The Relation Ship Between Total Soil Microbes With N, P , K Nutrient Levels By Paddy Plant (Case Study In Ajamu Village, Panai Hulu District, Labuhanbatu Regency)

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***Abstract**.*
The neglect of returning organic matter to the soil and the intensive use of chemical fertilizers in paddy fields have caused the physical, chemical, and biological quality of the soil to decline. Such soil conditions cause the population of soil biota that plays a role in nitrogen fixation and phosphate solubility to decrease. This study aims to determine the relationship between total microbes and nutrient levels of N, P, K in rice plants in Ajamu Village, Panai Hulu District, Labuhan Batu Regency. This research was conducted from December 2021 to January 2022. Sampling was carried out by taking leaves and rhizosphere soil of rice plants at 5 zigzag sampling points in a rice field area. Parameters observed in this study were nutrient levels of N, P, K and total microbes. The analysis was carried out using correlation and regression methods.

Keywords: *rice, nutrient levels, total microbes.*

I. INTRODUCTION

Rice is one of the main food sources for the Indonesian people, so the stability of its productivity needs to be maintained. Therefore, apart from oil palm and rubber plantations, Labuhanbatu Regency is also one of the rice-producing districts in North Sumatra. One of the areas that cultivate rice plants is Panai Hulu District with a planting area of 12,231 hectares and production of dry milled paddy rice of 60,930.35 tons (BPS Kabupaten Labuhanbatu, 2021).According to Dianawati (2013), soil organic matter is an important indicator in the sustainability of lowland rice cultivation. The presence of soil organic matter is closely related to the life of microorganisms and better soil fertility so that it makes the application of planting and fertilization systems more effective and can increase plant productivity. However, based on a survey, it is known that 73% of agricultural land in Indonesia has a low organic matter content (Djakakirana and Sabiham, 2007). The neglect of returning organic matter to the soil and the intensive use of chemical fertilizers in paddy fields have caused the physical, chemical, and biological quality of the soil to decline. Such soil conditions cause the population of soil biota that plays a role in nitrogen fixation and phosphate solubility to decrease, lack of nutrients, decrease disease protection, and wasteful use of fertilizers and water (Sisworo, 2006).

Soil biological quality increases with the presence of soil microorganisms, especially in the rhizosphere. According to Simatupang (2008), the population of microorganisms in the rhizosphere is generally more numerous and diverse than in non-rhizosphere soils. The activity of microorganisms in the rhizosphere is influenced by the exudate produced by plant roots. Some rhizosphere microorganisms play a role in nutrient cycles and soil formation processes, plant growth, influence the activity of microorganisms, as well as biological controllers against root pathogens. Husen et al (2006) added that the use of rhizosphere microbes has a very important role including being able to fix nutrients, produce growth hormones, suppress soil-borne diseases, and dissolve unavailable nutrients into available plants. Based on this, the presence of microbes can be used as a facilitator to increase the effectiveness and efficiency of the given fertilizer.So far, rice cultivation in the Ajamu village area only pays attention to chemical inputs for fertilization, namely using urea fertilizer which generally uses a dose of 75kg/ha, SP-36 100 kg/ha and KCL 50kg/ha. Fertilization is done 3 times. The second supplementary fertilization was given when the rice plants were 21 DAP using 150 kg/ha of urea fertilizer and the third supplementary fertilization at the age of 60 DAP using 75 kg/ha Urea and 50 kg/ha KCL. Fertilization is carried out without the addition of organic fertilizers or other organic materials, so it is necessary to study soil microorganisms in this case total microbes. Therefore, this study aims to determine the relationship between total microbes and nutrient levels of N, P, K in rice plants in Ajamu Village, Panai Hulu District, Labuhanbatu Regency.

II. MATERIALS AND METHODS

Place and time of research

This research was conducted from December 2021 to January 2022. The sampling location was in the Abadi Hamlet, Ajamu Village, Panai Hulu District, Labuhanbatu Regency. Nutrient uptake analysis was carried out at the Socfindo Bangun Bandar laboratory, North Sumatra Province, and the total number of microbes was calculated at the Soil Biology Laboratory, Faculty of Agriculture, University of North Sumatra.

Research Implementation

Sampling was carried out by taking leaves and rhizosphere soil of rice plants at 5 zigzag sampling points in a rice field area. The rice plants taken as samples are plants that are 2 months old. For every 1 sample, 300 grams of leaves were taken and alcohol blotted with a cotton swab and then put into the sample plastic and labeled. Furthermore, the rhizosphere soil (around the roots) was taken as much as 100 grams/sample and put into a plastic sample and labeled.

