.polybag<sup>-1</sup> + 70 g.polybag<sup>-1</sup> to achieve good phosphorus addition in plants at 35.29 me.100 g<sup>-1</sup>.

According to Saputra *et al.* (2024), the phosphorus nutrient level in Histosol (Organosol or Peat) soil is very low, so sufficient phosphorus nutrients need to be added to improve soil fertility. Meanwhile, according to Pulungan *et al.* (2018), the application of *Oryctes rhinoceros* (Linn.) Scarabaeus: Kolarhino larvae manure is believed to increase the activity of organisms in the soil, where the activity of these microorganisms can improve the physical and chemical properties of the soil.

This results in low phosphorus (P) nutrient content in the soil. With the addition of organic matter, the phosphorus nutrient content becomes quite significant. According to Lubis *et al.* (2023) and Sambora (2020), a phosphorus (P) nutrient content of 38.76 me.100 g<sup>-1</sup> is considered good because the average phosphorus (P) nutrient content in the soil is still relatively low. This also indicates that the potential to achieve better soil fertility and health is lacking in phosphorus (P) nutrients.

The application of solid organic matter from the faeces of *Oryctes rhinoceros* (Linn.) Scarabaeus larvae: Kolarhino, which contains various mineral nutrients, is ideal for soil fertility. The minerals contained in the larvae faeces help plants, improve soil quality, and support the overall soil nutrient cycle.

### 3) Content K<sub>2</sub>O – Total Soil

From the initial soil analysis of Histosol soil, the results obtained from the soil laboratory can be seen in Table 4 as follows:

**Table 4. Results of K<sub>2</sub>O – Total Analysis – Histosol Soi**

Analysis	K <sub>2</sub> O-Total (%)			
	Dosage	Units	Results	Description
N.P.K Fertilizer 16.16.16	15	g.polybag <sup>-1</sup>	0,72	m
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	70	g.polybag <sup>-1</sup>	1,08	m
<i>Luffa acutangula</i> (L.) Roxb.	100	ml.polybag <sup>-1</sup>	1,10	m
N.P.K 16.16.16 + <i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	15 +	g.polybag <sup>-1</sup>	1,35	h
N.P.K 16.16.16 + <i>Luffa acutangula</i> (L.) Roxb.	15 +	g.polybag <sup>-1</sup> +	1,39	h



	100	ml.polybag <sup>-1</sup>		
<i>Oryctes rhinoceros</i> (Linn.)	70	g.polybag <sup>-1</sup>		
Scarabaeus.: Kolarhino +	+	+	1,55	h
<i>Luffa acutangula</i> (L.) Roxb.	100	ml.polybag <sup>-1</sup>		

Description : Criteria for Planting Media, h = High, l = Low, m = Medium, sl = Slightly Low, vl = Very Low, vh = Very High, nm = Not Measurable

Based on Table 4, it can be concluded that the highest total soil potassium (K<sub>2</sub>O-Total) test results were found in the application of organic materials in the form of *Oryctes rhinoceros* (Linn.) Scarabaeus: Kolarhino larvae manure and Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. fruit at a dose of 70 g.polybag<sup>-1</sup> + 100 ml.polybag<sup>-1</sup> with a test result of 1.55% total potassium in Histosol soil. It can be said that with the presence of organic matter in Histosol soil or decaying plant and animal remains, decomposition will occur in the soil, thereby forming potassium levels in Histosol soil.

According to Rauf and Harahap (2019) in Siregar *et al.* (2021), the potassium nutrient content in Histosol soil (peat soil or Organosol) tends to be low to very low, with a potassium content of 1.55%. This can be considered with or without the addition of additional potassium fertilizer. Meanwhile, according to Wang and Wu (2017), potassium is a nutrient that plants need in large quantities after nitrogen and phosphorus in the photosynthesis process.

