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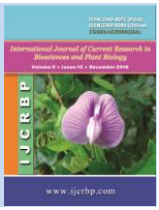

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Analysis of Land Characteristics (Soil and Climate) for Nutmeg Suitability Evaluation (*Myristica fragrans* Houtt) in The Banda Naire Island of Central Maluku Districts

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ABSTRACT

Nutmeg plant (*Myristica fragrans* Houtt) is a native Indonesian originating spice plant, from Banda Islands Maluku, which until now has not only been developed in Indonesia but has spread to foreign countries including Granada, India, Sri Lanka and Malaysia. The Research purpose of this study was to determine the land characteristics (soil and climate) in Banda islands. This study used a qualitative quantitative mix analysis. Quantitative analysis is used in determining the correlation between land characteristics (soil and climate) and nutmeg production in each region. Determination of land characteristics (soil and climate) that have a significant effect using regression analysis. The Next is determination of correlation between land index (storie method) and nutmeg production. The survey was carried out in four main nutmeg producing regions on Banda island, namely, Rajawali village (04 ° 30'33.5 "S - 129 ° 54'15.9" E), Tanah Rata village (04 ° 30'52.79 "S - 129 ° 54'17.30 "E), Pancabi village (04 ° 32'56.86" S - 129 ° 54'08.42 "E) and Walang village (04 ° 32'56.6" S - 129 ° 53'48.6 "E).The from supporting factors main high production of nutmeg in Banda island is the soil moisture throughout the year constant, mineral content of easily decayed is high (Plagioclase (45-65%), C-organic or> 2%, CEC> 16 cmol (+) kg , KB 84%, slope (8-15%), pH H2O (6.3 - 6.7), soil drainage, no flooding (FO), rough fragments 5 - 10%, depth of soil (70 - 150), rainfall annual (2,406.56 mm / year), maximum temperature (31,01),degree day (9,969.09 ° C) and Humidity Index (2.74). Based on the results of the land index calculation with (method storie) obtained Ic (81.66) and Rc (90.16) entered land suitability class very well (S1), and this was related to high nutmeg productivity.

Introduction

Nutmeg (*Myristica fragrans* Houtt) is a native Indonesian herb, which originates from Banda Islands Maluku (Heyne, 1987, Hadad, 1990). Nutmeg plants are known as spice plants that have high economic value and multipurpose because each part of the plantcan be used in various industries. One the essential oils is very popular in the international market because the essential oils is very wide, among others; as raw material in the perfume, cosmetics, pharmaceutical, food and beverage and flavoring industries even for the treatment of chronic diseases such as cancer (Sipahelut, 2016). Based on data from the Directorate General of Plantation (2017), the nutmeg plant area reached 186,904 ha where 38.9% were in Maluku and North Maluku provinces with production of 33,711 tons and export volume reaching 17,027 tons. Land evaluation was very important because land quality varied. in space and time at a place with another place. Land evaluation also needs to be done due to social changes and changes in government policies (Lopulisa, 2001; Baja 2012, Neswati, 2013). The selection of land suitable to reach optimal productivity can be done well if it is done through land evaluation studies by selecting land requirements (soil and climate) to grow and productivity.Banda Island has the same nutmeg genetic and cultivation methods which are relatively the same as the surrounding islands (Seram and Ambon islands) but have different yields / production.

Therefore, it is necessary to analyze the land characteristics to determine the land quality to the determine land requirements (soil and climate) of nutmeg plants for the development of nutmeg plants in other tropical regions in Indonesian. This study aims to determine of the land characteristics (soil and climate) in the Banda Naire island as the area origin of nutmeg plants with the highest production in Maluku for development in other tropical regions in Indonesian.

Materials and methods

The study determining of land requirements suitability for nutmeg plants, using a mixture of qualitative and quantitative methods. Determination of location is based on analysis of images satellite for distribution location and production data based in nutmeg production data from sub-districts in numbers (2017) and interviews with is farmers and direct observation of production nutmeg plant in the field.

Description of soil profiles and sampling of soil (intact and disturbed) in the field for laboratory analysis was carried out based on the FAO method (1976) (Guideline for soil profile description) including texture, pH, C-organic, P2O5, CEC, KB, Ca, Mg, K and Na. While the determination of profile taking points is based on differences in slope andheigh of places in each representative location. The representative location is chosen as shown in the following Table 1.

Table 1. Research locations of the Banda islands Central Maluku District.

No.	Island	Sub-district	Village	Coordinate
1	Banda	Banda Naire	1. Tanah Rata	04°30'51.63" S - 129°54°08.59" E
			2. Pancabi	04°32'56.86" S - 129°54'08.42" E
			3. Rajawali	04°30'33.5" S - 129°54'15.9" E
			4. Walang	04°32'55.6" S - 129°53'48.6" E

The selection of Banda island as for soil sampling location is based on data in nutmeg production which is categorized as high in Maluku Province and is of nutmeg origin island developed in the Maluku island with the name "Pala Banda", Furthermore, secondary data in the form of climate data and other supports were obtained from the relevant agencies, among others, at the

Meteorology, Climatology and Geophysics Agency (BMKG) Banda Neirain Banda Island, BMKG Pattimura Laha in Ambon, BMKG Amahai Central Maluku District in Masohi, Bapeda Maluku Province and the Spice Council Maluku Ambon.

