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Survey and Mapping of P Nutrient Status on Paddy Land in Aek Simare Irrigation Area, Laguboti District, Toba Samosir Regency, Northern of Sumatera, Indonesia

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ABSTRACT

Phosphorous is essential nutrient for paddy growth, deficiencies of it will reduce productivity of paddy. The research is aims to mapping of nutrient status available phosphate and total phosphate in Aek Simare Irrigation Area Laguboti District Toba Samosir Regency. This research was conducted at the Testing Laboratory of Agricultural Technology Research Center North Sumatera Province. Which began in Mey to June 2019. The method used is Free Grid Survey detailed level survey and analysis of nutrient data available phosphate by Bray I method, total phosphate by acid destruction method and then interpret to the map nutrient status. The result of research showing that status available phosphate classified by 3 status such as, medium (3,99 ha), high (44,26 ha) and very high (71,75 ha). Total phosphate classified in 4 nutrient status such as low (0,004 ha), medium (67,37 ha), high (45,316 ha) and very high (7,31 ha). Available phosphate and total phosphate are very related to increasing rice production in the Aek Simare Irrigation Area Laguboti District Toba Samosir Regency, Northern of Sumatra, Indonesia .

Keywords: *Mapping, phosphate status, paddy land, Toba Samosir, Northern of Sumatra.*

ABSTRAK

Pospor merupakan unsur hara esensial bagi pertumbuhan tanaman, kekurangan hara ini akan mengurangi produksi padi sawah. Penelitian ini bertujuan untuk memetakan status nutrisi yang tersedia fosfat dan total fosfat di daerah irigasi Aek Simare Kecamatan Laguboti Kabupaten Toba Samosir. Penelitian ini dilakukan di Laboratorium Penguji Pusat Penelitian Teknologi Pertanian Provinsi Sumatera Utara. Yang dimulai pada bulan Mei hingga Juni 2019. Metode yang digunakan adalah Free Grid Survey, survei level terperinci dan analisis data nutrisi yang tersedia fosfat dengan metode Bray I, total fosfat dengan metode destruksi asam dan kemudian diinterpretasikan ke peta status nutrisi. Hasil penelitian menunjukkan bahwa status tersedia fosfat yang diklasifikasikan berdasarkan 3 status yaitu, sedang (3,99 ha), tinggi (44,26 ha) dan sangat tinggi (71,75 ha). Total fosfat diklas ifikasikan dalam 4 status gizi seperti rendah (0,004 ha), sedang (67,37 ha), tinggi (45,316 ha) dan sangat tinggi (7,31 ha). Fosfat dan total fosfat yang tersedia sangat terkait dengan peningkatan produksi beras di Wilayah Irigasi Aek Simare, Kabupaten Laguboti, Kabupaten Toba Samosir, Sumatera Utara, Indonesia

Kata kunci: Pemetaan, status fosfat, lahan sawah, Toba Samosir, Sumatera Utara.

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INTRODUCTION

Toba Samosir Regency most of the population are farmers, including in Laguboti District. Of the total land area in Laguboti District, 27.73 percent of the land is paddy farming. The agricultural system in Laguboti District has progressed compared to other districts in Toba Samosir Regency. This can be seen from the farming system that has used a semi-technical irrigation system, and simple irrigation so that it is almost no longer dependent on rainfall (BPS,2018)

According to BPS (2018), The total land area in Laguboti District is 7,390 ha and is used for 2.013 ha of paddy fields while the rest is dry land, building /housing locations and others. The largest paddy field area is in Pardomuan Nauli Village with an area of 188 ha and the smallest paddy field area is in Sibuea Village with an area of 30 ha. While in Pasar Laguboti Village there is no use of land for rice fields.

