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Soil Organic Matter and Its Correlation with Several Chemical Properties of Inceptisols in Rice Fields in Java

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Abstract The study aimed to explore the connection between organic matter levels and chemical characteristics of Inceptisols soil used for wet rice cultivation in three Java locations: Jasinga 1, Jasinga 2, and Serpong. Soil samples were gathered from these areas, with nine soil profiles identified and samples taken at depths of 0-20 cm, 20-40 cm, and 40-60 cm, totaling 27 samples. Various soil properties were assessed, including pH, organic carbon, soil bases, total nitrogen, available phosphorus, and cation exchange capacity (CEC). The findings indicated that the chemical composition of paddy soil across the locations, encompassing organic matter content, pH, total nitrogen, available phosphorus, CEC, and alkaline exchangeable elements (Ca, Mg, K, Na), sufficiently met the nutritional requirements of rice plants. A noteworthy negative correlation between organic matter content and soil pH and exchangeable-Na levels underscored a direct influence on paddy soil fertility. Recommendations included enhancing organic matter and improving pH to optimize rice production.

Keywords Inceptisols, soil fertility, soil productivity, rice fields

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1. Introduction

Inceptisols, characterized as young soils with moderate weathering and low clay content (<8%) at depths of 20-50 cm, are commonly found in tropical regions, covering approximately 4% of the total land area of 207 million hectares. They typically feature a thick solum, ranging from 1 to 2 meters deep, with black or gray to dark brown coloration, a sandy loam texture, and a crumbly soil structure with loose consistency. Their pH ranges from 5.0 to 7.0, with relatively high organic matter content (10% to 31%), and moderate to high nutrient levels, but overall, fertility and chemical properties are relatively low [1]. Physical and chemical properties include a specific gravity of 1.0 g/cm^3, calcium carbonate content less than 40%, base saturation below 50% at a depth of 1.8 m, COLE (Coefficient of Linear Extensibility) ranging from 0.07 to 0.09, porosity between 68% and 85%, and significant available water at 0.1 ± 1 atm [2]. [3] state that Inceptisols are highly susceptible to erosion, particularly gully erosion development.

Inceptisols, categorized as acidic soil, are widespread in Indonesia, covering around 70.5 million hectares, with 5.2 million hectares being acidic and found across Sumatra, Java, Kalimantan, Sulawesi, and Irian Jaya. According to Pinto et al. [4], Inceptisols are currently extensively utilized for agricultural expansion beyond Java and are also targeted for residential development. Hence, special consideration is necessary for Inceptisols due to their substantial development potential, despite facing significant challenges, particularly concerning soil chemical properties.

In various regions of Java, Indonesia, and other tropical areas, Inceptisols are commonly encountered, exhibiting distinct characteristics shaped by their formation process and environmental conditions. The diverse chemical properties of Inceptisols across Java's locations profoundly influence agricultural success and farmer welfare. Therefore, gaining a comprehensive understanding of Inceptisols' chemical traits across Java is vital for effective soil management and enhanced agricultural output. Factors like soil acidity, organic matter levels, cation exchange capacity, nutrient content, water retention, and mineral composition significantly affect soil fertility, agricultural sustainability, and natural resource management.

Rahayu et al. [5] highlighted the morphological aspects of paddy soil, influencing horizon formation, coloration, and plow shape within the soil profile. Soil physics, including structure, density, and consistency, vary notably. Paddy fields typically exhibit higher cation exchange capacity (K+, Na+, Ca2+, and Mg2+), organic carbon, and base saturation compared to dry land. Similarly, Azmi et al. [6] noted that Inceptisols in paddy fields undergo chemical property alterations, particularly in basic cations (exchangeable-K, exchangeable-Ca, exchangeable-Mg, exchangeable-Na), CEC, and base saturation. Research findings indicate that twice-annual rice planting yields better chemical properties, exemplified by higher exchangeable-K values and CEC. Agricultural practices on Inceptisols can significantly modify soil chemistry, as Buragohain et al. [7] suggested, with long-term biological fertilizer usage in paddy fields positively influencing soil chemical and biological characteristics, thereby enhancing rice cultivation.

