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Research Article

Characterization of Alluvial Soil for Growth of Chinese Betel (Peperomia pellucida L.)

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ABSTRACT

This study aims to determine the characterization of alluvial soil as a place to grow Chinese betel (peperomia pellucida L.) in Ambon city. Parameters studied included morphological characterization of alluvial soil and description of Chinese betel nut (Peperomia pellucid a L.). The results of observations in the field and analysis of soil samples in the laboratory that have been collected are used as material to identify soil morphological characterization. Meanwhile Chinese betel nut (Peperomia pellucid a L.) collected from alluvial soil was selectively explored by exploring the research area using the Cruise Method. Furthermore, a phytochemical test was carried out to determine its phytochemical content. The results showed that the color of the soil and the rusty color of the alluvial soil in Ambon City was generally brown. The alluvial soil structure at the study site has an O horizon with a soil layer thickness of 17 cm, an A horizon with a thickness of 45 cm soil lumpy structure and a Bw horizon with a soil thickness of 30 cm and the C horizon with a thickness of 65 cm is classified as having a globular lumpy soil structure, It has a high clay and silt content. The lower the soil solum, the lower the C-organic content. The soil in Ambon city has moderate fertility. Low base saturation is associated with low C-organic content in the soil. Chinese sirih that grows on alluvial soil types in Ambon City contains several classes of compounds that are beneficial to health like flavonoids, alkaloids, tripenoids, phenolics, tannins and saponins so that they have ethnomedicin effects such as anticancer, antimicrobial, antidiabetic, antihypertensive and antioxidant activities.

Keywords*: Alluvial, Chinese Betel (Peperomia pellucid a L.), Soil*

Introduction

Alluvial soils are formed from the weathering processes of parent rock and organic matter which are influenced by environmental factors such as climate, organisms and time (Ren et al., 2020). The process of soil formation takes

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place with various physical, chemical and biological reactions (Khatun & Rahman, 2021;Xu et al., 2019). Alluvial soil is soil originating from young alluvial or colluvial deposits with weak soil profile development (Kawalko et al., 2021;Saint-Laurent et al., 2019). Soil properties vary depending on the parent material deposited and its distribution is not affected by altitude or climate, equivalent to Entisol soil equivalents (Siddique et al., 2021;Fattah et al., 2019). Meanwhile, according to the USDA soil taxonomy system, alluvial soil is equivalent to Entisol or Inceptisol soil (Islam et al., 2020;Hamid et al., 2020).

Alluvial soil is land that is passed by several rivers, so it is considered young soil and has not experienced horizon differentiation. Alluvial soil properties originate from the materials transported and deposited so that their properties vary depending on the parent material deposited and the distribution of alluvial soil is not affected by altitude or climate but is directly influenced by the material it originates from (Gaonkar et al., 2019;Tang et al., 2019).

Soil morphological characteristics are soil properties that exist in a place (Vogelgesang et al., 2020). Alluvial soil properties affect vegetation, one of which is Chinese betel nut (Peperomia pellucid a L.). This plant contains phytochemicals which are ethnomiamedicine for the community (Vashisht et al., 2018). According to Purba et al., (2021), soil fertility is specific because it is influenced by the morphological characteristics of the soil. This is what underlies the need to do research on the characterization of alluvial soil where Chinese betel nut (Peperomia pellucid a L.) grows in Ambon City.

Methods

Place and time

Research Observation of alluvial soil pedons was carried out in Ambon City, Maluku Province. Followed by chemical analysis of soil at the Soil Laboratory of the Faculty of Agriculture, University of Pattimura and tests for phytochemical content at the Chemistry Laboratory of the Faculty of Mathematics and Natural Sciences, University of Pattimura and analysis of soil physics at the Soil physics Laboratory, Faculty of Agriculture, University of Pattimura. This research was conducted September 2 2022 – January 6 2023.