In 2017, several villages in Laguboti Subdistrict included Ompu Raja Hutapea Village with 6.8 tons/ha of rice production, Higherir Ni Pasir Village with 7 tons / ha of rice production, Lumban Binanga Village with 7 tons / ha of rice production, Desa Ompu Raja Hatulian with rice production of 7 tons / ha and Desa Pardinggaran with rice production of 6.5 tons/ha (BPS, 2018)

In the first harvest period of 2019, production achieved by farmers in each village in the study area included Ompu Raja Hutapea Village 4.98 tons/ha, Higherir Ni Pasir village 5.56 tons/ha, Lumban Binanga village 3, 91 tons/ha, Ompu Raja Hatulian Village 4.29 tons / ha and Pardinggaran Village 4.37 tons/ha.

Phosphate (P) fertilization plays an important role in increasing crop production, because P plays a role in a variety of plant metabolic activities. However, from fertilization, only 15-20% of P fertilizer is applied to rice fields that can be absorbed by plants (De Datta et al.,1990). That is because most P is fixed in the soil. Therefore, efforts to increase fertilizer efficiency are needed.

METODOLOGY

This research was carried out in the rice fields west of Aek Simare Irrigation Area which entered the area of Ompu Raja Hutapea Village,Higher Ni Pasir, Lumban Binanga, Ompu Raja Hatulian and Pardinggaran Village Laguboti District Toba Samosir Regency with an area of 120 ha at an altitude of 905 m from sea level. The research was also carried out at the North Sumatra Agricultural Technology Assessment Laboratory. This research was conducted from April to June 2019. The research location is shown in Figure 1.

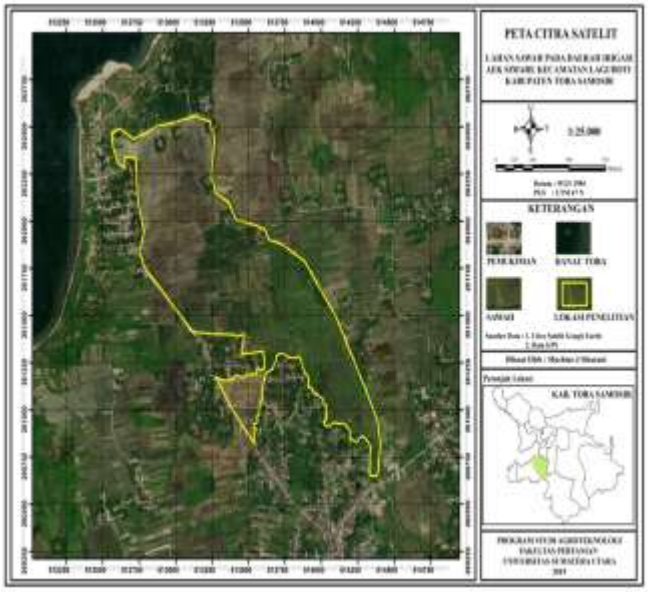

Figure 1. The research location

Grid Survey method with a detailed survey level (observation density of 1 sample per 6.25 hectares). With a land area of 120 ha and a total of 20 sampling points, obtained from the area of land divided by the observed density of each sample. Total P analysis with acid destruction method and P available using the Bray I. Area map in this study used a scale of 1: 25,000 so that 20 sample points were obtained in a free grid. Map of soil sampling points is attached in Figure 2.