Research Parameters

Parameters observed in this study were nutrient levels of N, P, K and total microbes. The results of the sample test were then analyzed descriptively by comparing the test results with the criteria for leaf nutrient levels of rice plants according to Jones (1991), and looking for their relationship with total microbes using Pearson's simple correlation analysis. The interpretation of the coefficients is categorized as follows:
r = 0.00 - 0.199 (very low), r = 0.20 - 0.399 (low), r = 0.40 - 0.599 (medium), r = 0.60-0.799 (strong)r = 0.80-1 (very strong).

III. RESULTS AND DISCUSSION

a. Total Microbes

Based on The results of the total microbial analysis (Table 1) can be seen that the highest microbial population is at sampling point number 5, which is 9.53×10^{6} . According to Saraswati et al., (2006) Population high microbial _ show existence ingredient sufficient organic matter , appropriate temperature , sufficient water availability , and _ condition ecology supporting ground . _ According to Roberts et al (2016). The density of the microbial population is related to the decomposition and air content of the soil, where the greater the density of soil microbes, to a certain level can cause the decomposition of organic matter more quickly than a smaller population.

Table 1. Results of Microbial Amount Analysis

Sample	Coordinate Point	Total Microbes
1	2 ⁰ 28'51",100 ⁰ 8'26,18'3,136 ⁰	1.41×10^{6}
2	2 ⁰ 28'51,100 ⁰ 8'27',20,5,m,90 ⁰	1.03×10^{6}
3	2 ⁰ 28'51,100 ⁰ 8'27"19.1m,69 ⁰	1.09×10^{6}
4	2 ⁰ 28'51,100 ⁰ 8'27,7,4m,86 ⁰	2.30×10^{6}
5	2 ⁰ 28'51,100 ⁰ 8'27,7,4m,29 ⁰	9.53×10^{6}

Karlen *et al* . (2006) stated that d i America Union , microbe soil looked at very important , and serve as wrong one indicator in determine index quality land h. The more tall population microbes soil then more tall activity biochemistry in soil and the more tall index quality land . Saraswati et al., (2006) also stated with knowing total population and activity microbes inside _ something soil could Becomes indication fertility land . Therefore, if microbial activity in lowland rice farming in the Ajamu area wants to increase, then farmers need to add organic matter so that the microbial population is also expected to increase and the soil quality is also getting better.

b. Nutrient Levels

Based on The results of the analysis showed that the average yield of N, P and K nutrients was 3.51%, 0.27% and 1.306%, respectively. Meanwhile, when the nutrient levels of N, P, K were compared with the nutrient criteria for rice plants, according to Jones (1991) it showed that the levels of N, P, and K nutrients were in optimum condition and in excess (Table 2). This is due to the input of chemical fertilizers (urea, SP36, and KCl) which is continuously applied in one growing season 3 times in the lowland rice area of Ajamu. This is in accordance with the statement of Sutedjo and Kartasapoetra (1999), that inorganic fertilizers are able to provide higher amounts of nutrients than organic fertilizers. In addition, high concentrations make nutrients available to plants more quickly. Roesmarkam and Yuwono (2002) also stated that inorganic fertilizers are able to provide nutrients in a short time so that the plant's nutrient needs are well met.

Table 2. Nutrient Levels of N, P, K

Sample	Coordinate Point	Results (%)	Criteria (Jones et al, 1991)
	Nitrogen Nutrient Levels		
1	2 ^{0} 28'51",100 ^{0} 8'26,18'3,136 ^{0}	3.33	Optimum
2	2 ^{0} 28'5100 ^{0} 8'27',20,5,m,90 ^{0}	3.72	too much
3	2 ^{0} 28'51,100 ^{0} 8'27"19.1m,69 ^{0}	3.78	too much
4	2 ^{0} 28'51",100 ^{0} 8'27",7,74m,86 ^{0}	3.25	Optimum
5	2 ^{0} 28'51,100 ^{0} 8'27,7,4m,29 ^{0}	3.47	Optimum
	Average	3.51	Optimum
	Phosphorus Nutrient Levels		
1	2 ^{0} 28'51",100 ^{0} 8'26,18'3,136 ^{0}	0.25	too much
2	2 ^{0} 28'5100 ^{0} 8'27',20,5,m,90 ^{0}	0.25	too much
3	2 ^{0} 28'51,100 ^{0} 8'27"19.1m,69 ^{0}	0.15	Optimum
4	2 ^{0} 28'51",100 ^{0} 8'27",7,74m,86 ^{0}	0.2	too much
5	2 ^{0} 28'51,100 ^{0} 8'27,7,4m,29 ^{0}	0.5	too much
	Average	0.27	too much
	Potassium Nutrient Levels		
1	2 ^{0} 28'51",100 ^{0} 8'26,18'3,136 ^{0}	1.54	Optimum
2	2 ^{0} 28'5100 ^{0} 8'27',20,5,m,90 ^{0}	1.55	Optimum
3	2 ^{0} 28'51,100 ^{0} 8'27"19.1m,69 ^{0}	1.15	Optimum
4	2 ^{0} 28'51",100 ^{0} 8'27",7,74m,86 ^{0}	1.14	Optimum
5	2 ^{0} 28'51,100 ^{0} 8'27,7,4m,29 ^{0}	1.15	Optimum
	Average	1.306	Optimum

