Jurnal Pertanian Tropik ISSN NO: 2356- 4725/p- ISSN : 2655-7576
Vol.8.No.2. 2021 (20) 144- 149 DOI: 10.32734/jpt.v8i2, August.8078

The Mapping of Irrigated Paddy Fields which were Polluted by Detergent Waste in Kolam Village, Percut Sei Tuan Sub-district, Deli Serdang District

Mulkan Syahputra*, Supriadi, Purba Marpaung
Agrotechnology Study Program, Faculty of Agriculture USU. Medan 20155
*Corresponding author: mulkan.7syahputra@gmail.com

ABSTRACT

Rice is the staple food of the Indonesian people and in some places polluted by waste. This research aim was to provide a survey and map on the effects of detergent waste (phosphate available), electrical conductivity and soil pH in Kolam Village, Percut Sei Tuan Subdistrict of Deli Serdang District and analysis of sample points to P available, electrical conductivity and soil pH. This research started in September 2017 until January 2018. The method used was Grid Free and P available analysis used Bray II method, analysis of Electrical Conductivity with conductivity meter and analysis of soil pH with a pH meter. The results showed that the P available distribution consisted of very low (18%), low (52%) and moderate (30%). The distribution of soil electrical conductivity was low and the pH of the soil was acidic. Based on the analysis of sample points on P available, Electrical Conductivity and soil pH showed that the farther the distances from the irrigation pollutant channel, the availability of P decreased (0.088 ppm / meter) but did not affect the pH and electrical conductivity.

Keywords: Soil Mapping, Detergents, Paddy Fields, Free Grid Survey.

INTRODUCTION

Soil survey is to classify and mapping the soil by grouping the same or similar soil into the same soil map unit and interpreting the soil suitability of each of these soil map units for certain land uses (Hardjowigeno and Widiatmaka, 2007).

Paddy field is a land that is used to grow paddy, both continuously throughout the year or take turns with other crops. The term paddy field is not a taxonomic term, but is a general term, as is forest land, plantation land, agricultural land and so on. According to Kyuma (2004) paddy fields are land that is used or potentially used to grow paddy. In this definition, paddy field covers all the land contained in climate zones with a temperature regime that is suitable for growing rice at least once a year (Hardjowigeno and Rayes, 2005).

Desa Kolam is a village located in Percut Sei Tuan Subdistrict, Deli Serdang District and is one of the central areas of paddy plants. The majority of the Desa Kolam villagers have a livelihood as farmers and casual laborers. The majority of the Desa Kolam villagers have a livelihood as farmers and casual laborers. Desa Kolam has a paddy field area of 613.18 ha consisting of 16 farmer groups with rice productivity of 5 tons/ha (BPS, 2017). In Desa Kolam there are paddy fields with irrigation streams which are polluted by household waste, such as detergent, soap and so on.

Detergents are cleaning agents that are commonly used by the public, both household and industrial scale. Continuous use of detergent every day causes the amount of detergent entering the waters to increase, hence it is found in river water, irrigation and soil

Detergents are generally composed of three main components, namely, surfactants ranging from 20-30%, 70-80% builders (phosphate compounds) and relatively little additives (bleach and fragrance), between 2-8% (Salager, 1999). Phosphate compounds in detergent are in a formed of Sodium Tri Poly Phosphate (STPP), then the STPP undergoes a hydrolysis process to form orthophosphate (PO_4^{3-}) which is a form of P available.

Jurnal Pertanian Tropik ISSN NO: 2356- 4725/p- ISSN : 2655-7576
Vol.8.No.2. 2021 (20) 144- 149 DOI: 10.32734/jpt.v8i2, August.8078

Phosphorus is a macronutrient, plants needed it in large quantities and is essential for plant growth. An important problem that must be known from phosphorus is that some phosphorus in the soil is generally not available for plants. Plants absorb phosphorus in the form of orthophosphate ions namely: $H_2PO_4^-$, HPO_4^{2-}, and PO_4^{3-} where the number of each form is very dependent on soil pH (Damanik et al. 2011).

In addition to detergent, soap waste is also found in the irrigation of Desa Kolam, in the process of soap making, the key component is NaCl. NaCl which is used generally in the form of salt water and solids (crystals), which function as foam formers. The higher the concentration of these salts in the soil solution, the higher the electrical conductivity of the soil solution. NaCl salts are adsorbed by the soil, but the adsorption is very weak compared to the soil adsorption on Ca, Mg, and K (Agus and Subika, 2009).

