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EVALUATION OF LAND SUITABILITY FOR AVOCADO CULTIVATION IN THE BAWANG GAJAH SUB-WATERSHED CENTRAL ACEH REGENCY

EVALUASI KESESUAIAN LAHAN TANAMAN ALPUKAT DI SUB DAS BAWANG GAJAH KABUPATEN ACEH TENGAH

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Abstract

Avocado (*Persea americana*) is an important horticultural crop with high nutritional value and economic potential. Land suitability evaluation is essential to determine land capability for optimal crop growth and sustainable production. This study aimed to assess the land suitability class for avocado cultivation in the Bawang Gajah Sub-Watershed, Central Aceh Regency. The study employed a survey-based approach comprising preparation, a preliminary survey, a field survey, and data analysis. Soil sampling was conducted based on the Land Mapping Unit (LMU) derived from the overlay of slope, land use, and soil type maps using GIS techniques. The results indicated that land suitability for avocado cultivation in the study area was classified as marginally suitable (S3). LMU 2 was limited by soil texture, while soil texture, P_2O_5, K_2O, and slope constrained LMU 3. LMU 4, 6, and 7 were limited by soil texture, P_2O_5, and slope, whereas P_2O_5 and slope constrained LMU 14. These limitations suggest that soil physical properties, nutrient availability, and topographic conditions are the main constraints for avocado cultivation. Improvement measures such as applying organic matter, constructing terraces, and applying balanced phosphorus and potassium fertilizers are recommended to enhance land suitability.

Keywords: *Land suitability evaluation, Land Mapping Unit, Avocado, Sub-watershed, Central Aceh*

Abstrak

Alpukat *(Persea americana)* merupakan buah yang digemari oleh masyarakat karena mudah didapat dan memiliki gizi tinggi. Evaluasi kesesuaian lahan merupakan penilaian tingkat kecocokan suatu lahan untuk penggunaan tertentu, khususnya tanaman budidaya, agar dapat tumbuh dan berproduksi secara optimal. Penelitian ini bertujuan untuk menentukan kelas kesesuaian lahan tanaman alpukat di Sub DAS Bawang Gajah Kabupaten Aceh Tengah. Penelitian dilaksanakan menggunakan metode survei yang terdiri dari tahap persiapan, survei pendahuluan, survei utama, serta analisis dan penyajian data. Pengambilan sampel tanah didasarkan pada Satuan Peta Lahan (SPL) yaitu peta hasil overlay peta kemiringan lereng, penggunaan lahan, dan jenis tanah. Hasil penelitian menunjukan bahwa kelas kessesuaian lahan tanaman alpukat di Sub DAS Bawang Gajah termasuk kelas marginal (S3) yang terdapat pada SPL 2 dengan faktor pembatas tekstur (S3rc-1), SPL 3 dengan faktor pembatas tekstur, P_2O_5, K_2O dan kemiringan lereng (S3rc-1; na-2;na-3;eh-1), SPL 4 dengan faktor pembatas tekstur, P_2O_5 dan kemiringan lereng (S3rc-1;na-2;eh-1). SPL 6 dengan faktor pembatas tekstur, P_2O_5 dan kemiringan lereng (S3rc-1;na-2;eh-1), SPL 7 dengan faktor pembatas tekstur, P_2O_5, dan kemiringan lereng (S3rc-1;na-2;eh-1), SPL 14 dengan faktor pembatas P_2O_5 dan kemiringan lereng (S3na-2;eh-1). Usaha perbaikan untuk faktor pembatas tekstur

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dapat dilakukan dengan penambahan bahan organik, kemiringan lereng dengan pembuatan teras sedangkan faktor pembatas P_2O_5 dan K_2O dapat dilakukan dengan penambahan pupuk P dan K.

Kata Kunci: Evaluasi, SPL, Karakteristik Lahan, Sub DAS Bawang Gajah

INTRODUCTION

Land use is a dynamic human activity that meets both material and spiritual needs (Arsyad, 2010). Land plays a crucial role as a growing medium for plants and as a habitat for humans and other living things (Zalmita *et al*., 2020). Therefore, land use must be tailored to its characteristics and quality for optimal, sustainable utilization (Ritung *et al*., 2011). Land use without evaluating its suitability can reduce crop productivity, particularly on steep slopes and shallow soils (Hardjowigeno, 2010).