Organic matter profoundly impacts soil chemical properties such as pH, CEC, and nutrient availability. Elevated organic matter levels enhance soil reducing power, pH, and CEC. Numerous studies have explored the correlation between organic matter and soil chemistry, indicating that organic and inorganic fertilizer application over time improves soil fertility [8]. Singh et al. [9] emphasized that organic matter addition boosts soil carbon and nitrogen content, enhancing fertility and plant productivity in an eco-friendly and cost-effective manner. Manure application emerges as a viable strategy to increase crop yields by enhancing soil pH and fertility [10]. Prolonged intensive land use leads to reduced organic matter and soil fertility, homogenizing soil properties and reducing spatial variability [11].

Given the above context, conducting research to analyze the relationship between organic matter content and Inceptisols' chemical properties in rice fields across three Java locations is imperative. The outcomes of this study aim to aid farmers, agricultural researchers, and policymakers in devising suitable strategies to bolster agricultural productivity, preserve the environment, and foster agricultural sustainability in these specific regions of Java.

2. Materials and Methods

From March to August 2021, a research study was conducted in Bogor Regency, West Java, and South Tangerang Regency, Banten, focusing on 30-year-old rice fields. Soil samples collected were analyzed at the Soil Chemistry and Fertility Laboratory, Department of Soil Science and Land Resources, Faculty of Agriculture, Bogor Agricultural Institute (IPB). Three locations were selected for profile observations and soil sampling, each with three soil profiles at depths of 0-20 cm, 20-40 cm, and 40-60 cm, totaling 9 soil profiles. The coordinates for sample collection were recorded at specific points in Curug Village, Jasinga District, Bogor Regency, West Java, and Kademangan Village, Setu District, South Tangerang Regency, Banten. Soil sample analysis encompassed pH H2O (1:2.5 ratio), total nitrogen (N-total) via the Kjeldhal method, available phosphorus (P-available) via the Bray I method, organic carbon (C-organic) via the Walkley and Black method, and exchangeable base cations (K, Ca, Mg, Na) and cation exchange capacity using 1 N NH4OAc extraction. Descriptive data analysis was conducted, comparing obtained data with soil property criteria, and Pearson correlation analysis was performed using SPSS 22.

3. Result and Discussion

3.1. Organic Matter Content, pH, N-total, P-available, and Cation Exchange Capacity Soil in Java

Table 1 presents the findings of soil analysis conducted in Jasinga and Serpong, focusing on various soil profiles and their chemical properties, including organic matter content, pH, total nitrogen (N-total), available phosphorus (P-available), and cation exchange capacity (CEC). Across the observed nine rice field soil profiles in the three research locations, organic matter content ranged from very low to medium. Notably, the organic matter content was highest in the upper soil layers and varied at different depths. In Indonesia, most rice fields exhibit organic matter content of less than 2%. The elevated organic matter content on the soil surface corresponds to the application of organic materials at the onset of planting in the research area. Total carbon and nitrogen content were observed to be higher in the top soil layer compared to the deeper layers [12].

Increasing organic material content in paddy soil can be achieved by incorporating organic fertilizers. Supplementing organic fertilizer alongside inorganic fertilizers at planting onset can enhance soil fertility [13, 14, 15]. Additionally, Wu et al. [16] suggest that carbon stability, particularly in biochar, plays a significant role in carbon sequestration, depending on the physiochemical characteristics of organic matter and soil properties. However, there remains limited understanding regarding the stability of biochar carbon in paddy soils.

Soil pH values across all locations ranged from 4.40 to 6.40, indicating a spectrum from very acidic to slightly acidic based on the criteria. Profile 2 at the Jasinga 1 location exhibited a higher pH compared to other profiles and locations.

