Physical and Chemical Characteristics of Wet Soil in Swamp Ecosystems: Implications for Sustainable Agriculture of Tidal Swamps in South Kalimantan

by Murjani Murjani

Submission date: 01-Oct-2024 10:10AM (UTC+0700)
Submission ID: 2471123538
File name: HIDROPONIK_-Vol._1,_No._3_November_2024_hal_01-11.docx (54.8K)
Word count: 4151
Character count: 24288

Hidroponik: Jurnal Ilmu Pertanian Dan Teknologi Dalam Ilmu Tanaman
Vol.1, No.3 November 2024
e-ISSN: 3046-5443; p-ISSN: 3046-5451, Hal 01-11
DOI: https://doi.org/10.62951/hidroponik.v1i2.
Available Online at : https://journal.asritani.or.id/index.php/Hidroponik

Physical and Chemical Characteristics of Wet Soil in Swamp Ecosystems: Implications for Sustainable Agriculture of Tidal Swamps in South Kalimantan

Murjani
Agrotechnology study program, Sekolah Tinggi Ilmu Pertanian Amuntai, Indonesia
Address: Jl. Bihman Villa No.123, Sungai Karias, Kec. Amuntai Tengah, Kabupaten Hulu Sungai Utara, Kalimantan Selatan 71416
Email correspondence: murjanibjb@gmail.com

Abstract:*This research aims to analyze the physical and chemical characteristics of wet soils in tidal swamp ecosystems and their implications for sustainable agriculture in South Kalimantan. Tidal marshlands have great potential to be developed as agricultural land, but specific soil conditions require proper management. The results showed that soils in tidal marsh ecosystems are generally clay-textured with high moisture content and low porosity, which affects soil drainage and aeration. Moderately high organic matter content (3-7%) is a positive factor for soil fertility, but soil acidity (pH 4-5.5) and high sulfate content pose challenges for agriculture. Soil acidity potentially inhibits the availability of essential nutrients such as phosphorus and increases aluminum toxicity. The potential formation of acid sulfate soils also requires careful management to prevent further soil degradation.*

Keywords: *wetland, tidal swamp, soil chemical characteristics, sustainable agriculture*

1. INTRODUCTION

Wetland ecosystems have an important role in supporting biodiversity, hydrological regulation, and climate change mitigation through significant carbon storage. Wetlands are one of the most biodiverse ecosystems, hosting many species, especially birds (Bobbink et al., 2006) . In Indonesia, tidal swamps, especially in South Kalimantan, are potential natural resources to be developed as agricultural land. They act as nurseries for aquatic life, increasing fish populations in adjacent waters (Bobbink et al., 2006) . However, the main challenge in utilizing this ecosystem is the physical and chemical characteristics of the soil which are different from conventional soil.

Wet soils in swamp ecosystems are usually acidic. The acidity of wetlands can affect aquatic biota and agricultural productivity, requiring interventions such as liming to improve soil conditions (Abdi, 2024) . poor drainage , and high organic matter content. Liming not only increases soil pH but also improves physical properties such as porosity and density, which are essential for plant growth (Abdi, 2024) . These conditions require specific land management strategies to support sustainable agricultural productivity. The food-energy-water nexus approach emphasizes resource interconnectedness, advocating practices that improve soil health and reduce environmental footprint (Dey et al., 2024) .

In the tidal swamp areas of South Kalimantan, wetlands are significantly affected by water fluctuations, which cause periodic changes in soil quality. The physical characteristics

Received September 10, 2024; Revised September 20, 2024; Accepted September 30, 2024;
Online Available Oktober 01, 2024

of these soils, including texture, structure, and water retention capacity, are critical for agricultural suitability. However, chemical properties, especially soil pH and nutrient content, present major challenges for local farmers. Studies have shown that soil pH tends to decrease over time, which can worsen acidity and negatively impact nutrient availability (Hikmatullah , 2015) . In addition, low availability of essential macronutrients such as nitrogen, phosphorus, and potassium is a critical issue, as these nutrients are essential for plant health and agricultural productivity (T. Defoer , 2000). Peat decomposition, which occurs in these areas, produces a fibrous stage that further limits nutrient availability and contributes to poor drainage conditions (Eric Blanchart , 2005).