Land suitability evaluation is the process of assessing land for a specific use to identify limiting factors for plant growth (Harahap *et al*., 2019; Harahap *et al*., 2020). Each plant type has different growth requirements, so land evaluation is important to determine the appropriate and optimal use of agricultural land (Astuti, 2010).

Avocado (*Persea americana*) is a horticultural commodity with high nutritional value and is widely consumed. Avocado production in Central Aceh Regency reached 60,135 tons per year in 2023 (BPS Aceh, 2024). Besides being fruit plants, avocados also serve as ground cover plants that can reduce soil damage from rainfall (Susetyaningsih, 2012).

Based on this, this study was conducted to evaluate the suitability of avocado plantation land in the Bawang Gajah Sub-watershed for increased production and sustainable land management in Central Aceh Regency. This study aims to determine the land suitability class for avocado plants in the Bawang Gajah Sub-DAS, Central Aceh Regency.

RESEARCH METHODS

Tools and materials

The tools used in this study included a soil drill, a meter, plastic bags, label paper, a GPS, an Abney level, a camera, a machete, a hoe, stationery, and the ArcGIS application. Analysis of the physical and chemical properties of the soil in the laboratory using an analytical balance, a pH meter, volumetric flask, a shaker bottle, a measuring cup, an Erlenmeyer flask, a biuret, a shaker, a test tube, an oven, a porcelain cup, filter paper, a distillation apparatus, a 2 mm sieve, a Kjeldahl flask, and a spectrophotometer

The materials used in this study include administrative maps, climate data, soil type maps, slope maps, land use maps, land map unit maps (SPL), and soil samples. Chemicals for the analysis of soil chemical and physical properties include reagents for the analysis of CEC, organic carbon, base saturation, soil pH, soil texture, and total phosphorus and potassium, including NH_4OAc, HCl, NaOH, $K_2Cr_2O_7$, H_2SO_4, H_3PO_4, H_2O_2, distilled water, $Na_4P_2O_7$, alcohol, H_3BO_3, and chemical indicators.

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This study used a survey-based approach to evaluate land suitability. The study consisted of four stages: preparation, preliminary survey, primary survey, and data analysis and presentation. Soil sampling was conducted using composite soil samples at the SPL (Study Area) and at a depth of approximately 0–30 cm. Laboratory soil analysis included physical and chemical properties related to avocado plant growth requirements.

Land suitability analysis is carried out using the matching method, namely comparing the characteristics and quality of the land resulting from the analysis with the land suitability criteria for avocado plants (Ritung et al., 2011)**.** Land suitability classes are determined as S1 (very suitable), S2 (reasonably suitable), S3 (marginally suitable), and N (not suitable) by identifying limiting factors in each SPL.

RESULTS AND DISCUSSION

Land Map Unit

The Land Map Unit (SPL) is a working map used as the basis for field observations in each observation plot. The SPL map is derived from the overlay of soil type, topography, and land use maps, yielding 14 land map units (Table 1). Of the 14 SPLs, only SPLs 2, 3, 4, 6, 7, and 14 were subjected to intensive observations.

Table 1. Land Map Units in the Bawang Gajah Sub-DAS

SPL	Slope (%)	Soil Type	Land Use
1	25-40	Inceptisol	Body of water
2	0-8	Inceptisol	Mixed garden
3	15-25	Entisol	Monoculture Farming
4	15-25	Ultisol	Monoculture Farming
5	>40	Inceptisol	Mixed garden
6	15-25	Entisol	Mixed garden
7	15-25	Ultisol	Mixed garden
8	>40	Inceptisol	Settlement
9	>40	Inceptisol	Rain-fed rice fields
10	>40	Ultisol	Mixed garden
11	25-40	Entisol	Rain-fed rice fields
12	>40	Inceptisol	Protected forest
13	>40	Entisol	Protected forest
14	25-40	Entisol	Mixed garden

Morphological and Chemical Properties of Soil

The results of soil morphology observations in the Bawang Gajah Sub-watershed indicate that soil drainage is somewhat hampered to good, soil depth is moderate to deep (75–100 cm), slope gradients range from 4–35%, and the erosion hazard level is very light to moderate. Soil texture is dominated by sandy loam and silty loam, while surface rocks and rock outcrops are generally low (<5%), so they are relatively supportive in land management (Table 2).