The pH value significantly influences soil acidity and nutrient availability, thereby impacting plant growth. Soil acidity in the Jasinga 1 and Jasinga 2 areas generally falls within the moderately acidic range, while in Serpong, it meets acidic criteria. Comparatively, Jasinga exhibits slightly better soil conditions than Serpong. Soil alkalinity or acidity plays a crucial role in nutrient availability to plants, with a pH range of 6.5-7.0 deemed more suitable for rice cultivation in these areas.

Research by Minasny et al. [17] on land cultivated for 12 years in South Korea revealed an increase in soil pH from 5.6 before 2000 to 5.9 after 2009, indicating a rise of approximately 0.3 pH units per decade. Based on spatial prediction confidence intervals, approximately 35% of paddy fields (4180 km2) are likely to experience a pH increase (probability > 66%), with 20% (2350 km2) having a high likelihood of experiencing pH elevation (probability > 90%).

Increasing the pH of soil with a constant charge can be achieved by incorporating significant quantities of plant residues, as opposed to soils with a variable charge [18]. Additionally, Wang et al. [19] suggests that the rate of pH increase is more pronounced in soils with higher acidity levels. To optimize nutrient provision, it is essential to lime all research locations to elevate the pH of each soil. The application of agricultural lime can effectively raise soil pH, increase calcium levels, enhance cation exchange capacity, and decrease exchangeable aluminum.

Table 1. Results of analysis of C-organic content, pH, N-total, P-available and cation exchange capacity of paddy soil in Java

Location	Profile	Depth (cm)	Organic matter (%)	pH	N-Total (%)	P-available (ppm)	CEC (me/100g)
Jasinga 1	Profile 1	0-20	2.06	5.80	0.15	1.78	51.00
		20-40	0.69	5.70	0.17	1.97	48.20
		40-60	0.86	4.70	0.07	2.15	49.40
	Profile 2	0-20	2.06	6.10	0.11	2.52	41.50
		20-40	0.34	6.20	0.06	2.70	47.80
		40-60	0.86	6.40	0.06	2.89	61.60
	Profile 3	0-20	2.06	5.40	0.11	3.07	41.10
		20-40	0.86	4.60	0.07	2.15	60.00
		40-60	1.03	4.40	0.10	1.60	54.90
Jasinga 2	Profile 1	0-20	1.41	5.25	0.13	2.33	45.43
		20-40	1.17	5.32	0.08	2.52	41.28
		40-60	1.10	5.88	0.08	2.70	65.18
	Profile 2	0-20	1.51	5.48	0.14	2.15	47.99
		20-40	0.96	5.54	0.13	2.70	49.77
		40-60	1.67	5.48	0.06	1.78	44.64
	Profile 3	0-20	1.24	5.48	0.10	2.33	48.98
		20-40	1.22	5.49	0.10	1.60	39.11
		40-60	1.07	5.89	0.13	2.15	39.90
Serpong	Profile 1	0-20	3.78	4.80	0.23	2.33	38.70
		20-40	3.27	4.70	0.18	19.12	31.60
		40-60	1.38	5.20	0.14	19.31	28.60
	Profile 2	0-20	2.06	5.10	0.07	2.52	20.70
		20-40	1.20	5.10	0.13	2.33	36.50
		40-60	2.92	5.10	0.11	2.15	26.30
	Profile 3	0-20	4.30	4.70	0.10	2.33	47.40
		20-40	1.03	4.70	0.10	2.52	41.50
		40-60	1.55	4.90	0.23	2.70	32.80

The nitrogen content in Inceptisols within rice fields typically ranges from 0.06% to 0.23%, falling into the categories of very low to low. As indicated in Table 1, nitrogen levels in Jasinga 1 and Jasinga 2 are predominantly very low to low, while across Serpong's observation profiles, they vary from 0.07% to 0.23%, categorized as very low to medium. The scarcity of nitrogen in paddy soil stems from several factors. According to Patti et al. [20], nitrogen levels are influenced by leaching through drainage water, evaporation, and plant absorption. A portion of nitrogen is lost during harvest, some is returned as plant residue, lost to the atmosphere, and then cycled back, and some is leached away. Nitrogen stands as the most dynamic factor in soil fertility and a primary limitation on crop yields in agriculture. The ability to mineralize nitrogen in soil is crucial for sustaining agricultural productivity and safeguarding the environment [21]. This nitrogen content also affects the increase in CO2 to enhance yields; therefore, adequate nitrogen in the soil is essential for rice absorption [22].

