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Soil Acidity Mapping of a Swampland Planted with Rice in Ampukung Village, Kelua District, Tabalong Regency

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ABSTRACT

Swamp land is one type of wetland in South Kalimantan, where the water level is influenced by the season/rainfall. Based on the puddle level and duration, swamp land has three typologies, namely shallow swamp, middle swamp, and deep swamp. The wetlands in Ampukung Village are classified in the height of the puddle and the length of the inundation. Most of the swamps have been utilized for agricultural activities, especially rice. Till now, rice farming in the swamps of Ampukung has not experienced any significant problems. In 2016, the rice harvest in Ampukung exceeded the target of South Kalimantan. This success is increased by planting twice a year. However, some issues need to be addressed regarding the characteristics of the land in Ampukung Village. Soil fertility, especially soil acidity, is one of the limiting factors in the utilization of swamp land. Therefore, it is necessary to identify the acidity of the soil in the swamp of Ampukung village. The acidity data is basic information to determine the condition of soil fertility to achieve the target of planting rice twice a year. This information will be presented in the form of a map to assist users in interpreting the research data. This study found that the soil pH in the swamp lands of Ampukung Village, which was planted with rice, was highly acidic and homogeneously distributed.

Keywords: soil pH, Ampukung swamp, sub-optimal swampland, rice productivity.

1. Introduction

Ampukung is located in Kelua District, Tabalong Regency, South Kalimantan Province. In general, rice is the main commodity of Ampukung Village. In 2016, the rice harvest in Ampukung village exceeded the target of South Kalimantan. Yields of harvested dry grain (HDG) reached 8 t ha^{-1} and milled dry grain (MDG) 6 tons, while the target for South Kalimantan was only 4 t ha^{-1} (Info Publik, 2016).

The success of the 2016 harvest is due to twice-a-year planting. However, the characteristics of the land which is classified as tidal swampland, are another problem. Tidal swamps are wetlands that are affected by rainfall and river overflows. Therefore, it is always flooded during the rainy season and dried in the dry season.

Based on its depth, swamps land are divided into three typologies (Sudana, 2005). First is a shallow swamp. It is flooded with less than 50 cm for less than three months. Second is the middle sSwamp. It is flooded between 50 - 100 cm for 3 - 6 months. The third is the deep swamp. It is flooded with more than 100 cm for more than six months. The difference in swamp land typology causes differences in the level of soil fertility, especially soil acidity. Generally, shallow swamps have higher fertility and acidity than middle tidal swamps and deep swamps (Subagyo, 2006).

Acidity inequality of the soil in the swampland typology will affect the availability of nutrients in the soil. Additionally, high soil acidity will further increase the solubility of Al and Fe, which can poison plants, especially rice, if not controlled (Notohadiprawiro, 2000).

Soil acidity data in the swamp of Ampukung Village, which is planted with rice, has not been found. This research is expected to be one of the basic information on the soil acidity in swamps in Ampukung Village, Kelua District, Tabalong Regency, South Kalimantan. This information can be used to achieve twice a year planting of rice. This information will be presented in the form of a map for easier use. Therefore, this study aimed to determine the distribution of soil pH in swampy areain Ampukung Village, Kelua District, Tabalong Regency.

2. Materials and Methods

Materials

This study was conducted in Ampukung Village, Kelua Districts, Tabalong Regency. Soil analysis was carried out at the Physics-Chemical Laboratory of the Soil Science Department, Faculty of Agriculture, Lambung Mangkurat University, Banjarbaru. The soil samples originated from rice fields in swamp land at a depth of 0-20 cm using an auger.