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Table 2. Soil Morphological Properties in the Bawang Gajah Sub-DAS, Central Aceh Regency

SPL	Drainage	Soil Depth (cm)	Slope	Danger of Erosion	Soil Texture	Surface Rock (%)	Outcrop Rock (%)
2	Good	100	4	Very light	Sandy Loam	0.01	4
3	Good	100	22	Light	Sandy Loam	0	0
4	Good	100	24	Currently	Sandy Loam	0	0
6	Good	100	24	Currently	Sandy Loam	0	0
7	Hampered	75	24	Currently	Sandy Loam	0.03	0.09
14	Good	100	35	Currently	Dusty Clay	0	0

The soil's chemical properties indicate low to moderate fertility. The soil pH is classified as slightly acidic to acidic (4.91–5.84), the cation exchange capacity is low to moderate (9.60–19.60 cmol/kg), and the organic carbon and total nitrogen contents are low. Base saturation is moderate, while the availability of P_2O_5 varies from low to high, and K_2O is low to moderate. These conditions indicate the presence of major limiting factors, including soil acidity, low organic matter, and nutrient availability (N, P, and K), which can limit avocado plant growth (Table 3).

Table 3. Results of Soil Chemical Properties Analysis in the Bawang Gajah Sub-DAS, Central Aceh Regency

SPL	CEC (Cmol)	pH (H_2O)	C-organic (%)	KB (%)	N total (%)	P_2O_5 (mg/100%)	K2O (mg/100%)
2	12.2	5.25	1.23	42.8	0.13	56.12	0.32
3	17.6	5.69	1.27	51.36	0.15	1.84	0.2
4	11.2	5.84	1.02	49.03	0.12	68.08	0.27
6	9.6	4.91	0.81	51.15	0.11	13.8	0.24
7	19.6	5.2	1.79	53.52	0.17	1.84	0.3
14	16	5.81	1.18	36.63	0.11	4.6	0.43

Assessment of Land Suitability Class for Avocado Plants

A land suitability class assessment is conducted to determine the level of suitability and identify limiting factors affecting avocado plant development, thereby informing land improvement efforts. Determination of land suitability classes at SPL 2, 3, 4, 6, 7, and 14 is done qualitatively using the matching method, whereby land characteristics are matched with avocado plant suitability criteria (Ritung *et al*., 2011).

The evaluation results show that all SPLs in the Bawang Gajah Sub-watershed, Central Aceh Regency, are included in the S3 land suitability class (marginally suitable). The main limiting factors found are soil texture, P_2O_5 availability, and slope gradient. SPL 2 is limited by soil texture, SPLs 3, 4, 6, and 7 are limited by soil texture, P_2O_5, and slope gradient, while SPL 14 is limited by P_2O_5 and slope gradient (Table 4).

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Table 4. Land Suitability Class for Avocado Plants in the Bawang Gajah Sub-DAS, Central Aceh Regency

SPL	Land Suitability Class	Limiting Factors	Repair Efforts
2	S3rc-1	Texture	Addition of organic materials
3	S3rc-1; na-2; na-3; eh-1	Texture, P_2O_5, K_2O, slope	Adding organic materials, providing P and K fertilizers, and making terraces
4	S3rc-1; na-2; eh-1	Texture, P_2O_5, slope	Addition of organic materials, application of P fertilizer, and making terraces
6	S3rc-1; na-2; eh-1,	Texture, P_2O_5, slope	Addition of organic materials, application of P fertilizer, and making terraces
7	S3rc-1; rc-3; na-2; eh-1	Texture, P_20_5, slope	Addition of organic materials, application of P fertilizer, and making terraces
14	S3na-2; eh-1	P_2O_5, slope	Providing P fertilizer, making terraces

Land Suitability Class Improvement Efforts

Based on the identified limiting factors, improvement efforts are needed to increase the land's suitability class. Limiting factors are divided into those that can be economically improved and those that are permanent. Improved factors include rooting media, nutrient availability and retention, erosion hazard, and drainage, while permanent factors include altitude and climatic conditions (Hardjowigeno & Widiatmaka, 2001).

The limiting factor of soil texture in SPL 2, 3, 4, 6, and 7 can be overcome by adding organic matter to improve soil structure and increase cation exchange capacity (Hasibuan, 2015). The limiting factor of slope found in SPL 3, 4, 6, 7, and 14 can be addressed by creating terraces that reduce the velocity of surface flow (Idjudin, 2011). The limiting factor of P_2O_5 found in SPL 3, 4, 6, 7, and 14 can be overcome through phosphorus fertilization (e.g., SP-36). According to Rosalina and Nirwanto (2021), P fertilization significantly increases crop production by regulating various plant metabolic activities. The P element also functions to encourage root growth and development, as well as stimulate fruit ripening. The limiting factor for K_2O_5 is only present in SPL 3, and this can be improved by applying potassium fertilizer, such as KCl. KCl fertilizer is a high-potassium fertilizer that increases yields and harvest quality and helps plants become more resistant to pests and diseases (Solihin *et al*., 2019).