Regarding phosphorus (P) content, Jasinga 1 and 2 rice fields exhibit very low levels (<10 ppm), while in Serpong's profile 1, layer B2, P content is classified as low, measuring 19.12 ppm and 19.31 ppm. This discrepancy arises from generally low phosphorus levels in the soil, which vary based on soil type. Although Inceptisols are categorized as young soil, phosphorus levels remain relatively low, primarily due to two factors: (1) the high demand for phosphorus as a major plant macronutrient, resulting in more phosphorus being depleted as plants absorb it; (2) the mobile nature of phosphorus in soil solution, making it susceptible to loss. Additionally, low phosphorus levels can be attributed to the low content of parent material, as phosphorus is typically not abundant in the acidic to intermediate soil formations found in West Java and Banten.

Furthermore, the application of organic materials to paddy soil has been shown to inhibit aluminum hydrolysis by up to 57.4% and increase available phosphorus in the soil by 31.26% to 50.64%. This rise in phosphorus availability is also attributed to the strong affinity of SiO44− in absorbing phosphorus from soil minerals, as SiO44− can temporarily adsorb exchangeable base cations like K+, Ca2+, Mg2+, and Na+ [23].

Cation exchange capacity (CEC) is a measure of a soil's ability to retain and release cations (positive ions). The CEC values across all samples ranged from 20.70 to 65.18 me/100g. Soils with higher CECs tend to offer better plant nutrition. Soil CEC depends on factors such as clay content type and amount, organic matter content, and soil pH. Therefore, CEC significantly influences soil fertility [24]. The observed rice field soil profiles in Table 1 exhibited CEC values ranging from moderate to very high, a difference attributed to organic matter content and soil pH, which are not overly acidic, thus enabling high soil CEC. Extremely acidic or alkaline soil pH levels may lead to a decrease in CEC. Clay mineral types also play a role in determining soil CEC, with montmorillonite-rich soils typically having higher CECs compared to soils dominated by kaolinite.

3.2. Base Cations and Bases can be Exchanged in Rice Fields in Java

Table 2 provides data on the chemical composition of soil in several locations and profiles for each location which include base saturation, interchangeable bases (exchangeable-Ca, exchangeable-Mg, exchangeable-K and exchangeable-Na).

Table 2. Results of analysis of base cations and exchangeable bases in rice field soil in Java