Methods

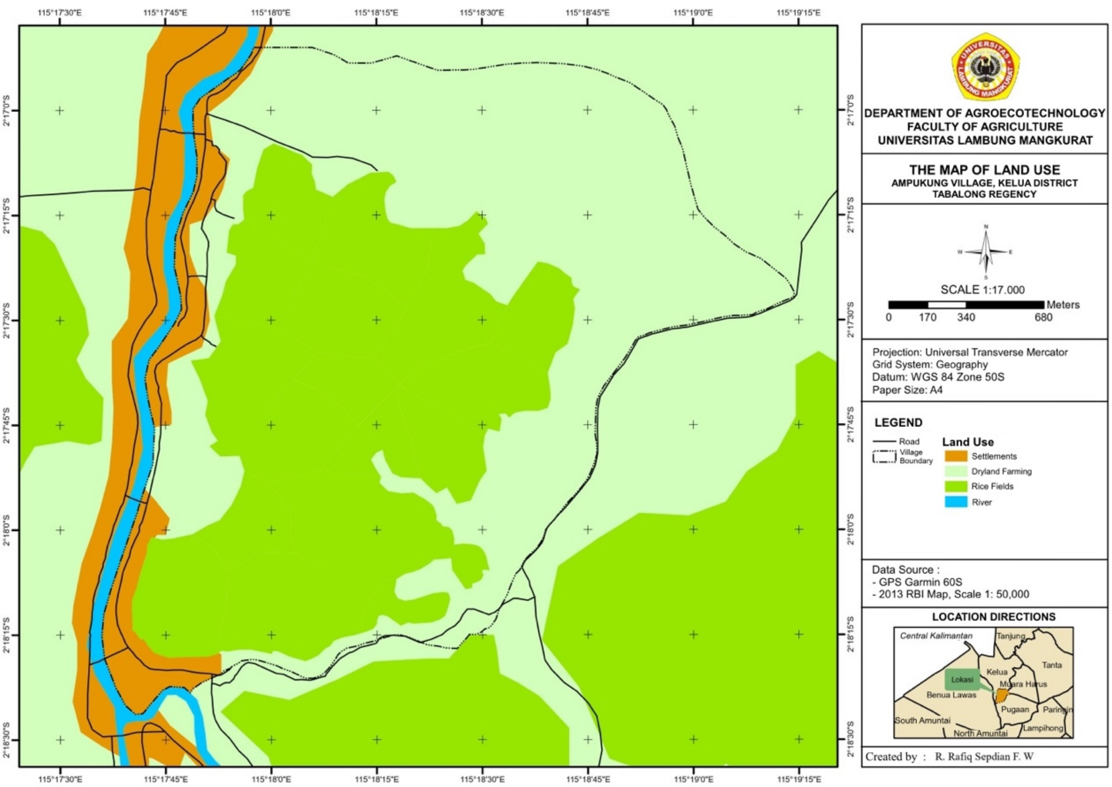

Figure 1. The map of land use in Ampukung Village.

A semi-detailed randomized survey was used in this study. The observations density was 1 sample per 300-350 m length, so the soil samples were 21. The soil sampling point was determined based on land use in Ampukung village (Figure 1). Soil sample of ±0.5 kg each were taken with an auger at a depth of 0-20 cm. The coordinates of the sampling were recorded using a GPS. The parameters observed were soil pH (H_2O 1:5). Data were analyzed using GIS (Geographic Information System) spatial analysis with ArcGIS 10.4 software. The output of the spatial analysis was the level/criteria cluster of soil pH (Triharto *et al*., 2014). The obtained data were grouped based on the assessment criteria of soil chemical properties by Soil Research Center (1983).

3. Results and Discussion

The research showed that the distribution of soil pH in the swamp lands of Ampukung Village was homogeneous with soil pH in the very acidic range (shown in the red area in Figure 2) of around 3.94. Based on the research of the Soil Research Center (1983), there are six criteria for soil pH, namely very acidic (<4.5), acidic (4.5-5.5), slightly acidic (5.6-6.5), neutral (6.6-7.5), slightly alkaline (7.6-8.5), and alkaline (>8.5).