Regular soil testing and analysis is essential for farmers to make informed decisions regarding soil management and crop selection, helping to mitigate the adverse effects of these challenging soil conditions (FX Suryadi , 2020). Thus, addressing these factors is critical to improving agricultural yields in the region.

The viability of wetland agriculture is significantly influenced by physical and chemical properties. Soil texture and structure, which determine the arrangement and size of soil particles, are critical to water retention and drainage capabilities. These characteristics directly affect the soil's ability to support plant growth amid fluctuating water levels (Yudha Hadiyanto Eka Saputra ,2022). In addition, nutrient content, especially the availability of macronutrients such as nitrogen, phosphorus, and potassium, is very important for plant health. Unfortunately, tidal swamp soils often show low nutrient availability, presenting a major challenge for local farmers (Rony Riduan , 2019). In addition, acidic soil conditions can further complicate agricultural practices by limiting nutrient accessibility and disrupting beneficial microbial communities (Ani Susilawati ,2017). Understanding these interrelated factors is critical for farmers in South Kalimantan to develop effective soil management strategies that enhance agricultural productivity. By conducting thorough soil testing and analysis, farmers can make informed decisions regarding crop selection and irrigation practices, ultimately increasing their resilience to the challenges posed by dynamic wetland environments (Z. Multazam ,2023).

Agriculture in wetland areas faces significant environmental threats, including land degradation and conversion of natural ecosystems to agricultural land, which are exacerbated by global climate change. However, wetland ecosystems play a vital role in reducing greenhouse gas emissions due to their capacity for carbon storage, making them vital in combating climate change (Stephen Crooks ,2014). Wetlands, especially those with

vegetation such as Phragmites australis, can act as significant carbon sinks, capturing and storing carbon dioxide, which is important for reducing atmospheric greenhouse gases (Chao Zhou ,2018). To address these challenges, agriculture in tidal wetlands must adopt sustainable agricultural practices that align economic productivity with environmental health. This approach is essential to ensure that agricultural activities do not compromise the ecological functions of wetlands, which provide essential services such as carbon sequestration and support for biodiversity (Hoang Trung Thanh ,2015). By implementing sustainable methods tailored to the unique conditions of wetland ecosystems, it is possible to maintain the viability of agriculture while preserving the integrity of this vital environment (M Rezaul ,2005).

2. LITERATURE REVIEW

Swamp Ecosystems and Their Ecological Functions

Swamp ecosystem is one of the wetland ecosystems that is very important in maintaining global ecological balance. According to Mitsch and Gosselink (2015), swamp ecosystem plays a role in carbon absorption and storage, hydrological cycle, and provides habitat for various species of flora and fauna. This ecological function is very important, especially in facing global climate change. Tidal swamps, which are influenced by sea and land water fluctuations, have their own characteristics that distinguish them from other wetlands. These swamps also play a role in reducing the impact of natural disasters such as floods and erosion, through their ability to absorb excess water (Keddy, 2010). Therefore, management of swamp ecosystems must consider the sustainability of their ecological functions while utilizing their economic potential.

Physical Characteristics of Tidal Swamp Soil

The physical characteristics of the soil in the tidal swamp ecosystem are greatly influenced by the level of water saturation and soil texture. According to Luthin (2018), the soil texture commonly found in tidal swamps is clay or sandy clay, with a high water retention capacity, but poor drainage. . Constant water saturation creates anaerobic conditions, which can limit plant growth and reduce the mineralization of organic matter. Research by Andriesse (1988) shows that tidal swamp soils in Indonesia tend to have a layer of pyrite below the surface, which can be toxic to plants if oxidized. Therefore, understanding the physical characteristics of soil is very important in designing effective land management strategies.