Location	Profile	Depth (cm)	BS (%)	Exch-Ca (me/100g)	Exch-Mg (me/100g)	Exch-K (me/100g)	Exch-Na (me/100g)
Jasinga 1	Profile 1	0-20	102.90	27.60	23.70	0.58	0.52
		20-40	101.10	24.30	23.40	0.51	0.50
		40-60	86.60	19.20	22.70	0.43	0.37
	Profile 2	0-20	109.20	21.90	22.80	0.40	0.29
		20-40	121.10	26.30	30.90	0.40	0.32
		40-60	97.00	26.60	32.40	0.45	0.33
	Profile 3	0-20	50.70	10.10	22.00	0.10	0.35
		20-40	42.80	9.90	14.80	0.51	0.56
		40-60	51.30	11.20	16.30	0.48	0.27
Jasinga 2	Profile 1	0-20	91.33	18.33	22.13	0.74	0.29
		20-40	89.46	14.80	21.09	0.71	0.33
		40-60	58.45	13.64	23.59	0.71	0.36
	Profile 2	0-20	86.41	18.51	22.23	0.43	0.30
		20-40	82.12	14.72	25.35	0.51	0.29
		40-60	81.59	7.82	27.90	0.45	0.25
	Profile 3	0-20	102.76	26.48	23.23	0.30	0.32
		20-40	98.98	18.69	19.17	0.53	0.32
		40-60	99.12	19.01	19.76	0.46	0.32
Serpong	Profile 1	0-20	36.60	11.30	2.60	0.05	0.18
		20-40	56.40	14.60	2.90	0.06	0.30
		40-60	73.10	17.40	3.10	0.08	0.37
	Profile 2	0-20	65.60	11,00	2.30	0.09	0.19
		20-40	21.20	6.00	1.60	0.06	0.11
		40-60	48.30	10.60	1.90	0.07	0.16
	Profile 3	0-20	17.70	6.30	1.80	0.05	0.20
		20-40	26.60	8.90	1.90	0.05	0.19
		40-60	49.60	13.30	2.60	0.07	0.30

Base saturation (BS) in Table 2 ranges from 17.70% to 121.10%, indicating a spectrum from very low to very high. The soil base saturation value represents the percentage of the total CEC influenced by base cations, namely Ca, Mg, Na, and K. The BS value is crucial for considering fertilization and predicting the availability of nutrients to plants. Base saturation is closely related to soil pH; soil with low pH generally has low base saturation, while soil with high pH has high base saturation. However, Table 2 shows that the base saturation of paddy soil in the three research locations ranges from very low to very high due to variations in the level of fertilization during the rice planting process. On soils where intensive fertilization is frequently applied, it will result in higher base saturation than on those that are not intensive.

The low base saturation in Inceptisols soil in rice fields in Jasinga and Serpong may be attributed to the climatic conditions in tropical areas, which can subsequently affect the growth of rice plants. The low base saturation in Inceptisols in rice cultivation in Jasinga and Serpong is thought to be caused by tropical climate conditions which in turn can affect the growth of rice plants. Low base saturation, cation exchange capacity, and soil organic matter are caused by high rainfall and hot temperatures, thereby accelerating the leaching of base cations such as potassium (K), calcium (Ca), magnesium (Mg), and sodium (Na) so that soil pH increasingly sour [25, 26, 27]. Added by Barchia et al., Gusmini et al., Herman et al. [28, 29, 30] high rainfall has an impact on the high replacement of aluminum (Al), iron (Fe), and hydrogen (H) which can be exchanged in the soil.

3.3. Correlation of Organic Matter with Chemical Properties of Selected Soil Inceptisols Paddy Fields in Java

The results of the correlation between organic matter content and selected soil chemical properties in Inceptisols in paddy fields at three locations can be seen in Table 3. At Jasinga location 2, organic matter was negatively correlated with pH and exchangeable-Na. The very real negative correlation of organic matter with soil pH and exchangeable-Na shows that the lower the soil organic matter content, the lower the soil pH value, and soil exchangeable-Na levels. The results align with the soil organic matter content showing low pH values and exchangeable-Na levels at all research locations. This shows that the low organic matter content at all research locations that have been in rice fields for approximately 30 years affects the organic matter content and chemical properties of the soil. In a study conducted over 20 years in Qiyang County in Yunan, long-term inorganic fertilizer (NPK) reduced the annual average soil pH by 0.07, while organic fertilizer increased the soil pH by approximately 0.04 [31]. Consistent with research results Voltr et al. [32], it is stated that the application of inorganic fertilizer without being accompanied by organic fertilizer had a negative effect on soil nutrient content and soil texture. The correlation of organic matter with soil chemical properties in Inceptisols in paddy fields at all research locations is in line with the importance of maintaining soil fertility, especially in the simultaneous application of organic matter and inorganic fertilizer.