In this research, was done P available, pH and electrical conductivity mapping and also analysis of the relationship between the distance of sample points to P available, pH and electrical conductivity in the area of irrigated Paddy fields, Desa Kolam, Percut Sei Tuan Subdistrict, Deli Serdang District.

MATERIALS AND METHODS

This research was carried out in Desa Kolam, Percut Sei Tuan Subdistrict, Deli Serdang District with an altitude of 10-20 meters above sea level. Soil analysis was carried out at the Faculty of Agriculture Laboratory, University of Sumatera Utara and the mapping was made using the ArcGIS program. This research was conducted in September 2017 until completion.

The material used in this research was a map of the research location, soil samples taken from the research site, and chemicals for analysis in the laboratory.

The tool used in this research was GPS (Global Position System) to find out the coordinates of soil sampling, Plastic bags for soil sample containers and cameras to document field activities, as well as laboratory equipment for analysis.

The method used in this research was the Grid method with a detail level

RESULTS AND DISCUSSION

Soil pH

On the results of pH analysis of the 20 samples taken the highest pH value was 6.52 while the lowest was 5.44 and the average pH value was 6.05. Based on the results of soil pH analysis, the soil pH content was grouped according to the criteria of the Soil Research Center (*Pusat Penelitian Tanah*, 1983). There is 1 criterion of soil pH in Desa Kolam, which is acidic. The distribution area of soil pH was shown in Table 1 and Figure 1.

Based on the results of analysis, soil pH has (100%) acidic criteria. The factor that causes acid soil pH was when taking soil samples in Desa Kolam, the soil was not flooded hence the pH of the paddy field soil was not nearly neutral. This was in accordance with the opinion of Agus (2014) which stated that in paddy field, flooding will change the soil pH to neutral (7.0). Due to flooding, paddy fields have a reduction layer that does not contain oxygen and the pH of the paddy filed/soil is usually close to neutral.

Table 1. Soil pH Distribution Area Based on The Criteria

Jurnal Pertanian Tropik ISSN NO: 2356- 4725/p- ISSN : 2655-7576
Vol.8.No.2. 2021 (20) 144- 149 DOI: 10.32734/jpt.v8i2, August.8078

