

Test of Drip Water Application on *Saccharum officinarum* Linn. and Dreg Litter on Physical and Chemical Fertility of Mollisol Soil and Plant Growth of *Allium schoenoprasum* (L.) Chives

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Abstract

The content of *Saccharum officinarum* Linn. is a plant that contains water which is very sweet and good for human health and very good for the soil because the water contained in *Saccharum officinarum* Linn. is very good and can increase soil fertility and contains important nutrients, namely nutrients N, P, and K. *Saccharum officinarum* Linn. water droplets play an important role as a natural liquid organic fertilizer that can improve soil structure and the ability of plant roots and soil to absorb nutrients. *Allium schoenoprasum* (L.) Chives is one type of plant including leeks which is widely used as an additional seasoning for cooking, and is commonly referred to as Lokio or Lengkiu or also hobo leeks. Growth in this hobo leek plant really requires a lot of nutrients or macro nutrients N, P, and K as a process of growth, as well as good and fertile soil media as a place of growth.

Keywords: *Saccharum officinarum*, *Allium schoenoprasum*, Batak Leek, Lokio, Lengkiu

1. Introduction

Batak leek plant or scientific name is referred to as *Allium schoenoprasum* (L.) Chives is one type of plant that is widely used, especially Batak people who are used as a seasoning for cooking because it has a delicious aroma. In addition, the benefits of the *Allium schoenoprasum* (L.) Chives plant for health are maintaining eye health, preventing premature aging, containing lots of vitamin K, increasing fertility, preventing thrush and rich in minerals and dietary processes and also able to neutralise toxins in the body (Bah et al., 2012).

Saccharum officinarum Linn. is a plant that is rich in sweet water content and has a round stem shape and has a few white hairs that prevent pest attacks. *Saccharum officinarum* Linn. has a positive impact on soil fertility levels which are rich in macro mineral nutrients namely nitrogen (N), phosphorus (P), and potassium (K) and rich in micro minerals such as magnesium (Mg), zinc (Zn), and copper (Cu) which easily absorb water and which can support the photosynthesis process in plants. The use of *Saccharum officinarum* Linn. plants as liquid organics and also the use of pulp litter as solid organics can fertilise the soil because it is rich in benefits for soil fertility, and does not leave toxic residues that can poison the soil and plants (Kadarwati, 2016).

Saccharum officinarum Linn. droplets contain natural sugar content which provides extra energy for plants. The sugar contained in *Saccharum officinarum* Linn. is able to increase plant growth and productivity naturally. The content contained in *Saccharum officinarum* Linn. drops is phosphorus (P)



which is needed by plants as the development of plant roots, and sufficient phosphorus content in the soil, plants will grow well and produce quality (Aprianto, 2022).

Saccharum officinarum Linn. litter or pulp is a waste rich in organic matter that can be processed into organic fertilizer and organic mulch. It can be applied to the soil base because it has great benefits for soil and plants, one of which is improving soil structure, soil acidity (pH), increasing soil microbial content and also increasing the content of macro and micro nutrients of soil (Iqbal, 2012).

The reason researchers conducted research on drip water and litter dregs of *Saccharum officinarum* Linn. plants to determine the growth and development of leek plants *Allium schoenoprasum* (L.) Chives which can grow on Mollisol soil media. In the analysis of soil fertility in Mollisol soil, an application analysis test was carried out on the application of *Saccharum officinarum* Linn. drip water applied and litter dregs used from the final product of *Saccharum officinarum* Linn. and formulations on the use of inorganic fertilizer 16.16.16 + 0.5 + 6 into Mollisol soil.

2. Methods

This research was conducted at the Soil Laboratory Research Farm of the Insitut Teknologi Sawit Indonesia, Medan. This research was conducted for 3 months from January 2025 to April 2025. In this study, the materials used were the fruit of *Saccharum officinarum* Linn. namely with the type of variety VMC 7616, Mollisol soil taken from the Palm Oil Plantation PPKS Tanjung Morawa, North Sumatra, as well as inorganic fertilizers N.P.K+Mg+Ca 16.16.16+0.5+6, and others.