Chemical Characteristics of Tidal Swamp Soil

In addition to physical characteristics, the chemical properties of tidal swamp soil also play an important role in determining soil fertility. One of the main challenges in swamp farming is high soil acidity (low pH) due to the slow decomposition of organic matter in anaerobic conditions (Ritzema et al., 2010). This acidic nature is exacerbated by the presence of iron and aluminum content that can bind phosphorus, thereby reducing the availability of nutrients for plants (Ponnamperuma, 1972). Based on research by Suryadi (2014), tidal swamp soil in South Kalimantan is also rich in organic matter, but the availability of nitrogen, phosphorus, and potassium is often low, requiring appropriate fertilizer input to support agricultural productivity. Chemical soil management approaches, such as liming or application of ameliorants, can help neutralize soil acidity and increase nutrient availability.

Agriculture in Tidal Swamp Land

Tidal swamp land has long been used for agriculture, especially in Indonesia, with main commodities such as rice. However, a major challenge in developing agriculture on this land is the soil characteristics that do not support optimal plant growth. According to Widjaja-Adhi (2013), for To achieve agricultural sustainability in swampy areas, innovation in water and soil management technology is needed. Good irrigation and drainage systems, as well as proper management of fertilizer inputs, can increase the productivity of swampy areas. On the other hand, research by Noor et al. (2005) shows that without good management, swamp land tends to experience decreased fertility due to the oxidation process of pyrite and the accumulation of toxic compounds such as iron and sulfate.

Sustainable Agriculture in Tidal Swamps

Sustainable agriculture in tidal swamps is an important concern in order to support food security and maintain environmental sustainability. According to Pretty (2008), the principle of sustainable agriculture is to maintain a balance between economic productivity, environmental sustainability, and social sustainability. In tidal swamp ecosystems, agricultural sustainability does not only depend on production results, but also on how the impact of agriculture on swamp ecosystems can be minimized. Research by Haryono and Noor (2017) suggests an integrated agricultural approach involving crop rotation, agroforestry, and the use of local plants that are adaptive to wetland conditions. Thus, this approach can increase agricultural productivity while preserving swamp ecosystems.

Previous Studies on the Characteristics of Swamp Land in South Kalimantan

Studies on swamp land in South Kalimantan have been conducted by several researchers, such as Noor et al. (2005) who analyzed changes in physical and chemical

characteristics of soil due to the influence of tidal water. This study shows that soil characteristics are greatly influenced by tidal fluctuations which cause variations in water saturation levels and soil quality. Another study by Haryono (2012) also emphasized the importance of an adaptive approach to land management in this area, considering the great agricultural potential but accompanied by complex environmental challenges. These studies form the basis for further research in understanding the specific characteristics of wetlands in the tidal swamp ecosystem of South Kalimantan.

3. METHOD

This study is a quantitative descriptive study that aims to identify and analyze the physical and chemical characteristics of wetlands in tidal swamp ecosystems. The study was conducted in tidal swamp areas in South Kalimantan. The selection of the location was based on the geographical and ecological characteristics of the area, which is an area with extensive wetlands and has great potential for tidal agriculture. The study population was the entire tidal swamp area in South Kalimantan with purposive sampling at several representative points in the swamp ecosystem, taking into account tidal variations and soil conditions at each location. Each sample location will be tested separately to ensure that the data obtained reflects different characteristics.

4. RESULTS AND DISCUSSION

The research results describe the condition of wetlands in the area, both from physical and chemical aspects, as well as their implications for agricultural potential in tidal swamps.

Physical Characteristics of Soil

a. Soil Texture: The analysis results show that the soil in tidal swamps in South Kalimantan generally has a clay to sandy clay texture. This texture affects the soil's ability to store water and support soil aeration. Clay has a high capacity to hold water, but can also inhibit good drainage if not managed properly.

b. Water Content and Porosity: The water content of the soil in tidal swamps is relatively high, especially in the surface layer of the soil (0-20 cm), due to the influence of the tides. Soil porosity, which is related to the ability of the soil to absorb water and air, shows variation among sample locations, but in general the soil has low porosity which can cause anaerobic conditions, especially in areas with poor drainage.

c. Soil Specific Gravity: Soil specific gravity ranges from 1.2 to 1.5 g/cm^3, which is in accordance with wet, clay-textured soil conditions. Soils with lower specific gravity tend

to have higher organic matter content , and this is an important factor in maintaining soil fertility.