Tools and materials

The tools used in this study were soil drills, hoes, shovels, knives, label paper, tape measure, pH step-by-step, GPS (global positioning system), Keys to Soil Taxonomy book, guidebook for Fundamentals of Soil Science, Munsell Soil Color Chart book, Abney Level, ring sample, data filling form, stationery, books, 1 kg plastic bag, rubber, camera. The tools used for analysis in the laboratory are film bottles, sieves, shakers, aluminum cups, mashers, desiccator analytical scales, volumetric flasks, filter paper, measuring cups, ovens, centrifuges, measuring pipettes (Vashisht et al., 2018). The materials used in this study were soil samples, distilled water, H2O2 solution and HCl solution to see the content of lime and organic matter in the soil, KCl solution to determine soil KCl pH, ammonium acetate solution (NH4OAc) pH 7 and 1% NaOH solution to carry out titrations to determine dd base cations. Research Design The research method used is a quantitative (measured) descriptive survey method based on observing soil characteristics in the field by looking at soil parameters and soil analysis in the laboratory. While samples of Chinese betel (Peperomia pellucid a L.) were photographed and then described based on morphological characteristics and continued with phytochemical tests

Research procedure

Making a soil pedon begins by looking at the type of soil at the location of the research, to be precise on the soil where Chinese betel nut (Peperomia pellucid a L.) grows, then tracing the location by drilling the soil several times, after the soil is considered representative, a representative soil pedon is made. In this study using a method of digging soil pedons by making a size of 150 cm x 100 cm x 150 cm following (Jain & Kalamdhad, 2020). Data obtained from observing soil pedons is filled in using description paper. Filling in the soil pedon data includes observing the state of the land environment such as topography, slope, vegetation, climate, and land use (Moreno et al., 2018a). Observation of soil morphology such as horizon

depth, horizon boundaries, topographical boundaries, soil color and soil rustiness (viewed using the Munsell soil color chart book), soil structure, soil consistency, and roots (Moreno et al., 2018b).

Soils that have been observed and described are taken for soil samples for analysis in the laboratory. Before carrying out the analysis in the laboratory, the soil samples were air-dried for 1 week. If the soil sample is dry, then grind it finely and sift it. Soil that has been pounded and sieved using a 2.0 mm sieve for soil texture analysis and using a 0.5 mm sieve for analysis of soil chemical properties. The parameters for analyzing the chemical and physical properties of the soil are pH, C-organic, base saturation (KB). The physical properties of the soil are three fraction soil texture (Yao et al., 2022).

After taking soil samples, betel cina (Peperomia pellucid a L.) taken from the soil was subjected to phytochemical tests after first conducting interviews with the community about its benefits.

Data analysis

Data from observations in the field and analysis of soil samples in the laboratory that have been collected are used as material to identify soil morphological characterization (Gayo et al., 2022). Whereas Chinese betel nut (Peperomia pellucid a L.) collected from alluvial soil was carried out selectively by exploring the research area using the Cruise Method (Kar et al., 2021), then carrying out a phytochemical test to determine its phytochemical content.

Results and Discussions

from the pedon to be examined or categorized as having a moderate level of maturity. The soil characteristics are in accordance with the statement of Nuryani et al. (2003) in Gayo et al., (2022) that Inceptisol soil has a rather thick soil solution, which is around 1 - 2 m, soil color is black or gray to dark brown, soil texture is sand, dust, and clay, crumbly soil structure with crumbly consistency.

C.2. Soil Physical and Chemical Characterization

Soil Texture

The results of soil analysis showed that the percentage of the sand fraction obtained for the O and A horizons was 35%, 25% silt and 41% clay categorized into the sandy loam texture class. Horizon Bw obtained 30% sand, 25% dust, and 45% clay fractions with a sandy clay texture class. In the C horizon, the percentage of sand obtained is 40%, silt is 30% and clay is 35% which is categorized into sandy clay loam. Based on these results, the soil has a higher clay and silt content. This is in line with research by Gayo et al ., (2022) who found that alluvial soil has a clay and silt texture.

C-Organic

The results of soil analysis showed that the C-organic content could only be detected in the O horizon. The C-organic content in the O horizon was 0.67%, the AC horizon was not detected because the value was below the smallest limit. The C-organic value in the O horizon is categorized as very low, namely <1%. The results showed that the lower the soil solum, the lower the C-organic content. The soil in Ambon city has low to moderate fertility. Low base saturation is related to the C-organic content in the soil, if the organic C is high, the base saturation value is also high.

Base Saturation (KB)

Base saturation is related to the acidity level of the soil. A high KB value will indicate that the soil has a high soil pH, and if it is known that the KB value is low, then the soil has a low soil pH (Puja, 2018). The percentage of alluvial soil KB is classified as low on the O horizon of 25.35% and 25.45% on the Bw horizon, while on the A and C horizons it is classified as high with values of 55.95% and 58.45%. The soil in the research location is classified as having low to moderate fertility. Low base saturation is associated with low C-organic content in the soil. According to Rofik et al (in Gong et al., 2022) , the high and low levels of C-organic, high and low base saturation values affect the level of soil fertility.