This study used a Factorial Randomised Group Design (RAK) consisting of Factor 1 Drip Water of *Saccharum officinarum* Linn. (S₁) with a dose of 100 ml.polybag⁻¹ + *Saccharum officinarum* Linn litter (A₁) at a dose of 100 g.polybag⁻¹ + Nutrient Fertilizer 16.16.16+0.5+6 (P₁) at a dose of 5 g.polybag⁻¹, Factor 2 Drip Water of *Saccharum officinarum* Linn. (S₂) at a dose of 200 ml.polybag⁻¹ + *Saccharum officinarum* Linn litter (A₂) at 200 g.polybag⁻¹ + Nutrient Fertilizer 16.16.16+0.5+6 (P₂) at a dose of 10 g.polybag⁻¹, Factor 3 Drip Water of *Saccharum officinarum* Linn. (S₃) at a dose of 300 ml.polybag⁻¹ + *Saccharum officinarum* Linn litter (A₃) at 300 g.polybag⁻¹ + Nutrient Fertilizer 16.16.16+0.5+6 (P₃) at a dose of 15 g.polybag⁻¹.

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

The observations and indicators in this research consist of initial soil test observations on Mollisol Soil consisting of Soil Texture (%), Soil Acidity in potential of Hydrogen (pH) H₂O, Soil C-Organic (%), N-Total (%), P₂O₅-Total HCl 25% (me.100 g⁻¹), K₂O-Potential Ex. HCl 25% (me.100 g⁻¹), Cation Exchange Capacity (CEC) (me.100 g⁻¹), and the final observations on Mollisol Soil are Soil Acidity (pH) H₂O, Soil C-Organic (%), N-Total (%), P₂O₅-Total HCl 25% (me.100 g⁻¹), K₂O-Potential Ex. HCl 25% (me.100 g⁻¹), Cation Exchange Capacity (CEC) (me.100 g⁻¹), and observation of plant growth of *Allium schoenoprasum* (L.) Chives namely on the length of onion leaves (cm).

3. Results and Discussion

3.1. Results of Analysis of Physical and Chemical Properties of Inceptisol Soil

a. Initial Soil Analysis – Mollisol Soil

To determine the characteristics of planting media in Mollisol Soil, an initial analysis of the quality and fertility of Mollisol soil was conducted. The following Table 1 lists the results of the initial soil analysis on Mollisol Soil, as follows:

Table 1. Preliminary Soil Analysis Results – Mollisol Soil

Texture	Method of Analysis	Units	Results	Description
Sand	Hydrometer	%	49,10	Clay
Dust			48,00	
Clay			11,00	
Analysis	Method of Analysis	Units	Results	Description
C-Organic	Spectrophotometry	%	4,00	m
N-Total	Kjedhal	%	0,49	m
P ₂ O ₅ -Total HCl 25%	Spectrophotometry	me.100 g ⁻¹	21,55	m
K ₂ O Potential Ex. HCl 25%	AAS/ Acetic Acid 1 N	me.100 g ⁻¹	0,98	m
CEC	Volumetry/NaCl 10%	me.100 g ⁻¹	22,78	m
pH H ₂ O	Electrometry	---	5,9	h (Slightly Sour)

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

The results of soil analysis tested on the physical and chemical properties of soil are listed in Table 1, where the physical properties of soil are soil texture. The soil texture consists of three fractions: sand, dust, and clay. The sand fraction is 49.10%, the dust fraction is 48.00% and the clay fraction is 11.00% with loam criteria.

In the soil chemical analysis test where the organic carbon test (C-Organic) is 4.00% with moderate criteria, while N-Total is 0.49% with moderate criteria, P₂O₅-Total HCl 25% is 21.55 me.100 g⁻¹ with moderate criteria, K₂O-Potential Ex. HCl 25% is 0.98 me.100 g⁻¹ with moderate criteria, Cation Exchange Capacity (CEC) is 22.78 me.100 g⁻¹ with moderate criteria, and Soil acidity (pH) H₂O is 6.5 with high criteria and slightly acidic. It can be concluded that in the initial analysis of the Mollisol soil, it was found to be rich in organic matter resulting in moderate levels of organic carbon in the soil, dark in colour and with a fertile surface suitable for agricultural use.

According to Yosephine et al. (2022) stated that soils that have a characteristic horizon that is rich in available and abundant nutrients, plant growth will be better and more fertile. Meanwhile, according to Lubis et al. (2025), soil fertility in each soil has different characteristics, depending on the characteristics of each soil. Soils rich in organic matter will obviously have a content rich in nitrogen and potassium as well as high levels of organic carbon that are needed by plants.