Lingga and Marsono (2007) stated that fertilizer application should be carried out accurately and according to the recommended concentration, because if excessive will cause poisoning in plants. Kusmanto (2010) added that in order to achieve optimal fertilization efficiency, fertilizer must be applied in sufficient quantities to meet the needs of the plant, not too much and not too little. If the application of fertilizer is too much, the soil solution will be too concentrated so that it can cause poisoning to plants, on the other hand, if there is too little fertilization, the effect of fertilization on plants may not be visible. According to Wiraatmaja (2017) plants that lack nitrogen, phosphorus and potassium nutrients will experience growth and production barriers, both in quantity, quality and continuity. The plants that are fertilized excessively will cause their growth to grow densely, their vegetative growth is dominant, so that they only bear little fruit.

c. Total Microbial Relationship With Nitrogen Nutrient Levels

Based on the results of the correlation test, it is known that the relationship between total microbes and nitrogen nutrient levels has a low and negative correlation (-0, 212). The low correlation indicates that the total microbial has a small effect on the high and low levels of nitrogen nutrients in rice plants in the rice fields of Ajamu village. The closeness level of 4.50% which states that the relationship between the two variables is not strong and the negative sign indicates that the relationship is inversely proportional. Based on these results, it is assumed that the microbial population found in the soil in the rice fields of Ajamu village is very small and contains nitrogen fixing bacteria. The relationship graph is presented in Figure 1 below.

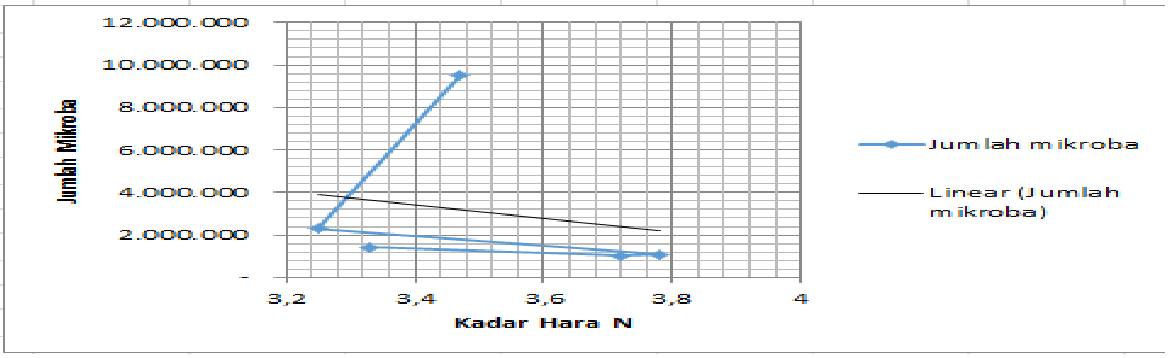

Fig 1. The relationship between total Microbes and Nitrogen Nutrient Levels

According to Selao (2010), nitrogen is one of the most abundant biomolecular elements but is not always available in usable biological form. Danapriatna, 2010) added that nitrogen has high loss properties from washing, denitrification and volatilization. So that the role of soil microbes such as N-fixing bacteria is expected to help supply N in the soil through fixing and fixing nitrogen. Nitrogen must be fixed by groups of prokaryotes that produce complex enzymes, namely nitrogenases that can reduce dinitrogen from the atmosphere to ammonium (Selao, 2010). Saraswati (2008) added that there are groups of symbiotic and non-symbiotic N-fixing bacteria, and to enrich this group of bacteria, it is necessary to add organic matter to the soil.

d. Relationship of Total Microbes with Nutrient Levels of Phosphorus

Based on the results of the correlation test, it is known that the relationship between total microbes and phosphorus nutrient levels has a very high correlation (0.94) and a positive correlation. The very high correlation indicates that the total microbial has a very large influence on the high and low levels of phosphorus nutrients in rice plants in the rice fields of Ajamu village. The higher the number of microbes, the greater the phosphorus nutrient content. The level of closeness of 88% which states that the relationship between the two variables is strong. Based on this, it can be assumed that the total soil microbes in the rice fields in Ajamu village are dominated by phosphate solubilizing bacteria or mycorrhizae which can increase P nutrient levels. The graph of the relationship is presented in Figure 2 below.