Criteria	Percentage (%)
Acidic	100
Total	100

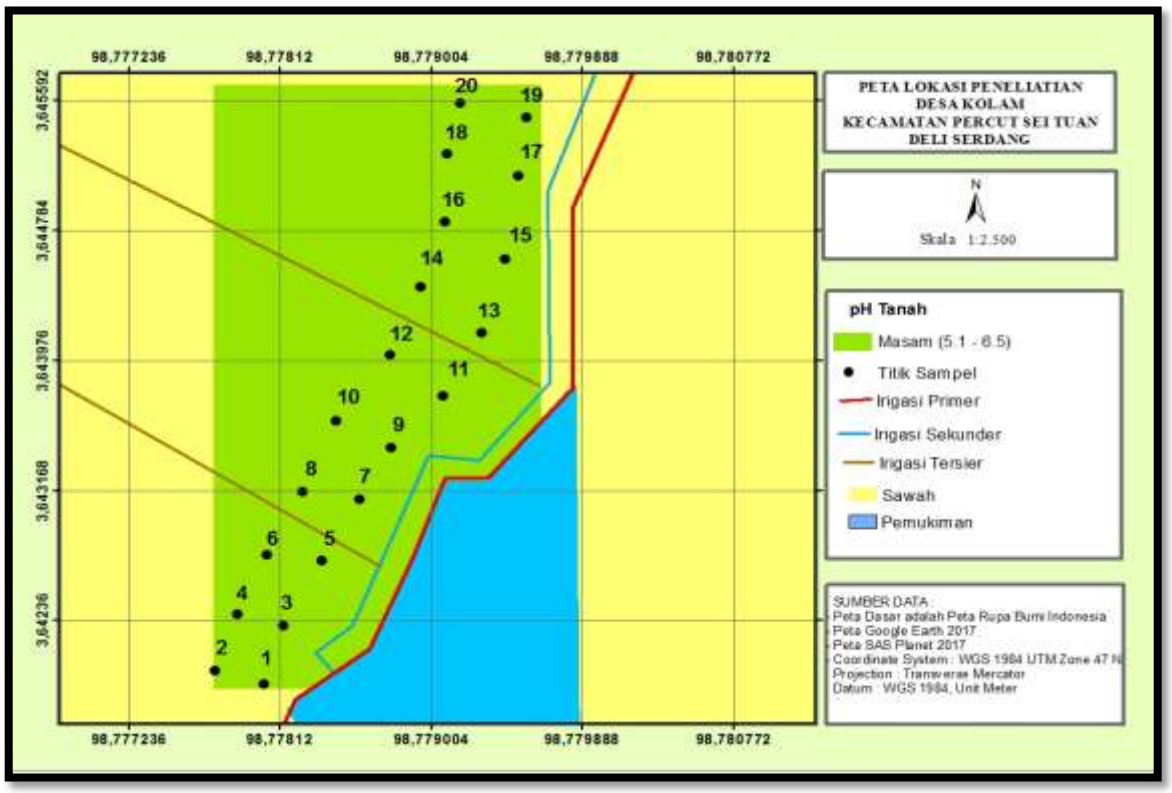

Figure 1. Map of Soil pH Distribution

P Available

Based on the results of P available analysis from 20 samples taken, the highest P available value was 18.33 ppm while the lowest P available value was 6.83 ppm and the average was 11.6 ppm. The results of P available analysis in the research area were obtained data on P available content of soil which was then grouped according to the criteria of the Center for Soil Research Staff (*Pusat Penelitian Tanah*, 1983). There are 3 P available criteria in Desa Kolam paddy fields, namely very low (18%), low (52%) and moderate (30%). The P available distribution area was shown in Table 2 and Figure 2.

The P available analysis results have very low (18%), low (52%) and moderate (30%) criteria, based on the criteria of the Center for Soil Research Staff (1983). The factors that influence P available are soil pH which is in the acid criteria. This was based on Abdulrachman et al (2009), that most P is not available to plants because it is fixated as Al-P and Fe-P on acid soils.

The results of P available analysis indicated that the availability of P in Desa Kolam is dominated by low criteria (52%). The paddy field flooding factor affects the amount of P available, because at the time of sampling, paddy fields in Desa Kolam were not flooding. This was in accordance with the Sanchez (1993) opinion, which stated that with flooding, the level of phosphorus in the soil solution increases greatly. This increase is caused by 1) the reducing of feriphosphate to ferophosphate which is more soluble, 2) the availability of soluble-reducing phosphorus compounds as a result of the dissolution of the previously oxidized layer, the increase in the organic phosphorus mineralization on acid soils caused by increasing pH 6 and 7.

Jurnal Pertanian Tropik ISSN NO: 2356- 4725/p- ISSN : 2655-7576
Vol.8.No.2. 2021 (20) 144- 149 DOI: 10.32734/jpt.v8i2, August.8078