In the test of Soil Acidity (pH) H₂O in Mollisol Soil, that soil pH has an analysis result of 6.5 with slightly acidic criteria. In plant growth, both horticultural crops and annual crops, plants will be able to grow with soil acidity levels ranging from 5.5 - 7.0. With such pH levels, plants will be able to grow, and microbial conditions in the soil can grow and digest food in the soil so that organic matter in the soil can function for plants in their growth (Siswanto, 2019; Novizan, 2002; Hadad et al., 2006; Lubis, 2025).

b. Final Analysis of Mollisol Soil – Soil Acidity (pH)

To determine the characteristics of the growing media in Mollisol Soil, a final analysis of the quality and fertility of the Mollisol soil that has been applied is conducted. The following Table 2 lists the results of the final soil analysis on Mollisol Soil, as follows:

Table 2. Final Analysis of Mollisol Soil – Soil Acidity

potential of Hydrogen (pH)				
Drip Water <i>Saccharum officinarum</i> Linn.	Dreg Litter <i>Saccharum officinarum</i> Linn.	Nutrient Fertilizer 16.16.16+0.5+6		
		g.polybag ⁻¹		
ml.polybag ⁻¹	g.polybag ⁻¹	5	10	15
100	100	6,0 n	6,4 n	6,5 n
200	200	6,5 n	6,8 n	6,9 n
300	300	7,0 n	7,0 n	7,2 n

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

In the observation of the potential of Hydrogen (pH) analysis in Table 2, the soil acidity is neutral, this is due to the influence of Drip Water *Saccharum officinarum* Linn. and Dreg Litter *Saccharum officinarum* Linn. to Mollisol soil media. Mollisol soil pH has increased to neutral, and is best in the application of 300 ml.polybag⁻¹ Drip Water *Saccharum officinarum* Linn. and 300 g.polybag⁻¹ Dreg Litter *Saccharum officinarum* Linn. + 15 g.polybag⁻¹ Nutrient Fertilizer 16.16.16+0.5+6.

According to Tafajani (2011), plants will be able to grow well with a Ph between 5.5 - 6.5, meaning that the soil Ph must be able to match the plants in their growth, the application of organic matter can also help increase soil acidity.

c. Final Analysis of Mollisol Soil – Soil Organic Carbon

To determine the characteristics of the growing media in Mollisol Soil, a final analysis of the quality and fertility of the Mollisol soil that has been applied is conducted. The following Table 3 lists the results of the final soil analysis on Mollisol Soil, as follows:

Table 3. Final Analysis of Mollisol Soil – Soil Organic Carbon (%)

Soil Organic Carbon (%)				
Drip Water <i>Saccharum officinarum</i> Linn.	Dreg Litter <i>Saccharum officinarum</i> Linn.	Nutrient Fertilizer 16.16.16+0.5+6		
		g.polybag ⁻¹		
ml.polybag ⁻¹	g.polybag ⁻¹	5	10	15
100	100	5,15 h	5,27 h	5,33 h
200	200	5,57 h	5,59 h	5,67 h
300	300	5,69 h	5,72 h	5,73 h

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

The results of the analysis of the C-Organic Test of Mollisol soil in Table 3 are where the C-Organic content of Mollisol soil after the application of organic matter is an increase, where the highest increase occurs in the application of organic matter Drip Water *Saccharum officinarum* Linn. 300 ml.polybag⁻¹ + Dreg Litter *Saccharum officinarum* Linn. 300 g.polybag⁻¹ + 15 g.polybag⁻¹ Nutrient Fertilizer 16.16.16+0.5+6 of 5.73% with high criteria.

According to Gana (2008), Organic matter has an important role in the soil as a trigger for soil fertility so that organic matter as a trigger for nutrient suppliers for soil organisms, so that organic carbon levels increase in the soil which can be needed by plants.

d. Final Analysis of Mollisol Soil – Soil Total Nitrogen

To determine the characteristics of the planting media in Mollisol Soil, a final analysis of the quality and fertility of the Mollisol soil that has been applied is carried out. The following Table 4 lists the results of the final soil analysis on Mollisol Soil, as follows:

Table 4. Final Analysis of Mollisol Soil – Soil Total Nitrogen (%)

Soil Total Nitrogen (%)			Nutrient Fertilizer 16.16.16+0,5+6		
Drip Water <i>Saccharum officinarum</i> Linn.	Dreg Litter <i>Saccharum officinarum</i> Linn.		g.polybag ⁻¹		
			5	10	15
ml.polybag ⁻¹	g.polybag ⁻¹				
100	100		0,50 m	0,54 h	0,55 h
200	200		0,57 h	0,58 h	0,62 h
300	300		0,64 h	0,65 h	0,68 h

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

In the results of the Mollisol Soil analysis test in Table 4, is the N-Total soil is the highest application in the application of Drip Water *Saccharum officinarum* Linn. 300 ml.polybag⁻¹ + Dreg Litter *Saccharum officinarum* Linn. 300 g.polybag⁻¹ + 15 g.polybag⁻¹ Nutrient Fertilizer 16.16.16+0.5+6 is 0.68% with high criteria.