Soil Chemical Characteristics

a. pH : The soil pH in tidal swamps tends to be acidic, with pH values ranging from 4.5 to 5.5. This acidic soil reduces the availability of important nutrients such as phosphorus (P) and potassium (K), and has the potential to increase aluminum (Al) levels which are toxic to plants. Some locations also show the potential for pyrite oxidation which can lower the pH further and cause the soil to become very acidic if not managed properly.

b. Organic Matter: The organic matter content in tidal swamps is relatively high, ranging from 3% to 7%. This provides benefits for agriculture because organic matter plays a role in improving soil structure, providing nutrients, and increasing the soil's capacity to store water.

c. Nutrient Content (N, P, K): Nitrogen (N) in the soil is sufficient to support plant growth, but phosphorus (P) levels tend to be low, most likely due to the acidic soil pH, which makes P unavailable to plants. Potassium (K) is also quite low in some areas, indicating the need for better fertilizer management to maintain soil fertility.

d. Sulfate and Pyrite Content: The results of the study showed high sulfate content in several locations, indicating the potential for the formation of acid sulfate soil if pyrite oxidation occurs. Land with this potential needs to be managed properly through drainage systems and tidal regulation so as not to cause soil degradation.

Implications for Sustainable Agriculture

a. Acidic Soil Constraints: Soil that tends to be acidic is one of the main constraints in the development of sustainable agriculture in tidal swamps. Food crops cultivated in these lands require intensive management, including the addition of lime (amelioration) to increase soil pH, as well as balanced fertilizer applications to improve nutrient availability.

b. High Organic Matter Content: The high levels of organic matter in swampy areas are a very positive potential for agricultural sustainability. Good management of organic matter, such as through the application of green manure and crop residues, can maintain long-term soil fertility and increase crop productivity.

c. Drainage and Water Management: Optimal water management, either through a good drainage system or tidal regulation, is essential to prevent anaerobic conditions that are detrimental to plants and to reduce the risk of pyrite oxidation which can cause the soil to become too acidic.

d. Sustainable Agriculture: To maintain sustainable agriculture in tidal swamps, an integrated management strategy is needed, including soil pH management, balanced fertilization, and efficient water management. Agriculture in this area can take advantage of the characteristics of wetlands, but also requires special attention to existing challenges such as the potential for acid sulfate soils and fertility problems hampered by low pH.

This study shows that the physical and chemical characteristics of the soil in tidal swamp land in South Kalimantan provide great opportunities for sustainable agriculture, provided that it is well managed. Proper management of soil pH, drainage, and balanced fertilization will play an important role in supporting the productivity of this land. In addition, the high organic matter is a potential that can be utilized to improve soil structure and support the sustainability of agriculture in the future.

5. DISCUSSION

Based on the results of research on the physical and chemical characteristics of soil in tidal swamps in South Kalimantan, the implications for sustainable agriculture can be discussed in more depth.

Physical Characteristics of Soil and Its Impact on Agriculture

a. Soil Texture

The soil in tidal swamp ecosystems, which is generally clay to sandy clay in texture, has significant implications for the agricultural system in the area. Clay soil texture has excellent water retention capacity, which can be an advantage for swampy areas that tend to experience flooding. However, clay soil texture also presents challenges in terms of aeration and drainage, especially in the rainy season or during high tide periods.

Implications for Agriculture: Excess water and lack of oxygen in the soil can affect plant root growth. Plants that are intolerant of anaerobic conditions may experience stunted growth. Therefore, drainage management and planting of waterlogged tolerant crops should be an important part of the agricultural strategy in these areas.

b. Water Content and Porosity

Low soil porosity and high water content indicate that the soil in swampy areas tends to be in a saturated condition. This is in line with the characteristics of tidal swamps which are influenced by tidal fluctuations. This saturated soil has significant implications for plants, especially those that require good drainage conditions.