It is said that it is important to provide potassium nutrients in Histosol soil because the potassium nutrient content in this soil is relatively very low. With a potassium level of 1.55%, this makes the level quite good and there is no need to worry about Histosol soil after application. Periodically, it is necessary to monitor and ensure the nutrients contained in Histosol soil.

#### 4) Content C-Organic of Soil

From the initial soil analysis of Histosol soil, the results obtained from the soil laboratory can be seen in Table 5 as follows:

**Table 5. Results of Soil Organic Carbon Analysis (C-Organic) – Histosol Soil**

Analysis	C-Organic (%)			
	Dosage	Units	Results	Description
N.P.K Fertilizer 16.16.16	15	g.polybag <sup>-1</sup>	11,70	vh
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	70	g.polybag <sup>-1</sup>	14,87	vh
<i>Luffa acutangula</i> (L.) Roxb.	100	ml.polybag <sup>-1</sup>	16,17	vh
N.P.K 16.16.16 + <i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	15 +	g.polybag <sup>-1</sup>	20,74	vh
N.P.K 16.16.16 + <i>Luffa acutangula</i> (L.) Roxb.	15 +	g.polybag <sup>-1</sup>	22,89	vh
	100	ml.polybag <sup>-1</sup>		
	70	g.polybag <sup>-1</sup>	25,79	vh



<i>Oryctes rhinoceros</i> (Linn.)	+	+
Scarabaeus.: Kolarhino +	100	ml.polybag <sup>-1</sup>
<i>Luffa acutangula</i> (L.) Roxb.		

Description : Criteria for Planting Media, h = High, l = Low, m = Medium, sl = Slightly Low, vl = Very Low, vh = Very High, nm = Not Measurable

Based on Table 5, it is known that there was an increase in soil organic carbon (C-Organic) levels, which were initially relatively high, from 8.97% to 25.79%. This increase reached approximately 16.82%. The increase in soil organic carbon content was caused by the application of solid organic matter from *Oryctes rhinoceros* (Linn.) Scarabaeus. Larvae faeces: Kolarhino and Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. fruit at a dose of 70 g.polybag<sup>-1</sup> + 100 ml.polybag<sup>-1</sup>. It is possible that the organic content in the soil has been fulfilled by organic matter from plant or animal residues, resulting in relatively high nutrient content, and the addition of solid organic matter will also increase organic carbon.

It is said that the level of organic carbon in the soil is still considered good and of sufficient quality, and meets the requirements for organic carbon levels in Histosol soil. This high level of organic carbon means that the soil contains sufficient organic matter and is suitable for planting crops, as the organic matter content in Histosol soil must be in the range of 20-30%.

According to Pardede *et al.* (2021), the increase in organic matter content also comes from combustion residues and dead plant residues. This allows for organic fertilisation so that the reclaimed soil has a high organic carbon content.

This indicates that the organic carbon (C-Organic) content in the solid organic matter of *Oryctes rhinoceros* (Linn.) Scarabaeus. larval faeces from Kolarhino can increase the C-Organic nutrient content in Histosol soil, and local microorganisms from *Luffa acutangula* (L.) Roxb. fruit can also increase the C-Organic nutrient level, which is excellent for the fertility and health of Histosol soil.

### 5) Soil Cation Exchange Capacity Content

From the initial soil analysis of Histosol soil, the results obtained from the soil laboratory can be seen in Table 6 as follows:

**Table 6. Results of Cation Exchange Capacity Analysis – Histosol Soil**

Analysis	CEC (me.100 g <sup>-1</sup> )			
	Dosage	Units	Results	Description
N.P.K Fertilizer 16.16.16	15	g.polybag <sup>-1</sup>	28,87	h
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	70	g.polybag <sup>-1</sup>	32,10	h
<i>Luffa acutangula</i> (L.) Roxb.	100	ml.polybag <sup>-1</sup>	33,15	h
N.P.K 16.16.16 + <i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	15 +	g.polybag <sup>-1</sup>	38,87	H
	70			
	15	g.polybag <sup>-1</sup>	43,18	vh