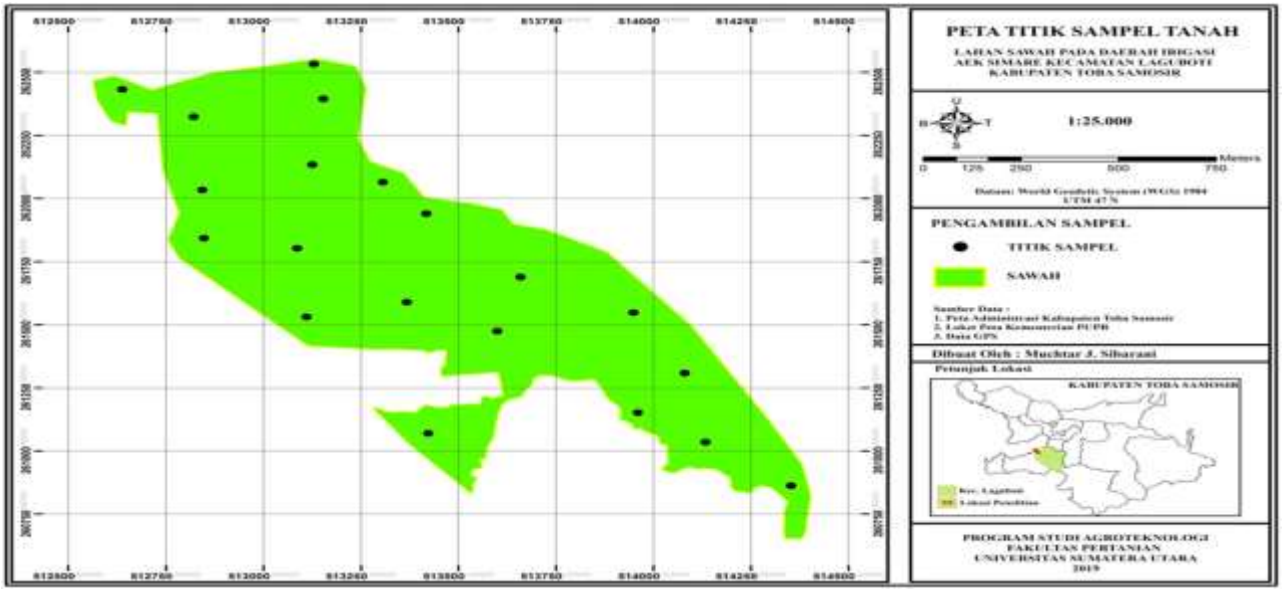

Figure 2. Map of Soil Sample Points (Source: Personal Documentation, 2019)

RESULT AND DISCUSSION

From the analysis of Phosphate (P) available soil (Table 1) obtained data on the available P content are then grouped according to the criteria of

Figure 2. Map of soil sampling points (PUSLITANAK, 1983) and (Agriculture Department. 2007).

There are 3 groups of P nutrient status available on paddy fields in the irrigation area of Aek Simare, namely Medium, higher and very higher.The results of the analysis of soil samples in Table 1, the lowest available P content is found in soil sample 8 which is 20.35 ppm and the highest available P content is found in sample 1 which is 200.66 ppm.

The area for available nutrient status P is shown in Table 2 and Figure 3. From the survey results, a sample of paddy soil with an area of 120 ha and the results of the analysis of P available land obtained that P is available on paddy fields with medium criteria has an area of 3.99 ha (3.33%), high criteria has an area of 44.26 ha (36.88%) and very high criteria has an area of 71.75 ha (59, 79%).

Table 1. Analysis of P available

Soil sampel	P available (ppm)	Criteria
1	200,66	Very high
2	30,50	Higher
3	29,10	Higher
4	59,40	Very higher
5	32,71	Higher
6	30,87	Higher
7	25,74	Medium
8	20,67	Medium
9	29,06	Higher
10	52,94	Very higher
11	29,55	Higher
12	42,94	Very higher
13	38,38	Very higher
14	43,34	Very higher
15	49,76	Very higher
16	46,15	Very higher
17	29,59	Higher
18	38,54	Very higher
19	23,08	Medium
20	26,75	Higher

Table 2. Area of P Distribution Area Available Based on Criteria

Criteria	Score (ppm)	Width (ha)	Width (%)
Medium	16-25	3,99	3,3
Higher	26-35	44,6	36,88
Very Higher	>35	71,5	59,79
Total		120	100

