ASSESSMENT OF MOISTURE AND ORGANIC CONTENT IN SOFT SOIL ENVIRONMENTS OF PADDY FIELDS

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ABSTRACT

This study primarily investigates the moisture content (MC) and organic content (MC) of soil. The sample preparation was carried out in accordance with the BS 1377 standard, and the samples were obtained from a paddy field located in Kampung Tajar, Pendang Kedah. Distinguishable variations in in-situ soil properties are seen between soft and normal soil types. The moisture content in soft soil varies between 46 and 75 percent, with an average organic content of 9.50 percent, which is surpassed. In contrast, normal soil has a narrower range of moisture content, varying from 35 to 60 percent at a depth of 20 – 40 cm, with organic content consistently below 9.50 percent. This study will comprehensively analyze and discuss all of the obtained results.

Keywords: Soft soil, paddy field, soil depth, soil strength, OC, MC

INTRODUCTION

Soft soil is rarely found in paddy fields. Recently, farmers have reported problems and expressed complaints about significant financial losses caused by the problem of soft soil. According to data from the Muda Agricultural and Development Authority (MADA), a significant number of hectares were impacted. Specifically, in 2012, a total of 6230 hectares were affected. In 2016, the total land area was only 83 hectares. Nevertheless, in 2022, there was a significant increase in the frequency of occurrences, resulting in a total affected area of 2724 hectares (Mohamed Fauzi et al. 2023). Nevertheless, the exact underlying elements that determine the categorization of soft soil are still unknown. There are several key criteria that can be utilized as indicators of the properties of this specific type of soft soil. In order to address this worry, our study examines important soil properties that could potentially indicate the presence of soft soil. Through a thorough analysis of these parameters, the goal is to provide significant

insights that can assist farmers, researchers, and agricultural agencies in comprehending and addressing the issues presented by soft soil in paddy fields.

MATERIAL AND METHODS

Two field plots situated in Kampung Tajar Kedah, with coordinates N 6 04'58.4", E 100 24'56.2", were utilized for sample collection. One area is designated for the analysis of normal soil, while the other is specifically allocated for the examination of soft soil. The size of each allotment ranges from 0.6 to 0.9 hectares. Each plot consisted of a total of 5 sampling locations, located at two different depths: 20 cm and 40 cm below the soil surface. The locations from which samples were obtained from the soft soil plot are designated as A, B, C, D, and E. However, the samples for the normal soil plot are labeled as P, Q, R, S, and T. The sample preparation followed the guidelines outlined in BS 1377: Part 2, 1990 clause 3.2 for Moisture Content and ASTM D7348-08 for Loss on Ignition, as well as BS 1377.

RESULTS AND DISCUSSION

Moisture Content

Based on the findings shown in Table 1, the moisture content range at a depth of 20 cm is almost the same for both conditions. Furthermore, the moisture content at the specified depth continues to display high readings for soft soil. Although the soil is 40 cm deep, the soft quality of the soil yields a nearly same value at a depth of 20 cm. In this layer, a high moisture content results in reduced or no strength compared to a layer with low moisture content. The soil strength decreases as the percentage of moisture content increases. Observations indicate that the moisture content remains consistent up to a depth of 40 cm. However, in the control plot, the percentage of moisture content drops as the depth increases to 40 cm. The text explicitly indicated that the soft soil had consistently larger water content at both depths compared to the normal soil. According to MARDI (2008), the typical moisture content of soil in rice cultivation is below 40 percent. However, the findings presented by Rendana M. et al (2017) indicated that the moisture level exceeded 40 percent in both situations. In 2021, Rendana et al. reported that the water content exceeded 40 percent. Based on this discovery, it may be inferred that the moisture content levels exceeded 45 to 75 percent as a result of the soil's low density. Several factors influenced the soil's increased moisture content, including soil capillary action, void ratio, soil texture, water holding capacity, permeability and environmental factors (such as climate change).