N.P.K 16.16.16 + <i>Luffa acutangula</i> (L.) Roxb.	+	+		
	100	ml.polybag <sup>-1</sup>		
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino +	70	g.polybag <sup>-1</sup>	47,89	vh
<i>Luffa acutangula</i> (L.) Roxb.	+	+		
	100	ml.polybag <sup>-1</sup>		

Description : Criteria for Planting Media, h = High, l = Low, m = Medium, sl = Slightly Low, vl = Very Low, vh = Very High, nm = Not Measurable

As shown in Table 6, there was an increase in the cation exchange capacity (CEC) of Histosol soil, from 27.18 me.100 g<sup>-1</sup> to 47.89 me.100 g<sup>-1</sup>. The difference in increase ranged from 20.71 me.100 g<sup>-1</sup>. This indicates that cation exchange capacity depends on the amount of organic matter in the soil, which causes an increase in cation exchange capacity (CEC).

According to Lubis (2023), the cation exchange capacity (CEC) content based on the analysis results is considered high, and the Histosol soil is very good. High cation exchange capacity (CEC) in soil indicates that the soil has the ability to provide nutrients that are important for plant growth and soil health.

According to Hanafiah *et al.* (2009) and Rauf and Harahap (2019), the nutrient level in the CEC test on acidic soil that has been given sufficient organic material can increase the cation exchange capacity (CEC) of the soil, thereby improving the soil's ability to provide nutrients.

This indicates that the organic matter content in Histosol soil is very high, thereby influencing the increase in CEC levels, as well as affecting soil acidity (pH) and organic carbon (Organic C) levels. According to Pardede *et al.* (2021) and Siregar *et al.* (2021), peat soil (Histosol) stores higher levels of carbon in the soil compared to mineral soil. Histosol soil has terrestrialised properties, which cause the formation of a limnic framework with natural mud, enabling it to store KTK (cation exchange capacity) levels well and exchange with positive ions in the soil.

#### 6) Content potential of Hydrogen H<sub>2</sub>O Ratio 1:1 Soil

From the initial soil analysis of Histosol soil, the results obtained from the soil laboratory can be seen in Table 7 as follows:

**Table 7. potential of Hydrogen H<sub>2</sub>O Analysis Results – Histosol Soil**

Analysis	potential of Hydrogen H <sub>2</sub> O			
	Dosage	Units	Results	Description
N.P.K Fertilizer 16.16.16	15	g.polybag <sup>-1</sup>	4,5	Sour
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	70	g.polybag <sup>-1</sup>	5,5	Sour
<i>Luffa acutangula</i> (L.) Roxb.	100	ml.polybag <sup>-1</sup>	5,6	Slightly Sour
N.P.K 16.16.16 + <i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino	15 +	g.polybag <sup>-1</sup>	5,7	Slightly Sour



N.P.K 16.16.16 + <i>Luffa acutangula</i> (L.) Roxb.	15 +	g.polybag <sup>-1</sup> +	6,8	Neutral
<i>Oryctes rhinoceros</i> (Linn.) Scarabaeus.: Kolarhino + <i>Luffa acutangula</i> (L.) Roxb.	70 +	g.polybag <sup>-1</sup> +	6,8	Neutral
	100	ml.polybag <sup>-1</sup>		

Table 7 shows the results of soil acidity (pH) analysis on Histosol soil. The soil, which was originally very acidic, is now close to neutral. Table 7 shows that the acidity level in the application of a mixture of solid organic matter from *Oryctes rhinoceros* (Linn.) Scarabaeus: Kolarhino larvae manure and Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. fruit at a dose of 70 g.polybag<sup>-1</sup> + 100 ml. per polybag<sup>-1</sup>, the soil pH was 6.8, which was not significantly different from the application of a mixture of N.P.K 16.16.16 and Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. fruit at a dose of 15 g per polybag<sup>-1</sup> + 100 ml per polybag<sup>-1</sup>, which resulted in a soil pH of 6.8.