Table 2. P Available Distribution Area Based on The Criteria

Criteria	Percentage (%)
Very Low	18
Low	52
Moderate	30
Total	100

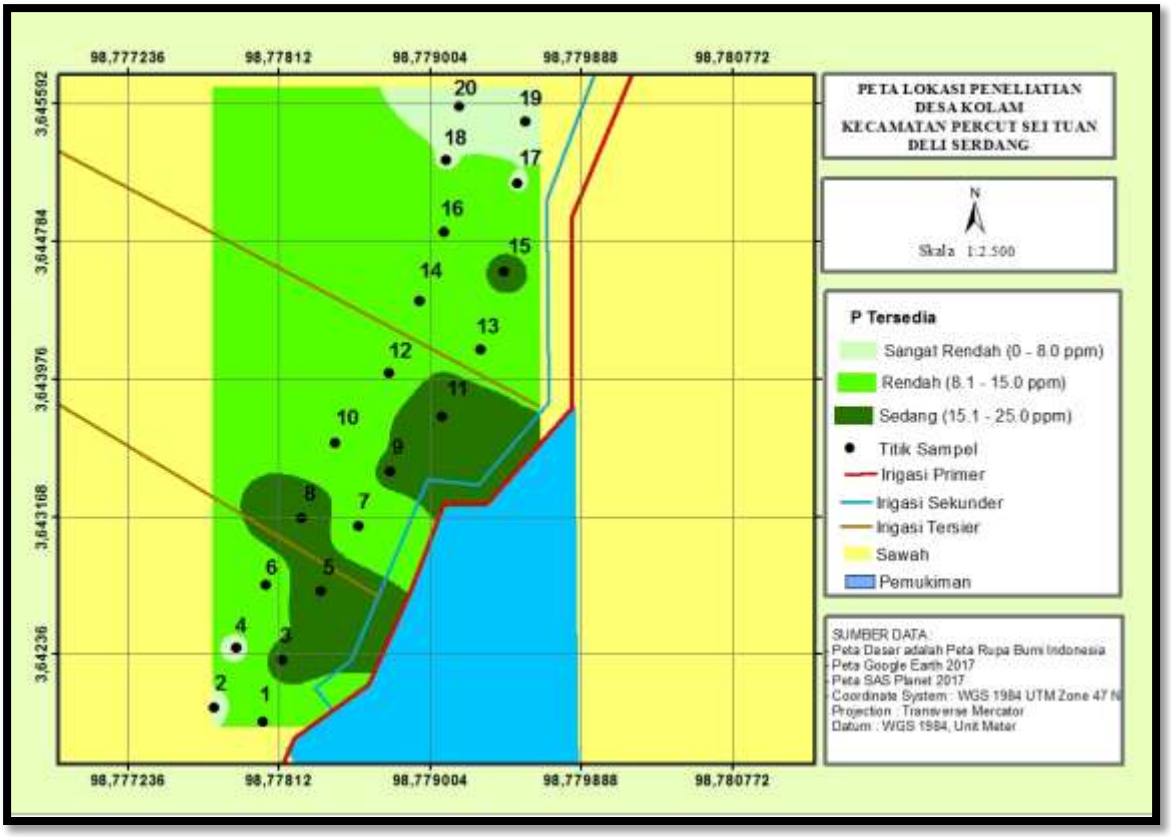

Figure 2. P Availabel Distribution Map

Electrical Conductivity (EC)

Based on the results of the electrical conductivity (EC) analysis of the 20 samples taken, the highest EC value was 150 µmhos / cm while the lowest was 30 µmhos / cm and the average value of EC was 61 µmos / cm. Based on the results of the EC analysis, the EC content obtained then was grouped into criteria, namely; very low. EC's distribution area was shown in Table 3 and Figure 3.

The analysis results of soil electrical conductivity (EC) has a very low criteria (100%). Factors that cause the low electrical conductivity in soil among others is the result of soil leaching by rainwater, because the intensity of rainfall in Desa Kolam is quite high (2500-3000 mm/year). This was supported by Agus and Subika (2009) who stated that the higher the concentration of salt in the soil solution, the higher the electrical conductivity of the soil solution. The NaCl salt is adsorbed by the soil, but the adsorption is very weak compared to the soil adsorption on Ca, Mg, and K. Thus Na is easier to leach. Leaching is easier if the soil has a rough texture and high rainfall.

Table 3. EC Distribution Area Based on The Criteria

Jurnal Pertanian Tropik ISSN NO: 2356- 4725/p- ISSN : 2655-7576
Vol.8.No.2. 2021 (20) 144- 149 DOI: 10.32734/jpt.v8i2, August.8078