According to Dametie and Fantaye (2009) that, in determining soil fertility in addition to organic matter, total soil nitrogen levels are also dominant, because microorganisms in the soil can fix nitrogen in the soil so that soil nitrogen levels are high.

e. Final Analysis of Mollisol Soil – Soil Total Phosphor

To determine the characteristics of the growing media in Mollisol Soil, a final analysis of the quality and fertility of the Mollisol soil that has been applied is conducted. The following Table 5 lists the results of the final soil analysis on Mollisol Soil, as follows:

Table 5. Final Analysis of Mollisol Soil – Soil Total Phosphor HCl 25% (me.100 g⁻¹)

Soil Total Phosphor HCl 25% (me.100 g ⁻¹)			Nutrient Fertilizer 16.16.16+0,5+6		
Drip Water <i>Saccharum officinarum</i> Linn.	Dreg Litter <i>Saccharum officinarum</i> Linn.		g.polybag ⁻¹		
			5	10	15
ml.polybag ⁻¹	g.polybag ⁻¹				
100	100		22,72 m	23,89 m	25,97 m
200	200		27,15 m	32,44 m	33,65 m
300	300		35,89 m	36,15 m	39,55 m

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

In the results of Mollisol soil test analysis can be seen in Table 5, which is related to soil phosphorus, is where the highest soil phosphorus test results in the application of Drip Water *Saccharum officinarum* Linn. 300 ml.polybag⁻¹ + Dreg Litter *Saccharum officinarum* Linn. 300 g.polybag⁻¹ + 15 g.polybag⁻¹ Nutrient Fertilizer 16.16.16+0.5+6 is 39.55 me.100 g⁻¹ soil.

Nutrient phosphorus in plants is very functional as a provider and store of chemical energy in the process of metabolism and catabolism. Carbohydrate metabolism in leaves which results in the transfer

of sucrose is influenced by P-Anorganic although not directly. According to Tsado et al. (2013) that, in growing plants, it will require P nutrients in the soil with the function of increasing the number of tillers, plant height and plant yield.

f. Final Analysis of Mollisol Soil – Potential Potassium Soil

To determine the characteristics of the planting media in Mollisol Soil, a final analysis of the quality and fertility of the Mollisol soil that has been applied is carried out. The following Table 6 lists the results of the final soil analysis on Mollisol Soil, as follows:

Table 6. Final Analysis of Mollisol Soil – Potential Potassium Soil Ex. HCl 25% (me.100-1)

Potential Potassium Soil Ex. HCl 25% (me.100 g ⁻¹)				
Drip Water <i>Saccharum officinarum</i> Linn. ml.polybag ⁻¹	Dreg Litter <i>Saccharum officinarum</i> Linn. g.polybag ⁻¹	Nutrient Fertilizer 16.16.16+0,5+6 g.polybag ⁻¹		
		5	10	15
100	100	1,15 h	1,25 h	1,32 h
200	200	1,44 h	1,57 h	1,69 h
300	300	2,00 h	2,14 h	2,28 h

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

Mollisol soil analysis test results can be seen in Table 6, where the highest soil potassium test results in the application of Drip Water *Saccharum officinarum* Linn. 300 ml.polybag⁻¹ + Dreg Litter *Saccharum officinarum* Linn. 300 g.polybag⁻¹ + 15 g.polybag⁻¹ Nutrient Fertilizer 16.16.16+0.5+6 at 2.28 me.100 g⁻¹ soil.