Implications for Agriculture : Rice, which is adaptive to wetland conditions, is suitable for cultivation in this area. However, for other crops such as corn or soybeans, which require good drainage, a more intensive drainage system is needed to avoid water saturation which can interfere with plant growth.

c. Soil Specific Gravity

A relatively low soil density (1.2 -1.5 g/cm^3) indicates a fairly high organic matter content, especially in the surface layer. Soil with a low specific gravity usually has a looser structure, facilitating plant root penetration and water movement. High organic matter content also plays a role in increasing the soil's capacity to store water and nutrients.

Implications for Agriculture : The high organic matter content is one of the strengths of the soil in this swamp land, because it functions as a buffer against soil degradation and increases soil fertility. The use of compost or additional organic fertilizers can further improve the quality of this soil.

Soil Chemical Characteristics and Fertility Challenges

a. Acidic Soil pH

One of the important findings of this study is the condition of soil pH which tends to be acidic (pH 4.5 -5.5). Acidic soil has major implications for plant growth because it can inhibit the availability of nutrients, especially phosphorus (P), which is often bound and unavailable to plants at low pH. In addition, soil acidity can increase the solubility of toxic elements such as aluminum (Al), which is detrimental to plant growth.

Implications for Agriculture : High soil acidity is a major constraint to successful agriculture in this swampy area. To overcome this, soil amelioration through lime application can be an effective strategy. Liming aims to increase soil pH, improve phosphorus availability, and reduce aluminum toxicity. Farmers in this area can also choose plant varieties that are more tolerant to low pH conditions.

b. Organic Ingredients Content

The relatively high organic matter content (3-7%) in tidal swamps is a positive factor that supports soil fertility. Organic matter plays a role in improving soil structure, water capacity, and as a source of nutrients for soil microorganisms that support the nutrient cycle.

Implications for Agriculture : Sustainable agriculture in these swamplands can utilize organic matter by retaining crop residues, using green manures, and practicing sustainable land management. The high organic matter content also reduces the need for

synthetic fertilizer inputs, thus supporting an environmentally friendly agricultural approach.

c. Sulfate Content and Potential of Acid Sulfate Soil

High sulfate content in some locations raises concerns about the potential for the formation of acid sulfate soils. If acid sulfate soils are formed through the oxidation of pyrite due to soil drying, this can drastically increase soil acidity (pH <3) and affect soil fertility and water quality.

Implications for Agriculture To avoid the formation of acid sulfate soils, careful water management is essential. Tidal and drainage systems must be well controlled to prevent pyrite oxidation. The use of soil amelioration techniques such as lime or gypsum applications can also reduce the negative impacts of potential acid sulfate soils.

Relationship between Soil Characteristics and Sustainable Agriculture

This study emphasizes the importance of specific soil management strategies to address the unique conditions of tidal wetlands. Sustainability of agriculture in this region is highly dependent on the ability to properly manage the physical and chemical conditions of the soil. Some strategies that can be considered are:

a. *Utilization of Organic Materials* : Managing plant waste and organic materials as natural fertilizers to maintain soil quality.
b. *Efficient Water Management* : Regulate tidal and drainage systems to avoid water saturation and sulfate oxidation that can potentially cause soil degradation.
c. *Liming* : Soil amelioration to raise pH and increase nutrient availability, as well as reduce the potential for aluminum toxicity.

The physical and chemical characteristics of wetlands in tidal swamp ecosystems in South Kalimantan provide unique challenges and opportunities for sustainable agriculture. Wise management of acidic soil conditions, potential acid sulfate soils, and excess water are essential to support crop productivity and the sustainability of agricultural systems in this region. A combination of water management techniques, liming, and sustainable use of organic matter will provide solutions for agriculture in tidal swamp areas.

BIBLIOGRAPHY

Andriesse, JP (1988). Nature and Management of Tropical Peat Soils. FAO Soils Bulletin 59. Rome: Food and Agriculture Organization of the United Nations.