This is because a pH level (soil acidity) of 6.8 is excellent and optimal for plant growth. A pH (soil acidity) between 6 and 8 is considered neutral and very suitable for plant growth and development.

According to Yunita *et al.* (2023), the acidic reaction of Histosol soil is caused by organic acid compounds that decompose in the soil without the aid of air, resulting in the formation of organic acids in Histosol soil.

According to Yang *et al.* (2021), efforts were made to increase soil acidity (pH) by using agricultural lime (Kaptan or Dolomite) and fertilising with organic materials that can increase soil acidity to slightly acidic. According to Zhou *et al.* (2021), pH (soil acidity) is one of the limiting factors in the decomposition of organic matter in the soil because it affects the activity of microorganisms in the soil.

The results of research by Hikmatullah and Sukarman (2014) show that soil acidity (pH) in peat soil or Histosol soil with high acidity levels is an important factor in limiting the decomposition of organic matter. According to Zhang *et al.* (2021), peat soil has a relatively high pH of 3-5, so the acidity level still needs to be increased by applying organic materials such as local microorganisms. The results of research by Siregar *et al.* (2021) show that the acidity level of Histosol soil is caused by drainage conditions and organic acid hydrolysis.

#### 4. CONCLUSION

In conclusion, it was concluded that research conducted on Histosol soil or peat soil with a ratio of 65% soil and 35% peat, using *Oryctes rhinoceros* (Linn.) Scarabaeus insect larvae as solid organic material, showed that: Kolarhino and Local Microorganisms (MoL) from *Luffa acutangula* (L.) Roxb. fruit, there is an increase in the fertility and health of Histosol soil.

#### 5. REFERENCES

Agustina, L. 1990. Dasar Nutrisi Tanaman. Rhineka Cipta, Jakarta.