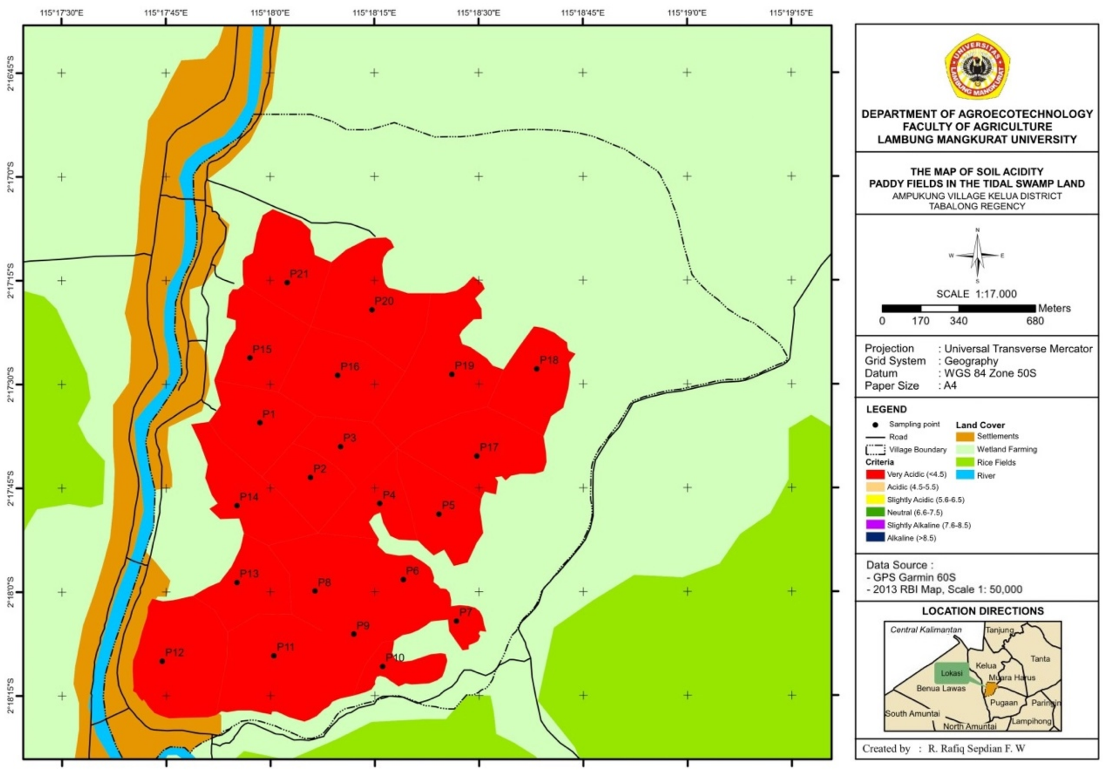

Figure 2. Map of soil acidity in paddy fields in the tidal swamplands of Ampukung Village.

Table 1. Sample code, coordinate point, and soil pH in swampland in Ampukung Village

Sample code	Coordinate point		Soil pH
	S	E	
P1	2°17'35,449"	115°17'58,610"	3,99
P2	2°17'43,397"	115°18'5,892"	4,04
P3	2°17'38,886"	115°18'10,460"	3,91
P4	2°17'47,125"	115°18'16,027"	4,31
P5	2°17'48,664"	115°18'24,353"	4,13
P6	2°17'58,274"	115°18'19,272"	3,81
P7	2°18'4,403"	115°18'26,942"	3,73
P8	2°18'0,007"	115°18'6,379"	3,58
P9	2°18'6,133"	115°18'12,021"	3,53
P10	2°18'10,946"	115°18'16,071"	4,12
P11	2°18'9,252"	115°18'0,647"	3,55
P12	2°18'10,180"	115°17'44,352"	3,99
P13	2°17'58,756"	115°17'55,373"	4,34
P14	2°17'47,682"	115°17'55,169"	4,11
P15	2°17'26,147"	115°17'57,035"	3,67
P16	2°17'28,592"	115°18'9,864"	4,33
P17	2°17'40,553"	115°18'30,065"	3,89
P18	2°17'27,654"	115°18'38,498"	4,06
P19	2°17'28,750"	115°18'26,285"	3,99
P20	2°17'19,298"	115°18'14,774"	3,88
P21	2°17'15,396"	115°18'2,498"	3,77

pH has a big influence on plant growth, especially on nutrient availability and toxin solubility. The nutrients needed by rice will not be available when the soil pH is very low. Moreover, one of the chemical properties of soil that affects soil pH is Al and Fe in soil solution. This is evidenced by the results of soil Al and Fe analysis of 28.33 ppm and 23.15 ppm respectively with high criteria based on the Soil Research Center (1983). Soils with an acidic pH have high dissolved Al and Fe and are toxic to plants (Mossor-Pietrazewska, 2001; Mukhlis, 2007). This occurred in the rice planting area in the swamp of Ampukung village.

Soil reaction (pH) to rice in the swamps of Ampukung village can be increased by liming the soil to optimize the growth and development of rice plants. The optimum pH for rice plants is between 4.0-7.0 (Sijabat, 2007). Therefore, the soil pH in the tidal swamp in Ampukung village can be increased to 5.6. An increase in one soil pH value requires 2000 kg/ha of agricultural lime and 3.320 kg/for an increase of 1.66 soil pH.

4. Conclusion

The soil pH distribution in tidal swampland planted with rice in Ampukung Village, Kelua District, Tabalong Regency, was homogeneous based on soil pH criteria with an extremely acidic range, shown in red on the soil acidity map.

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