Criteria	Percentage (%)
Very Low	100
Total	100

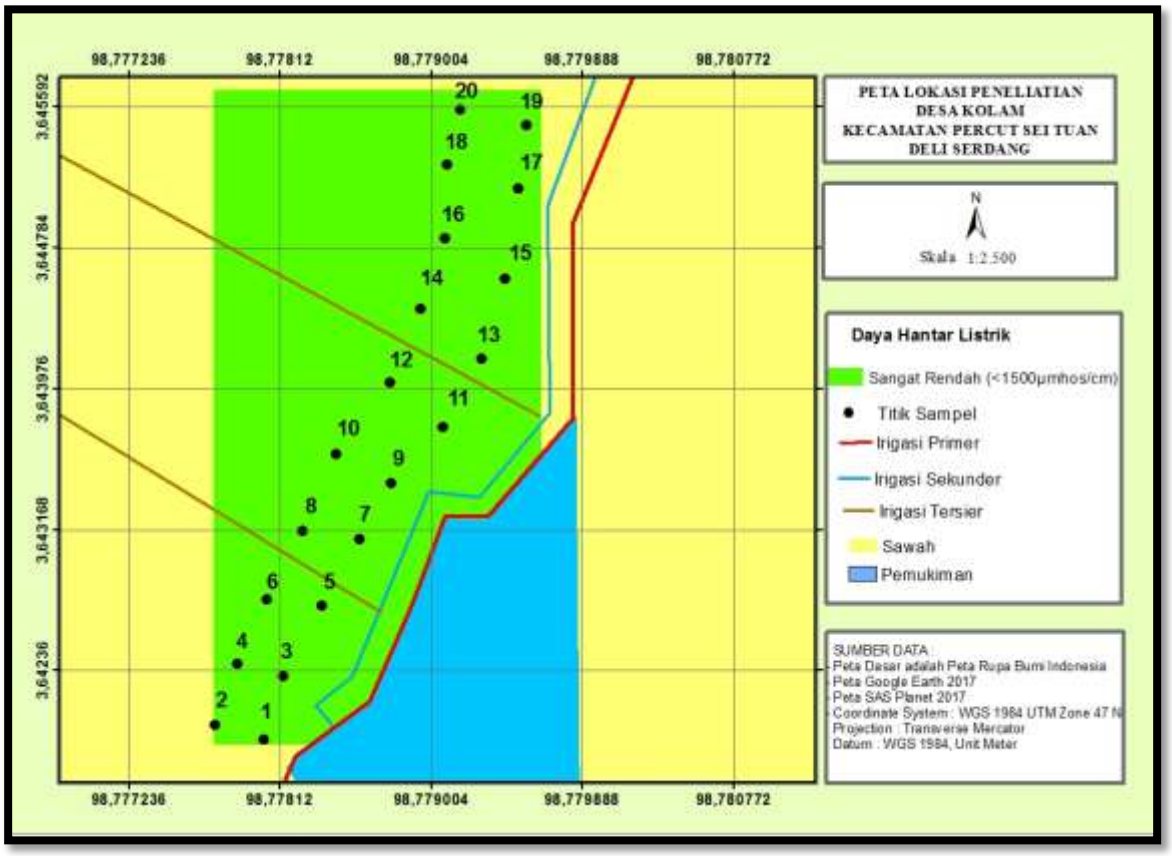

Figure 3. Electrical Conductivity (EC) Distribution Map

CONCLUSION

Phosphate available distribution in Desa Kolam consists of very low (18%), low (52%) and moderate (30%) criteria. Distribution of soil electrical conductivity in Desa Kolam is very low and the soil pH is acidic. The farther from the irrigation pollutant channel, the availability of phosphate decreases (0.088 ppm/meter) but it did not affect the pH and electrical conductivity.

REFERENCES

Abdulrachman S, H Sembiring dan Suyanto. 2009. Pemupukan Tanaman Padi. Balai Besar Penelitian Tanaman Padi. Pusat Penelitian dan Pengembangan Tanaman Pangan. Iptek Pangan No. 5, Pp: 123-166.

Agus. 2014. Padi (*Oryza sativa*). http://www.ristek.go.id. Accessed on 21st of April 2018.

Agus F, dan Subika I G M. 2008. Lahan Gambut: Potensi untuk Pertanian dan Aspek Lingkungan. Balai penelitian dan World Agroforestry Centre (ICRAF). Bogor.

Badan Pusat Statistik. 2017. Data Produksi Padi, Jagung, dan Kedelai Provinsi Sumatera Utara tahun 2016 Berita Resmi Statistik. Medan.

Damanik M M B, B E Hasibuan, Fauzi, Sarifuddin, dan H Hanum. 2011. Kesuburan Tanah dan Pemupukan. USU Press. Medan.

Hardjowigeno S, dan M L Rayes. 2005. Tanah Sawah : Karakteristik, Kondisi dan Permasalahan Tanah Sawah di Indonesia. Bayumedia Publishing. Malang.

Hardjowigeno S, dan Widiatmaka. 2007. Evaluasi Kesesuaian Lahan dan Perencanaan Tataguna Lahan. Gadjah Mada University Press, Yogyakarta.

Kyuma K. 2004. Paddy Soil Science. Kyoto University and Trans Pacific Press. Printed in Melboure by BPA Print Group. 380 pp.

Pusat Penelitian Tanah. 1983. Kriteria Penilaian Data Sifat Analisis Kimia Tanah. Balai Penelitian dan Pengembangan Pertanian Departemen Pertanian. Bogor.

Rayes M L, 2007. Metode Inventarisasi Sumber Daya Lahan. Penerbit Andi. Yogyakarta.

Salager J L, 1999. Surfactants-type and Uses. Merida, Venezuela : Laboratorio FIRP Escuela de Ingeneira Quimica, Universidad Los Andes.

Sanchez P A. 1993. Sifat dan Pengelolaan Tanah Tropika. Jilid 2. Terjemahan Dr. Amir Hamzah. Penerbit ITB. Bandung.