Table 1: Result of In-situ Moisture Content

Plot Condition	***In situ* Moisture Content (%)**	
	20 cm	40 cm
Soft Soil	47.52 - 73.20 (46 – 75)	46.43 – 71.67 (46 – 75)
Normal Soil	51.88 – 69.87 (50 – 70)	36.08 – 56.38 (35 – 60)

Loss of Ignition

Loss on Ignition (LOI) is a method used to quantify the percentage of organic matter in a soil sample (Konare et al., 2010). The mean organic content in the soft soil plots varied between 10.42 percent and 10.57 percent. The reported range for the normal plot is 8.45 to 8.88 percent, which is lower. The data suggest that the soft soil plots contain a substantial amount of organic materials. The soil's low organic matter concentration contributes to its susceptibility to compaction (Rendana et al., 2017). As a result, the soil on the normal plot was found to have a lower proportion of organic matter content compared to the soft soil. According to Plaster (2008), the existence of organic materials can potentially cause a decrease in soil bulk density. This phenomenon can be ascribed to the concurrent rise in the quantity of organic matter existing in the soil and the ratio of empty spaces within the soil. The deposition of plant and animal remains in the soil results in an augmented organic composition. The breakdown of organic matter derived from prior plant growth, crop leftovers, and other biological materials enhances the soil's organic content. The manner in which farmers handle crop wastes, such as rice straw, might have an impact on the organic content. When residues are added to the soil instead of being taken away, the organic content generally increases.

Furthermore, when paddy fields are consistently submerged in water, creating anaerobic conditions, the breakdown of organic matter is hindered. This can result in the gradual accumulation of organic material, ultimately leading to an increased organic content in the soil. In addition, soil microorganisms, such as bacteria and fungi, are essential for the process of breaking down organic materials. Their enzymatic processes decompose plant and animal remains, liberating organic chemicals into the soil and augmenting its organic content.

The level of organic matter in soil can be affected by multiple causes, and its effect on soil characteristics is crucial for comprehending the difficulties encountered by paddy fields with loose soil. The data reported in Table 2 offers useful insights into the unique attributes of soft and normal soil in paddy fields, specifically regarding organic content (OC) and in-situ moisture content (MC) at various soil depths. The organic content of soft soil at depths of 0-20 cm and 20-40 cm is greater (10.69-11.27% and 9.87-10.16% respectively) compared to normal soil (8.98-9.40% and 7.93-8.37% respectively).The moisture content of soft soil in its natural state ranges from 47.52% to 73.20%, which is higher than the moisture content of normal soil, which ranges from 51.88% to 69.87%. These differences suggest a connection between greater organic matter and enhanced water retention in soft soil.

Table 2: Results of Soft and Normal Soil

Paddy Condition	Depth (cm)	Mean OC (%)	*In situ* MC (%)
Soft Soil	0 – 20	10.69 – 11.27	47.52 – 73.20
	20 – 40	9.87 – 10.16	46.43 – 71.67
Normal Soil	0 – 20	8.98 – 9.40	51.88 – 69.87
	20 – 40	7.93 – 8.37	36.08 – 56.35

CONCLUSION

Based on this discovery, it may be inferred that the soft soil had a consistently high moisture content up to a depth of 40 cm, along with a higher organic content compared to the normal soil. The findings underscore the importance of considering several soil parameters in order to fully understand the existence of soft soil in paddy fields. This provides a foundation for making informed judgments on soil management and applying measures to address the issue in agricultural practices.

ACKNOWLEDGEMENT

The author would like to acknowledge the Malaysian Agricultural Research and Development Institute (MARDI) and the Ministry of Agricultural and Food Security (KPKM) for their financial support in conducting research during the Tenth and Eleventh Malaysian Plans (Rancangan Malaysia ke 10 & 11). The author expresses gratitude for the valuable support offered by Mr. Saifulizan and other technicians from the Engineering Research Center, MARDI, in relation to the soil sample. Special appreciation is extended to Dr. Azman and Dr. Teoh, who provided helpful guidance and managed the research effectively. The author expresses deep gratitude to the MUDA Agricultural and Development Authority (MADA) for providing the necessary data and information for this research.

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