C.3. Chinese Betel (Peperomia pellucida L.) Growing on Alluvial Soil

Morphology of Chinese Betel (Peperomia pellucida L.)

The results showed that Chinese Betel (Peperomia pellucida L.) which grows on alluvial soil in Ambon city, has a height of 20-30 cm with upright, soft and light green stems. Single leaf with a spiral position, oval shape, 1-4 cm long, 1.5-2 cm wide, pointed tip, incised base, flat edge, curved spine, smooth surface, soft, and green. yellowish white. Fibrous roots, white and not deep roots, compound interest, grain shaped, located at the end of the stem or in the leaf axilae, grain length 2-3 cm, soft stalk.

Figure 1. Chinese Betel Plant (Peperomia pellucida L.)

Pratiwi et al.'s research (2022) found that Chinese betel has a fibrous root system, 20-30 cm high and has watery upright stems. However, when it grows taller, the stems of this plant will hang and branch. The leaves are single and have a pointed tip, the bottom is wavy, the leaf bones are pinnate, the leaf edges are flat and have a green leaf color, the leaf surface is smooth and shiny while the bottom is slightly rougher. The fruit is a small green fruit that is neatly arranged lengthwise in the axils of the leaves while the seeds are small, black in color.

Chinese betel nut (Peperomia pellucida L.) phytochemicals

Phytochemical test results for Chinese betel nut grown on alluvial soil types contain several classes of compounds that are beneficial to health like flavonoids, alkaloids, tripenoids, phenolics, tannins and saponins. According to Tarigan et al., (in Rabha, 2021), Chinese betel leaf plants contain chemical compounds belonging to the glycosides, flavonoids, tannins and steroid/triterpenoid groups. This is in line with Nurhaliza's research (in Munira et al., 2020) who added that the largest class of compounds found in Chinese betel nut are flavonoids. According to Angelina et (in Momin & Yeligar, 2019), the Chinese betel plant (Peperomia pellucida L.) contains alkaloids, flavonoids, saponins, tannins and triterpenoids (Slavova & Karanasios, 2018). Apart from these ingredients, Chinese betel (Peperomia pellucida L.) also contains other chemical compounds that have been studied previously, namely essential oil compounds, especially carotol dillapiole , β-carophyllene (Patra et al., 2020).

Benefits of Chinese Betel (Peperomia pellucida L.)

The results of the interviews found that Chinese betel (Peperomia pellucida L.) which grows on alluvial soil types has been used traditionally in treating several diseases such as skin diseases, headaches, fever, wounds, as an anti-gout, anti-inflammatory, antioxidant, antidiabetic and anti-hypertensive. This has been proven by previous research that Chinese betel can treat inflammation of the skin, acne (Perumal et al., 2022), headaches, fever. In

addition, Chinese Betel also treats kidney disease and stomach ache. In addition, Chinese betel has anticancer, antioxidant and antimicrobial activity, analgesic, anti-inflammatory, hypoglycemic activity, antibacterial activity, antimicrobial, anticancer, antibacterial, antidiabetic and antihypertensive (Masaenah et al., 2021). So it can be concluded that Chinese betel (Peperomia pellucida L.) is an ethnomedicin or herbal medicine (Elechi & Ewelike, 2019).

Conclusion

The results showed that the soil color and rusty color of the alluvial soil in Ambon city were generally brown in color where the alluvial soil structure found at the study site was the O horizon with a 17 cm thick layer of soil, the A horizon with a 45 cm thick soil layer, and the Bw horizon with a lumpy structure. soil thickness of 30 cm and on the C horizon with a thickness of 65 cm is classified as having a rounded lumpy soil structure. The soil has a high clay and silt content. the further down the soil solum, the lower the C-organic content. Soil in the city of Ambon is classified as having moderate fertility. Low base saturation is related to the C-organic content in the soil, if the organic C is high, the base saturation value is also high. Phytochemical test results for Chinese betel nut grown on alluvial soil types contain several classes of compounds that are beneficial to health like flavonoids, alkaloids, tripenoids, phenolics, tannins and saponins so that they have ethnomedicin effects such as anti - inflammatory, antioxidant, antidiabetic and antihypertensive activities.

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