- Fauzana, H., R. Rustam, D. Salbiah and P. Aritonang. 2023. Compost Organic Materials' Suitability as a Living Place for Rhinoceros Beetle Larvae (*Oryctes rhinoceros* Linnaeus) in Oil Palm Area. *Journal of Plant Protection*, 7(1): 11-21.
- Hanafiah, A.S., T. Sabrina, and H. Guchi. 2009. *Biologi dan Ekologi Tanah*. USU Press, Medan.
- Harita, G., E. Panggabean, and A. Rahman. 2022. Respon Pertumbuhan dan Produksi Tanaman Gambas (*Luffa acutangula* L.) dengan Pupuk Organik Cair Limbah Industri dan Kompos Kulit Bawang Merah. *Jurnal Ilmiah Pertanian*, 4(2): 96-110.
- Hikmatulla and Sukarman. 2014. Physical and Chemical Properties of Cultivated Peat Soils in Four Trial Sites of ICCTF in Kalimantan and Sumatra, Indonesia. *J. Trop Soils*, 19(3): 131-141.
- Lubis, E.J. 2025. Effect of Biochar on Growth of Main Nursery Palm Oil Seedlings (*Elaeis guineensis* Jacq.) on Soil Chemical Properties in Vertisol Soil Planting Media. *Tropical Plantation Journal*, 4(1): 35-43.
- Lubis, E.J., A. Rauf, and Sarifuddin. 2023. Effectiveness of Fertilization Techniques on Growth Two Varieties of Palm Oil Seeds (*Elaeis guineensis* Jacq.) in Main Nursery. *Journal of Social Research*, 2(8), 2759-2772.
- Najiyati, S., I. Muslihat, and I.N.N. Suryadiputra. 2005. *Panduan Pengelolaan Lahan Gambut untuk Pertanian Berkelanjutan*. Proyek Climate Change, Forest and Peatlands in Indonesia. Wetlands International – Indonesian Programme and Wildlife Habitat Canada, Bogor, Indonesia.
- Pardede, A.E., N. Yulianti, A. Sajarwan, Sustiyah, and F.F. Adji. 2021. Kajian C-Organik Gambut Pedalaman pada Berbagai Tutupan Lahan. *Jurnal Penelitian UPR : Kaharati*, 1(2): 54-63.
- Pulungan, D.R., Wardati, and H. Fauzana. 2018. Pemberian Kotoran Larva Kumbang Tanduk (*Oryctes rhinoceros*) untuk Meningkatkan Pertumbuhan Bibit Kelapa Sawit (*Elaeis guineensis* Jacq) di Pembibitan Utama. *Jurnal Photon*, 8(2): 45-51.
- Rauf, A., and F.S. Harahap. 2019. *Optimalisasi Lahan Pertanian menggunakan Agen Biomassa*. Medan (ID): USU Press, Medan.
- Sambora, R. 2020. Kandungan Hara Makro Tanah Gambut pada Pemberian Kompos Limbah Kulit Durian dan Pengaruhnya terhadap Pertumbuhan Tanaman Kangkung (*Ipomea reptans* Poir.). Skripsi, Fakultas Pertanian dan Peternakan, Universitas Islam Negeri Sultan Syarif Kasim, Riau.
- Saputra, R. 2021. Respon Produksi Tanaman Gambas (*Luffa acutangula* (L.) Roxb.) terhadap POC Buah-Buahan dan Pupuk P. Skripsi Fakultas Pertanian, Universitas Islam Riau.
- Saputra, R.A., S. Fatimah, M. Noor, and Jumar. 2024. Dynamics of Acidity and Ionic Status in Peat Soil Amended with Various Types of Ash. *Agrotechnology Research Journal*, 8(2): 120-129.
- Sihite, L., W. Marbun, and Mukhlis. 2013. Klasifikasi Tanah Gambut yang Dijadikan Sawah dan Dialihfungsikan menjadi Pertanaman Kopi Arabika dan Hortikultura. *Jurnal Online*



- Agroekoteknologi, 2(1): 200-212.
- Siregar, A., H. Walida, K.D. Sitanggang, F.S. Harahap, and Y. Triyanto. 2021. Characteristics of Soil Chemical Properties of Peatlands in Gelangal Plantation in Sei Baru Village, Panai Hilir District, Labuhan Batu Regency. *Agrotechnology Research Journal*, 5(1): 56-62.
- Wang, Y., and W.H. Wu. 2017. Regulation of Potassium Transport and Signaling in Plants. *Curr Opin Plant Biol.* 39: 123-128.
- Yang, L., Y. Ru, S. Xu, T. Liu, and L. Tan. 2021. Bioresource Technology Features Correlated to Improved Enzymatic Digestibility of Corn Stover Subjected to Alkaline Hydrogen Peroxide Pretreatment. *Bioresource Technol* 325: 124688.
- Yunita, Zuraida, and Y. Jufri. 2023. Status Hara Tanah pada Lahan Sawah untuk Pengembangan Padi Organik di Tenggulun Kabupaten Aceh Tamian. *Jurnal Ilmiah Mahasiswa Pertanian*, 8(2): 461-467.
- Zhang, L., M. Gallka, A. Kumar, M. Liu, K.H. Knorr, and Z.G. Yu. 2021. Plant Succession and Geochemical Indices in Immature Peatlands in the Changbai Mountains, Northeastern Region of China: Implication for Climate Change and Peatland Development. *Sci Total Environ*, 773.
- Zhou, C., C. Li, S. Siva, H. Cui, and L. Lin. 2021. Chemical Composition, Antibacterial Activity and Study of the Interaction Mechanisms of The Main Compounds present in the *Alpinia Galanga* rhizomes essential oil. *Ind Crops Prod*, 165: 113441.