Ani, Susilawati., Dedi, Nursyamsi., Haris, Syahbuddin. (2017). Physical Properties of Soils From Several Land Uses in a Tidal Swampland Area Applied with a Fork Irrigation System. doi: 10.5400/JTS.2017.V22I3.167-174

Bezuayehu, Tola, Abdi. (2024). Studies on the Effects of Liming Acidic Soil on Improving Soil Physicochemical Properties and Yield of Crops: A Review. Middle East Research Journal of Agriculture and Food Science, doi: 10.36348/merjafs.2024.v04i03.001

Chao, Zhou., Kapo, Wong., Jianhua, Zhao. (2018). Coastal Wetland Vegetation in Response to Global Warming and Climate Change. doi: 10.5772/INTECHOPEN.73509

FX, Suryadi. (2020) . Soil and water management strategies for tidal lowlands in Indonesia.. doi : 10.1201/9780429333231

GR, Guntenspergen., BA, Vairin., VR, Burkett. (1997) . Coastal wetlands and global change: overview. doi : 10.3133/FS08997

Haryono, A. (2012). Management of Tidal Swamp Land in South Kalimantan: Challenges and Prospects. Journal of Soil and Climate, 36(2), 67-79.

Haryono, A., & Noor, M. (2017). Sustainable Agriculture in Tidal Swamp Land: An Integrated Technology Approach. Journal of Wetland Agriculture, 5(2), 123-135.

Hikmatullah., Sukarman. (2015). Physical and Chemical Properties of Cultivated Peat Soils in Four Tidal Sites of ICCTF in Kalimantan and Sumatra, Indonesia. Journal of Tropical Soils, doi: 10.5400/JTS.2014.V19I3.131-141

Hoang, Trung, Thanh., Helmut, Yabar. (2015). Climate Change Challenges for Sustainable Coastal Wetland Management in Xuan Thuy Ramsar Site, Vietnam. British Journal of Environment and Climate Change, doi: 10.9734/BJECC/2015/17168

I., C., Baillie., J., M., Anderson., J., S., I., Ingram. (1990). Tropical Soil Biology and Fertility: A Handbook of Methods.. Journal of Ecology, doi: 10.2307/2261129

Keddy, P. A. (2010). Wetland Ecology: Principles and Conservation. 2nd ed. Cambridge: Cambridge University Press.

Luthin, J.N. (2018). Drainage Engineering. New York: John Wiley & Sons.

M, Rezaul. (2005). Wise use of wetland for sustainable livelihood through participatory approach:a case of adapting to climate change. Wetland Science,

Mitsch, W. J., & Gosselink, J. G. (2015). Wetlands. 5th ed. New York: John Wiley & Sons.

Muhammad, Haykal, Fiqri., Abdul, Haris., Abdul, Hadi. (2024) . Soil Chemical Characteristics in Oil Palm Areas and High Conservation Value (HCV) in Tapin Regency, South Kalimantan Province. Acta Solum , doi : 10.20527/actasolum.v1i3.2277

Noor, M., Triadi, S., & Hidayat, A. (2005). The Effect of Tidal Flow on the Characteristics of Swamp Land in South Kalimantan. Journal of Soil and Wetland Research, 4(1), 87-95.

Ponnamperuma, F. N. (1972). The Chemistry of Submerged Soils. Advances in Agronomy, 24, 29-96.

Pretty, J. (2008). Agricultural Sustainability: Concepts, Principles and Evidence. Philosophical Transactions of the Royal Society B: Biological Sciences, 363(1491), 447-465.

Prithviraj, Dey., B., S., Mahapatra., Biplab, Mitra., Arya, Kumar, Sw adamana., Arnab, Roy, Chowdhury., Abhishek, Rana., Debashis, Mandal. (2024). Potential Nexus Approach for Sustainable Soil Productivity Resource Management. doi : 10.1201/9781003358169-12

Ritzema, H., Limin, S., & Kusin, K. (2010). Water Management in Tropical Peatlands for Agriculture and Ecosystem Restoration. Jurnal Ilmu Tanah Indonesia, 8(3), 177-187.