The availability of potassium (K) is very important, because it is needed by plants. This occurs due to the application of organic matter into the soil. According to Ismail (2007) the need for Na in sugarcane can inhibit the accumulation of K in sugarcane, and the need for K in the soil will be able to maximise on organic matter so that the accumulation of K loss does not occur.

g. Final Analysis of Mollisol Soil – Cation Exchange Capacity

To determine the characteristics of the planting media in Mollisol Soil, a final analysis of the quality and fertility of the Mollisol soil that has been applied is conducted. The following Table 7 lists the results of the final soil analysis on Mollisol Soil, as follows:

Table 7. Final Analysis of Mollisol Soil – Cation Exchange Capacity (me.100-1)

Cation Exchangeable Capacity (me.100 g ⁻¹)				
Drip Water <i>Saccharum officinarum</i> Linn. ml.polybag ⁻¹	Dreg Litter <i>Saccharum officinarum</i> Linn. g.polybag ⁻¹	Nutrient Fertilizer 16.16.16+0,5+6 g.polybag ⁻¹		
		5	10	15
100	100	24,10 m	24,88 m	25,10 h
200	200	26,27 h	26,89 h	27,54 h
300	300	32,17 h	33,89 h	36,20 h

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

In the results of Mollisol soil analysis, namely the Cation Exchange Capacity (CEC) test can be seen in Table 7, where the highest CEC is found in the application, namely Drip Water *Saccharum officinarum* Linn. 300 ml.polybag⁻¹ + Dreg Litter *Saccharum officinarum* Linn. 300 g.polybag⁻¹ + 15

g.polybag⁻¹ Nutrient Fertilizer 16.16.16+0.5+6 was 36.20 me.100 g⁻¹. In this case it is associated with the use of organic matter in the soil, that organic matter has been sufficient to increase the CEC in Mollisol soil so that it can be needed for plants. According to Sulastri (2006), the cation exchange capacity (CEC) of soil can generally provide an overview of soil cations such as Ca²⁺, Mg²⁺, K⁺, Na⁺, NH₄⁺, H⁺, and Al³⁺ in the form of available and can be utilised by plants.

3.2. Results of Analysis Plant Growth Observation of *Allium schoenoprasum* (L.) Chives

To determine the observations of plant growth of *Allium schoenoprasum* (L.) Chives on Mollisol Soil, the final analysis of the quality and fertility of Mollisol soil that has been applied is carried out. The following Table 8 lists the results of observations of plant growth of *Allium schoenoprasum* (L.) Chives on Mollisol Soil, as follows:

Table 8. *Allium schoenoprasum* (L.) Chives Plant Height Observation Results (cm)

		Leek Length (cm)		
Drip Water <i>Saccharum officinarum</i> Linn. ml.polybag ⁻¹	Dreg Litter <i>Saccharum officinarum</i> Linn. g.polybag ⁻¹	Nutrient Fertilizer 16.16.16+0.5+6 g.polybag ⁻¹		
		5	10	15
100	100	32,00 a	34,20 a	35,00 b
200	200	34,00 a	34,88 a	37,12 c
300	300	34,15 a	35,00 b	38,22 c

Description: Number followed by the same index in the same row or column showed no the significant difference according to the DMRT test (Duncan's Multiple Range Test) 95% confidence level ($\alpha = 0,05$)

In Table 8, the observation of leaf length in *Allium schoenoprasum* (L.) Chives after the application of organic materials, there is the longest hobo onion leaf growth is in the application of Drip Water *Saccharum officinarum* Linn. 300 ml.polybag⁻¹ + Dreg Litter *Saccharum officinarum* Linn. 300 g.polybag⁻¹ + 15 g.polybag⁻¹ Nutrient Fertilizer 16.16.16+0.5+6 is 38.22 cm. this indicates that the more organic matter is given, the more fertile and higher plant growth will be. According to the opinion of Lubis et al. (2023) that, it is very necessary to apply inorganic fertilizer into the soil to support plant growth, but organic matter needs to be given into the soil, to ensure soil fertility and health.

4. Conclusion

In the conclusion of this study, that the application of organic matter from Drip Water *Saccharum officinarum* Linn. and Dreg Litter *Saccharum officinarum* Linn. and additional application of inorganic fertilisr 16.16.16+0.5+6 to Mollisol soil media can make Mollisol soil fertility increase and plant growth of *Allium schoenoprasum* (L.) Chives increase in length on leeks.

Based on the findings of this study, future research is recommended to explore the long-term effects of combined organic matter from Drip Water and Dreg Litter of *Saccharum officinarum* Linn. with inorganic fertilizer (16.16.16+0.5+6) on Mollisol soil fertility and the growth performance of *Allium schoenoprasum* (L.). Further studies could also investigate different ratios or application methods to optimize nutrient availability and uptake. Additionally, evaluating the impact of this treatment on other soil types and different plant species may provide broader insights into its potential use in sustainable agriculture.

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