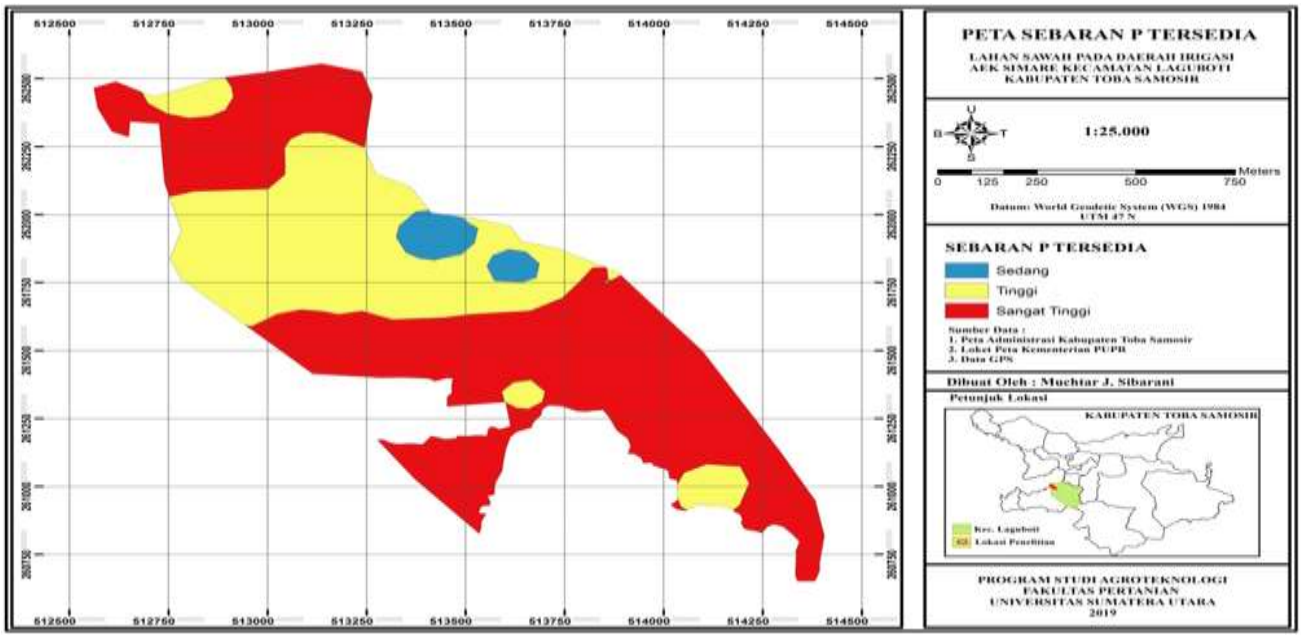

Figure 3. Map of P Distribution Available (Source:

From the survey results of soil samples and P analysis available, 120 ha of paddy land in the irrigation area of Aek Simare has a P content available with moderate criteria of 3.33%, high criteria of 36.88% and very high criteria of 59.79% based on PUSLITANAK (1983) and Agriculture Department. (2007), which is around 42.94%. (Table 2).

Available phosphate is a phosphate element found in the soil in the form available to plants and can be utilized by plants for metabolic processes. The form of P contained in the parent material before plant growth and soil formation is generally difficult to be available for plants. P available in the soil can be interpreted as P soil that can be extracted by water and citric acid.

According to the P nutrient status map available in Figure 3, the high and very high criteria are more dominant or have a greater area than the medium criteria, meaning that the soil at the study site is classified as having a high P content and has

a high potential in supplying the phosphate element to plant needs This is in accordance with the statement of Sanchez (1993) that soils that experience advanced weathering usually have a high phosphate mooring power.

Phosphate (P) total soil analysis results (Table 3) in the study area obtained total soil P content data which were then grouped based on the criteria of PUSLITANAK (1983) and Agriculture

There are 4 criteria for total P nutrient status in paddy fields in the Aek Simare Irrigation Area, which are lower, medium, high and very high as shown in Table 3. From the analysis of soil samples in Table 3, the lowest total P content was found in soil sample 3, which was 20.35 mg/100 gr and the highest total P content was in soil sample 13, which was 160, 30 mg / 100 gr. The total area for total P nutrient status is presented in Table 4 and Figure 4.

From the analysis of soil samples in Table 3, the lowest total P content was found in soil sample 3, which was 20.35 mg/100 gr and the highest total P content was in soil sample 13, which was 160, 30 mg / 100 gr. The total area for total P nutrient status is presented in Table 4 and Figure 4.