Table 3. Pearson correlation of organic materials with selected soil chemical properties in Inceptisols Ricefield in Java

Location	pH	N-Total	P-avalaible	CEC	BS	Exch-Ca	Exch-Mg	Exch-K	Exch-Na
Jasinga 1	0.111	0.467	-0.37	0.063	0.063	-0.125	-0.484	-0.325	-0.025
Jasinga 2	**-0.667***	-0.003	0.569	-0.302	0.628	0.022	0.378	-0.402	**-0.783***
Serpong	-0.124	0.55	0.214	-0.384	0.441	0.437	0.518	0.057	0.137

Notes *= Very real ($p<0.01$)

**=Real (nilai $p<0.05$)

4. Conclusion

The Inceptisols produced in rice fields exhibits quite good chemical properties, as indicated by various observational parameters. The research location in Jasinga showed better chemical properties compared to the location in Serpong. It is hoped that optimizing the use of Inceptisols in rice fields can improve the management of rice fields, allowing them to maintain soil fertility and provide nutrients to support plant growth and production. The very real negative correlation between organic matter content and soil pH and exchangeable-Na levels shows a direct relationship with the fertility of paddy soil. The use of organic materials and proper land management can serve as an alternative for the successful utilization of Inceptisols soil in paddy fields.

REFERENCES

[1] D. S. Sara, B. Joy, and E. T. Sofyan, “Application of Dolomite as Soil Conditioner to pH and Exchangeable Al in Inceptisol,” *Int. J. Life Sci. Agric. Res.*, vol. 03, no. 01, pp. 46–48, 2024, doi: 10.55677/ijlsar/V03I1Y2024-08

[2] S. Ketaren, P. Marbun, and P. Marpaung, “Klasifikasi Inceptisol Pada Ketinggian Tempat Yang Berbeda Di Kecamatan Lintong Nihuta Kabupaten Hasundutan,” *J. Agroekoteknologi Univ. Sumatera Utara*, vol. 2, no. 4, pp. 1451–1458, 2014, doi: 10.32734/jaet.v2i4.8443.

[3] J. Swanda, H. Hanum, and P. Marpaung, “The Change of Inceptisol Chemical Characteristics with Humic Material Aplication from Extract Peat which Incubated for Two Weeks,” *J. Online Agroekoteknologi*, vol. 3, no. 1, pp. 79–86, 2015.

[4] L. C. Pinto, C. R. de Mello, P. R. Owens, L. D. Norton, and N. Curi, “Role of Inceptisols in the Hydrology of Mountainous Catchments in Southeastern Brazil,” *J. Hydrol. Eng.*, vol. 21, no. 2, pp. 1–10, 2016, doi: 10.1061/(asce)he.1943-5584.0001275.

[5] M. L. R. Ayyu Rahayu, Sri Rahayu Utami, “Karakteristik dan klasifikasi tanah pada lahan kering dan lahan yang disawahkan di kecamatan perak kabupaten jombang,” vol. 1, no. 2, pp. 79–87, 2014, doi: https://jtsl.ub.ac.id/index.php/jtsl/article/view/115.

[6] C. U. Azmi, Z. Zuraida, and T. Arabia, “Beberapa Sifat Kimia Inceptisol yang Disawahkan Satu dan Dua Kali Setahun di Kecamatan Linge Kabupaten Aceh Tengah,” *J. Ilm. Mhs. Pertan.*, vol. 7, no. 3, pp. 467–476, 2022, doi: 10.17969/jimfp.v7i3.20894.

[7] S. Buragohain, B. Sarma, D. J. Nath, N. Gogoi, R. S. Meena, and R. Lal, “Effect of 10 years of biofertiliser use on soil quality and rice yield on an Inceptisol in Assam, India,” *Soil Res.*, vol. 56, no. 1, pp. 49–58, 2018, doi: 10.1071/SR17001.

[8] M. K. Bhatt, R. Labanya, and H. C. Joshi, “Influence of Long-term Chemical fertilizers and Organic Manures on Soil Fertility - A Review,” *Univers. J. Agric. Res.*, vol. 7, no. 5, pp. 177–188, 2019, doi: 10.13189/ujar.2019.070502.