Fig 2. The relationship between total microbes and phosphorus nutrient levels

According to Foth (1990), as much as 70% of the phosphate in the soil is in an insoluble state but in the presence of phosphate solubilizing bacteria it helps plants absorb phosphate by converting insoluble phosphate by secreting organic acids such as formic acid, acetic acid, propionate, lactate, glycolic, fumarate and succinate (Suliasih et al., 2010). In addition, mycorrhizae are other soil microbes that have the ability to increase the reach of roots in the absorption of non-mobile nutrients such as P in the soil and are able to provide results in increasing P availability and plant P levels (Hasanudin, 2004).

e. The Relationship of Total Microbes With Potassium Nutrient Levels

Based on the results of the correlation test, it is known that the relationship between total microbes and potassium nutrient levels has a moderate and negative correlation (-0.46). The moderate correlation showed that the total microbes had a moderate effect on the high and low levels of potassium nutrients in rice plants in the rice fields of Ajamu village. The level of closeness is 21% which states that the relationship between the two variables is moderate. Based on this, it can be assumed that the microbial population in this paddy field area contains moderate amounts of potassium solubilizing bacteria. The relationship graph is presented in Figure 3 below.

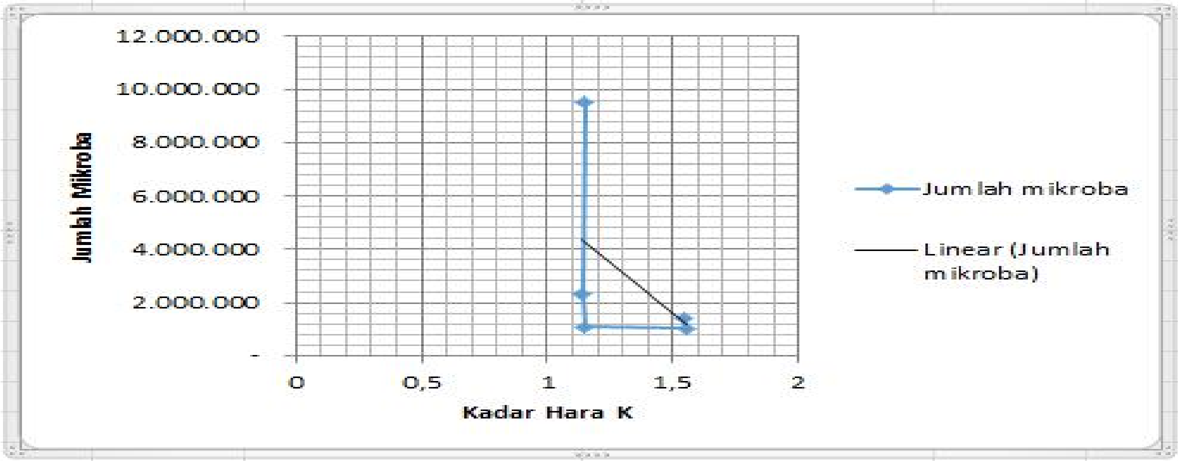

Fig 3. The relationship between total microbes and potassium nutrient levels

According to Novizan (2002), potassium is the element with the largest total amount compared to other elements in the soil, but only about 2% can be available and absorbed by plants. The low availability of potassium is due to the high level of fixation of potassium and the leaching process that removes potassium from the soil. To increase the availability of potassium nutrients, potassium solubilizing microorganisms are needed. According to Shanware et al., (2014), potassium solubilizing bacteria are able to produce potassium from a mineral by producing organic acids, such as acetate, citrate, oxalate, and so on. In addition, these organic acids will also interact with other cations such as Ca, Al, and Fe to form complex compounds.

IV. CONCLUSION

Based on the results of the analysis, it can be concluded that the highest microbial population is at the sampling point number 5, which is 9.53×10^{6} . The results of the average nutrient levels of N, P and K, respectively, were 3.51% (optimum), 0.27% (excessive) and 1.306% (optimum). The relationship between total microbes and nitrogen nutrient levels was low and negatively correlated (-0, 212) with a closeness level of 4.50%. The relationship between total microbes and phosphorus nutrient status was very high (0.94) and positive with a closeness level of 88%. The relationship between total microbial with potassium nutrient levels has a moderate and negative correlation (-0.46) with a closeness of 21%.

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