CONCLUSION

1. The land suitability class for avocado plants in the Bawang Gajah Sub-DAS, Central Aceh Regency, includes the marginal suitability class (S3), which is found in SPL 2, 3, 4, 6, 7, and 14, with limiting factors of texture, slope, P_2O_5, and K_2O.
2. Efforts to overcome the limiting factors of soil texture can be made by adding organic matter; the slope factor can be addressed by constructing terraces; and the limiting factors

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of P_2O_5 and K_2O can be addressed by applying P and K fertilizers.

REFERENCES

Astuti, R. (2010). *Evaluasi Kesesuaian Lahan untuk Pengembangan Pertanian*. Yogyakarta: Fakultas Pertanian, Universitas Gadjah Mada.

Arsyad, S. (2010). *Konservasi Tanah dan Air*. Bogor: IPB Press.

Harahap, F.S., Harahap, D.E. dan Harahap, P., (2019). Karakteristik Tanah dan Evaluasi Lahan pada Areal Penggunaan lain untuk Pengembangan Tanaman Padi Sawah di Kecamatan Salak Kabupaten Pakpak Bharat. *Ziraa'ah Majalah Ilmiah Pertanian*. 45(2): 195–204.

Harahap, F.S., Rauf, A., Elfiati, D., Sarifuddin, S. dan Sidabukke, S.H., (2020). Evaluasi Kesesuaian Di Areal Penggunaan Lain untuk Tanaman Gambir (*Uncaria Gambier* Roxb.) Di Kecamatan Salak, Kabupaten Pak-Pak Bharat. *Jurnal Tanah dan Sumberdaya Lahan*, 7(1), pp.7–14.

Hardjowigeno S. (2010). *Ilmu Tanah*. Jakarta: Akademika Pressindo

Hardjowigeno, S. dan Widiatmaka. (2001). Kesesuaian Lahan dan Perencanaan Tataguna Tanah. Jurusan Tanah, Fakultas Pertanian. Institut Pertanian Bogor.

Hasibuan, A. S. Z. (2015). "Pemanfaatan Bahan Organik dalam Perbaikan Beberapa Sifat Tanah Pasir Pantai Selatan Kulon Progo," *Planta Trop. J*. Agro Sci.31-40.

Idjudin, A. A. (2011). Peranan Konservasi Lahan Dalam Pengelolaan Perkebunan. *Jurnal Sumberdaya Lahan*. 5(2), 103–116.

Ritung S, Nugroho K, Mulyani A, dan Suryani E. (2011). *Petunjuk Teknis Evaluasi Lahan untuk Komoditas Pertanian*. Edisi Revisi. Balai Besar Pengembangan Penelitian Sumberdaya Pertanian. Bogor. 166 hal.

Rosalina, E., dan Nirwanto, Y. (2021). Pengaruh Takaran Pupuk Fosfor (P) Terhadap Pertumbuhan dan Hasil Beberapa Varietas Tanaman Padi (*Oryza sativa* L.). *Media Pertanian*, 6(1), 45–59.

Solihin, E., Sudirja, R., & Kamaludin, N. N. (2019). Pengaruh Dosis Pupuk Kalium terhadap Pertumbuhan dan Peningkatan Hasil Tanaman Jagung Manis (*Zea Mays* L.) pada Inceptisol. *Journal Agrikultura*, 30(2), 61–68.

Susetyaningsih, A. (2012). Pengaturan Penggunaan Lahan Di Daerah Hulu Das Cimanuk Sebagai Upaya Optimalisasi Pemanfaatan Sumberdaya Air. *Journal STT Garut*. ISSN: 2302-7312.

Zalmita, N., Alvira, Y., dan Furqan, M. H. (2020). Analisis Perubahan Penggunaan Pahan Menggunakan Sistem Informasi Geografis (SIG) di Gampong Alue Naga Kecamatan Syiah Kuala Tahun 2004-2019. *Jurnal Geografi*, 9(1)