[9] Singh, T.B., Ali, A. Prasad, M. Yadav, A. Shrivastav, P. Goyal, D. Dantu, P.K. Role of organic fertilizers in improving soil fertility. In *Contaminants in Agriculture*; Springer: Cham, Switzerland, 2020; pp. 61–77.

[10] A. Cai *et al.*, “Manure acts as a better fertilizer for increasing crop yields than synthetic fertilizer does by improving soil fertility,” *Soil Tillage Res.*, vol. 189, no. February, pp. 168–175, 2019, doi: 10.1016/j.still.2018.12.022.

[11] S. Chen, B. Lin, Y. Li, and S. Zhou, “Spatial and temporal changes of soil properties and soil fertility evaluation in a large grain-production area of subtropical plain, China,” *Geoderma*, vol. 357, no. August 2019, p. 113937, 2020, doi: 10.1016/j.geoderma.2019.113937.

[12] W. Zhou, G. Han, M. Liu, and X. Li, “Effects of soil pH and texture on soil carbon and nitrogen in soil profiles under different land uses in Mun River Basin, Northeast Thailand,” *PeerJ*, vol. 2019, no. 10, 2019, doi: 10.7717/peerj.7880.

[13] G. Ma *et al.*, “Effects of Organic and Inorganic Fertilizers on Soil Nutrient Conditions in Rice Fields with Varying Soil Fertility,” *Land*, vol. 12, no. 5, 2023, doi: 10.3390/land12051026.

[14] C. Nguemezi, P. Tematio, M. Yemefack, D. Tsozue, and T. B. F. Silatsa, “Soil quality and soil fertility status in major soil groups at the Tombel area, South-West Cameroon,” *Heliyon*, vol. 6, no. 2, p. e03432, 2020, doi: 10.1016/j.heliyon.2020.e03432.

[15] E. E. Oldfield, M. A. Bradford, and S. A. Wood, “Global meta-analysis of the relationship between soil organic matter and crop yields,” *Soil*, vol. 5, no. 1, pp. 15–32, 2019, doi: 10.5194/soil-5-15-2019.

[16] M. Wu, X. Han, T. Zhong, M. Yuan, and W. Wu, “Soil organic carbon content affects the stability of biochar in paddy soil,” *Agric. Ecosyst. Environ.*, vol. 223, pp. 59–66, 2016, doi: 10.1016/j.agee.2016.02.033.

[17] B. Minasny, S. Y. Hong, A. E. Hartemink, Y. H. Kim, and S. S. Kang, “Soil pH increase under paddy in South Korea between 2000 and 2012,” *Agric. Ecosyst. Environ.*, vol. 221, pp. 205–213, 2016, doi: 10.1016/j.agee.2016.01.042.

[18] Y. Wang, C. Tang, J. Wu, X. Liu, and J. Xu, “Impact of organic matter addition on pH change of paddy soils,” *J. Soils Sediments*, vol. 13, no. 1, pp. 12–23, 2013, doi: 10.1007/s11368-012-0578-x.

[19] Yunus, “Efek residu pengapuran dan pupuk kandang terhadap basa-basa dapat ditukarkan pada ultisol dan hasil kedelai,” *J. Solum*, vol. 3, no. 1, pp. 27–33, 2006. doi: 10.25077/js.3.1.27-33.2006

[20] P. S. Patti, E. Kaya, and C. Silahooy, “Analisis status nitrogen tanah dalam kaitannya dengan serapan N oleh tanaman padi sawah di Desa Waimital, Kecamatan Kairatu, Kabupaten Seram bagian barat,” *Agrologia*, vol. 2, no. 1, pp. 51–58, 2013.