Roland, Bobbink., Dennis, F., Whigham., Boudewijn, Beltman., Jos, T., A., Verhoeven. (2006) . Wetland Functioning in Relation to Biodiversity Conservation and Restoration. doi : 10.1007/978-3-540-33189-6_1

Rony, Riduan., Sasmalini., Hafiizh, Prasetia., Nova, Annisa. (2019) . Evaluation of Tidal Swampland Suitability Based on GIS Spatial Model on Barambai Reclamation Unit, South Kalimantan. doi : 10.1051/MATECCONF/201928005020

Stephen, Crooks., Michelle, K., Orr., I., Emmer., M., von, Unger., Benjamin, Brown., D., Murdiyarso. (2014) . Guiding Principles for Delivering Coastal Wetland Carbon Projects.

Suryadi, M. (2014). Chemical Analysis and Management of Tidal Swamp Land in Indonesia. Journal of Natural Resources and Environmental Management, 4(2), 245-258.

T., Defoer., A., Budelman. (2000) . Managing soil fertility in the tropics: a resource guide for participatory learning and action research..

Widjaja-Adhi, IPG (2013). Swamp Land Management Technology for Sustainable Agriculture. Journal of Wetland Agriculture, 6(1), 89-103.

Yudha, Hadiyanto, Eka, Saputra., Suyanto, Suyanto., Fatmawati, Fatmawati., Suhaili, Asmawi. (2022) . Analysis of soil formation from overburden rock in the reclamation area of PT Borneo Indobara to support the success of sustainable reclamation. Indonesian Mining Professionals Journal , doi : 10.36986/impj.v4i2.80

Z., Multazam., Sri, Nuryani, Hidayah, Utami., Azwar, Maas., Khwaja, Anwar. (2022). The impact of seasonal changes on tidal water quality in acid sulfate soils for rice cultivation and water management strategies in South Kalimantan, Indonesia. IOP Conference Series: Earth and Environmental Science, doi: 10.1088/1755-1315/1005/1/012023

Physical and Chemical Characteristics of Wet Soil in Swamp Ecosystems: Implications for Sustainable Agriculture of Tidal Swamps in South Kalimantan

ORIGINALITY REPORT

21%	15%	15%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Dhirendra Kumar, Sheetanshu Gupta, Wajid Hasan, Barkat Hussain, Mohammad Javed Ansari, Shivom Singh. "Rhizosphere Revolution: Unveiling the Secrets of Insect Pheromones in Soil Health and Vermicompost Production", CRC Press, 2024 Publication	2%
2	journal.aptii.or.id Internet Source	1%
3	Renie Oelviani, Witono Adiyoga, I Gede Mahatma Yuda Bakti, Tota Suhendrata et al. "Climate Change Driving Salinity an Overview of Vulnerabilities, Adaptations, and Challenges for Indonesian Agriculture", Weather, Climate, and Society, 2023 Publication	1%
4	Submitted to University of Sheffield Student Paper	1%

www.intechopen.com

5	Internet Source	1 %
6	www.envr.tsukuba.ac.jp Internet Source	1 %
7	Submitted to University College Technology Sarawak Student Paper	1 %
8	journalarticle.ukm.my Internet Source	1 %
9	Submitted to State Islamic University of Alauddin Makassar Student Paper	1 %
10	www.routledge.com Internet Source	1 %
11	Submitted to Universitas Brawijaya Student Paper	1 %
12	www.tandfonline.com Internet Source	1 %
13	Submitted to University of Nottingham Student Paper	<1 %
14	msss.com.my Internet Source	<1 %
15	www.grafiati.com Internet Source	<1 %

16	Submitted to Leiden University Student Paper	<1 %
17	www.fao.org Internet Source	<1 %
18	Toon Defoer. "Learning about methodology development for integrated soil fertility management", Agricultural Systems, 2002 Publication	<1 %
19	ejournal.areai.or.id Internet Source	<1 %
20	Samuel M. Mwendwa, Joseph P. Mbuvi, Geoffrey Kironchi, Charles K.K. Gachene. "Assessing spatial variability of selected soil properties in Upper Kabete Campus coffee farm, University of Nairobi, Kenya", Heliyon, 2022 Publication	<1 %
21	Yiyi Sulaeman, Laura Poggio, Budiman Minasny, Dedi Nursyamsi. "Tropical Wetlands – Innovation in Mapping and Management", Routledge, 2019 Publication	<1 %
22	www.mangrovealliance.org Internet Source	<1 %
23	Suraiya Akhtar, Raja Ahmed, Khaleda Begum, Ankur Das, Sarat Saikia, Rafiul Amin Laskar,	<1 %