Fertilization with a nutrient source of phosphorus can increase total P in the soil and the status of phosphorus with a moderate criterion in lowland soil should be fertilized with SP36 as a source of phosphorus with a recommended dose of 50 kg ha.

This is in accordance with Agricultural Land Resources Department (2010) which states that the recommendation for fertilization of P in the specific lowland rice plants of Laguboti District, Toba Samosir Regency is 50 kg/ha SP 36.

Table 3.Results Analysis P available

Soil sample	Content (mg/100 gr)	**C**riteria
1	125,95	Very Higher
2	24,98	Medium
3	20,35	Lower
4	48,98	Higher
5	35,83	Medium
6	39,13	Medium
7	24,76	Medium
8	24,05	Medium
9	21,70	Medium
10	39,13	Medium
11	64,86	Very Higher
12	78,46	Higher
13	160,30	Very Higher
14	60,32	Very Higher
15	59,41	Higher
16	53,06	Higher
17	29,90	Medium
18	31,60	Medium
19	55,33	Higher
20	30,83	Medium

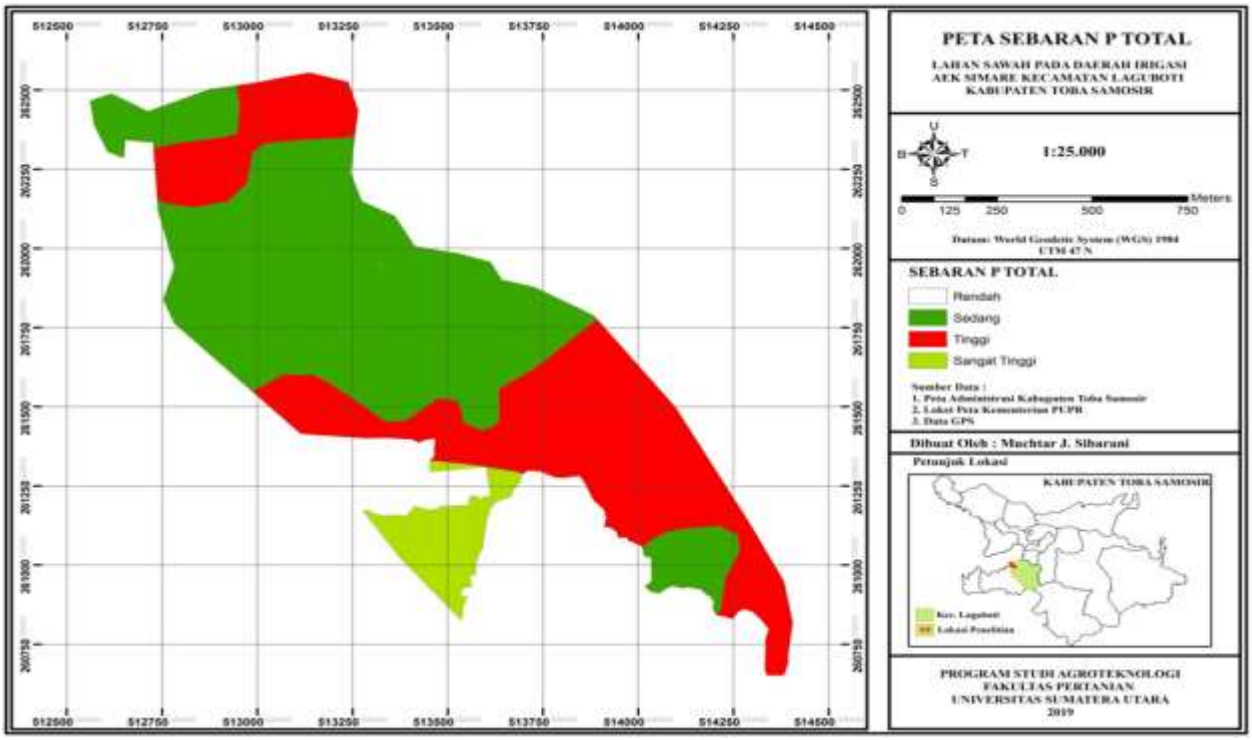

Figure 4. Map Distribution of Total Phosphate

The moderate total P nutrient status on paddy fields in the Aek Simare irrigation area is also likely to be caused by the burning of straw carried out by most farmers in paddy fields. This is because the burning of straw can result in the P element in straw being lost by 34-59%, which should have been returned to the soil. This is consistent with Husnain. (2010), which states that the percentage of nutrient content lost when burning straw is 33-35% for Si, 36-47% for K, 34-59% for P, 38-44% for Ca, 42-48% for Mg and 55-61% for Na.
From the results of interviews and discussions with farmers at the research location, the conventional farming system used. Starting from processing the land already using modern agricultural machinery, the use of hybrid seeds (certified), chemical fertilization with a certain dose, the use of herbicides and insecticides. But according to field observations and survey results, there has been no increase in agricultural output that is adequate in accordance with production standards in general. This is caused by several factors including non-simultaneous planting patterns, the use of hybrid (certified) and uncertified seeds, fertilization applications that are not appropriate to the dosage and recommendations that can result in a decrease and reduced production.
Planting patterns that are not simultaneous can trigger pest attacks that can reduce production. In accordance with observations at the research location, planting patterns that are not simultaneous can be seen from the presence of farmers who have harvested rice paddies side by side with farmers who have just planted, there are also farmers who are taking care of plants that have begun to grow. All of these things happened on the paddy field at the study site. The use of hybrid seeds (certified) is only used by a few farmers so that the increase in production does not occur as a whole. Farmers in the study area use more seeds from previous harvests or by borrowing seeds from other farmers. The use of hereditary seeds, which are classified as uncertified seeds, can reduce production and have