[21] X. Wen, C. Yanpeng, Y. Xinan, H. Yan, and Z. Li, “Soil nitrogen supply capacity as an indicator of sustainable watershed management in the upper basin of Miyun Reservoir,” *Ecol. Indic.*, no. October 2016, pp. 4–6, 2017, doi: 10.1016/j.ecolind.2017.04.016

[22] C. Zhu, Q. Zeng, H. Yu, S. Liu, G. Dong, and J. Zhu, “Effect of Elevated CO2 on the Growth and Macronutrient (N, P and K) Uptake of Annual Wormwood (Artemisia annua L.),” *Pedosphere*, vol. 26, no. 2, pp. 235–242, 2016, doi: 10.1016/S1002-0160(15)60038-8.

[23] I. Q. Chong *et al.*, “Improving Selected Chemical Properties of a Paddy Soil in Sabah Amended with Calcium Silicate: A Laboratory Incubation Study,” *Sustain.*, vol. 14, no. 20, pp. 1–13, 2022, doi: 10.3390/su142013214.

[24] T. Belachew and Y. Abera, “Assessment of Soil Fertility Status with Depth in Wheat Growing Highlands of Southeast Ethiopia,” *World J. Agric. Sci.*, vol. 6, no. 5, pp. 525–531, 2010.

[25] C. O. Othieno, A. N. Otinga, K. Wairimu, and M. Koech, “Potential for agricultural lime on improved soil health and agricultural production in Kenya,” *African Crop Sci. Conf. Proc.*, vol. 9, pp. 339–341, 2009.

[26] E. Elfarisna, E. Rahmayuni, and H. Gustia, “Efek Amelioran pada Pertumbuhan dan Produksi Tanaman Jagung Manis,” *J. Ilmu Pertan. Indones.*, vol. 28, no. 4, pp. 660–666, 2023, doi: 10.18343/jipi.28.4.660.

[27] E. Rahmayuni, S. Anwar, B. Nugroho, and L. T. Indriyati, “Chemical Characteristics of Exchangeable Al, Fe, Mn, and Inorganic P Fraction Ultisols at Forest, Dry Land and Rice Fields Land Use in Jasinga, Indonesia,” *Int. J. Environ. Sci. Dev.*, vol. 14, no. 4, pp. 228–233, 2023, doi: 10.18178/ijesd.2023.14.4.1438.

[28] M. F. Barchia, B. Sulistyo, E. L. Putri, and W. Herman, “Spatial Prediction of Soil Erodibility Indices of the Sensitive Landscape of Bengkulu Watershed , Indonesia,” *Int. J. Enviromental Sci. Dev.*, vol. 14, no. 3, pp. 190–194, 2023, doi: 10.18178/ijesd.2023.14.3.1433.

[29] Gusmini, F. Arlius, Adrinal, R. Fauzan, and E. L. Putri, “Restoration of soil chemical and mercury content in former mining land with the application of biochar, manure and clay for the sunflower growth and production,” *IOP Conf. Ser. Earth Environ. Sci.*, vol. 1160, no. 1, 2023, doi: 10.1088/1755-1315/1160/1/012029.

[30] W. Herman and Elara Resigia, “Pemanfaatan Biochar sekam dan kompos jerami padi terhadap perumbuhan dan produksi padi (Oryza sativa) pada tanah Ultisol,” *J. Ilm. Pertan.*, vol. 15, no. 1, pp. 42–50, 2018, doi: 10.31849/jip.v15i1.1487.

[31] H. Wang *et al.*, “Effects of long-term application of organic fertilizer on improving organic matter content and retarding acidity in red soil from China,” *Soil Tillage Res.*, vol. 195, no. August, p. 104382, 2019, doi: 10.1016/j.still.2019.104382.

[32] V. Voltr, L. Menšík, L. Hlisnikovský, M. Hruška, E. Pokorný, and L. Pospíšilová, “The soil organic matter in connection with soil properties and soil inputs,” *Agronomy*, vol. 11, no. 4, 2021, doi: 10.3390/agronomy11040779.

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