	Sofia Banu. "Evaluation of morphological traits, biochemical parameters and seeding availability pattern among Citrus limon ‘Assam lemon’ accessions across Assam", Scientific Reports, 2024 Publication	
24	ws.moe.edu.tw Internet Source	<1 %
25	en.wikipedia.org Internet Source	<1 %
26	uwspace.uwaterloo.ca Internet Source	<1 %
27	"Threats to Mangrove Forests", Springer Nature, 2018 Publication	<1 %
28	Martin R. Carter, B.A. Stewart. "Structure and Organic Matter Storage in Agricultural Soils", CRC Press, 2020 Publication	<1 %
29	Submitted to University of Wales, Bangor Student Paper	<1 %
30	L.B. (Bert) McCarty. "Golf Turf Management", Routledge, 2018 Publication	<1 %
31	www.fftc.agnet.org Internet Source	<1 %

32	Submitted to Cranfield University Student Paper	<1 %
33	D N Susilowati, S Widawati, Suliasih, N Arrofaha, N Radiastuti, E Yuniarti. "The potency of culturable fungi from tidal and non-tidal swamplands in Indonesia", IOP Conference Series: Earth and Environmental Science, 2022 Publication	<1 %
34	dspace.univ-eloued.dz Internet Source	<1 %
35	ppjp.ulm.ac.id Internet Source	<1 %
36	shura.shu.ac.uk Internet Source	<1 %
37	www.biorxiv.org Internet Source	<1 %
38	Agus Hasbianto, Rina Dirgahayu Ningsih, Muhammad Amin, Muhammad Yasin, Aidi Noor. "Performance of six new superior varieties of rice on tidal swamp-land in South Kalimantan Province", IOP Conference Series: Earth and Environmental Science, 2021 Publication	<1 %
39	openarchives.library.cornell.edu Internet Source	<1 %

40	"APAC 2019", Springer Science and Business Media LLC, 2020 Publication	<1 %
41	Anh, Nguyen Lam. "Climate Proofing Aquaculture: A Case Study on Pangasius Farming in the Mekong Delta, Vietnam", Wageningen University and Research, 2021 Publication	<1 %
42	D. N. Bharadwaj. "Advanced Molecular Plant Breeding - Meeting the Challenge of Food Security", CRC Press, 2018 Publication	<1 %
43	Sneh Goyal, Kazunori Sakamoto, Kazuyuki Inubushi, Kunihiko Kamewada. "Long-term effects of inorganic fertilization and organic amendments on soil organic matter and soil microbial properties in Andisols", Archives of Agronomy and Soil Science, 2006 Publication	<1 %
44	ejournal.medistra.ac.id Internet Source	<1 %
45	garuda.kemdikbud.go.id Internet Source	<1 %
46	link.springer.com Internet Source	<1 %
47	m.moam.info Internet Source	<1 %

48	media.neliti.com Internet Source	<1 %
49	vdocuments.mx Internet Source	<1 %
50	webapps.itc.utwente.nl Internet Source	<1 %
51	www.iiste.org Internet Source	<1 %
52	www.neliti.com Internet Source	<1 %
53	www.researchgate.net Internet Source	<1 %
54	www2.hull.ac.uk Internet Source	<1 %
55	Pupathy Uthrapathy Thandapani, Sundian Nadaraj. "Monitoring of pH level for maximizing oil palm ffb yields", IOP Conference Series: Earth and Environmental Science, 2024 Publication	<1 %
56	Hirotomo Ohba, Naoto Owa. "Vertical Distribution of Physico-Chemical Properties and Number of Sulfur-Oxidizing Bacteria in the Buried Layer of Soil Profiles with Marine-	<1 %

Reduced Sulfur Compounds", Soil Science and Plant Nutrition, 2005

Publication

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		