an impact on the vulnerability of diseases that result in decreased rice production.

The application of chemical fertilizers that are not in accordance with the dosage and recommendations, according to observations and results of interviews with farmers is one of the factors of low production. The application of fertilizer is applied twice. Namely 3 MST (weeks after planting) and 6 MST (weeks after planting).

The application of fertilizer that is not in accordance with the dosage and recommendation is by mixing several types of fertilizers including NPK, Urea, SS, ZA, SP36 for one application at 3 MST. Likewise with the second application of 6 MST, the same thing is done with 3 MST.

From the results of farmers' interviews and discussions, from a total of 20 farmers whose lands were sampled, only 13 farmers applied SP36 fertilizer for the addition of phosphate nutrients with the lowest dose of 37.5 kg / ha and the highest dose of 100 kg/ha which was one of the declining factors. Production due to inappropriate administration of dosages and the right amount. This is in accordance with Permentan No. 40 (2007) which states that the recommendation for fertilization of P on specific lowland rice plants in Laguboti District, Toba Samosir Regency is 50 kg/ha SP 36. While 7 farmers did not add SP36 fertilizer as additional phosphate nutrients for the paddy fields.

Excessive use of fertilizer can also reduce soil quality and reduce productivity in paddy fields. In accordance with the statement of De data (1990) and Soil research institute (2010), fertilizer is used in farming activities to increase the productivity of cultivated rice. However, if the use of fertilizer is excessive, it will cause damage and aridity of the soil. This condition makes the land saturated so that it is no longer fertile. The use of fertilizer that can not interfere with the growth of rice, rice plants do not get enough nutrition so the yield is low.

CONCLUSIONS

Phosphor is available in paddy fields in Aek Simare irrigation area consisting of medium criteria 3.99 ha at 3.33%, high criteria 44.26 ha at 36.88% and very high criteria 71.75 ha at 59.79%. Total P in paddy fields in the irrigation area of Aek Simare consists of low criteria 0.004 ha of 0.003%, medium criteria 67.37 ha of 56.14%, high criteria 45.316 ha of 37.76% and very high criteria of 7.31 ha (6.097%).

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