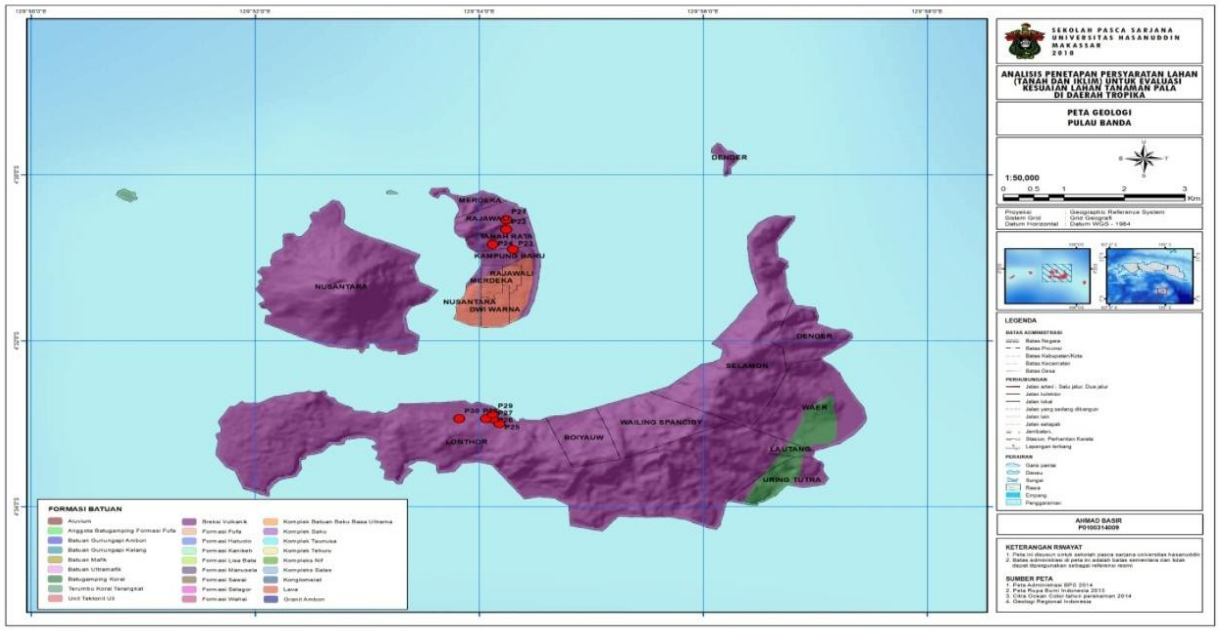

Fig. 1: Study area and location map of Banda Island.

Results and discussion

Climatic characteristic

Climate classification in particular rainfall according to Schmidt Ferguson, for Banda Island (C) type category (rather wet). The amount of annual rainfall on Banda Island (2,406.56 mm / year). Banda island, the lowest monthly rainfall is (74.77 mm / month) in September, while the highest monthly rainfall occurs in May at (350.59 mm / month) with monthly rainfall reaching an average of (200.55 mm / month). The rainy days in the monthly average of the locations study was obtained for Banda Island, the lowest of rainy days occurred in September and October (12 days) while the most rainy days occurred in May - June (22 days). The percentage of the monthly rainy days of the research location for Banda Island was the lowest percentage of 39.4% and the highest was 74.9% in June; the relative air humidity of Banda Island ranges from 79.87 - 85.73 Banda islands occurred in May.

The average air temperature (27.41 °C) is relatively slightly higher. The average minimum temperature (22.20 °C), and the highest Banda island (31.01 °C); wind velocity 3.73 knots (6,907.96 km /second); Percentage of monthly average sun radiation (53.78%). Data in sun radiation (n/N) (53.78%); degree of day in the growing cycle (830.76 °C). While the annual day degrees (9,969.09 ° C days). Data on monthly average days (780.36 ° C days); The results of the average month rainfall data and potential evapotranspiration data were obtained by humidity index monthly average (2.74).

Soil physical characteristics

The results of field observations indicate that the topography of the research location varies. In general, the representative soil profile is located in a relatively flat or wavy location with a slope of 0 - 3%, 3-8%, 8-15% and 15-30% where most of the slope is 3-15%. Based on the results of observations in the field nutmeg plants produce well on slopes of 8 - 30%. To grow optimally based on observations

in the field, nutmeg plants need good drainage conditions. The drainage class in the field is determined by observing the soil profile whether there are symptoms of oxidation reduction or the effect of water in the soil cross section, such as the presence of gray or rusty spots.

At the location of observation the profile at the time of excavation was not found in water, classified as a class without inundation (F0); which is dominated by the texture of sandy clay loam. The shape of the soil structure at each soil horizon is generally classified as granular (at the surface horizon) and rounded and lumpy globular (at the subsurface horizon) with weak to moderate levels of development or stability. Related to the texture of the soil is the consistency of the soil which is the resistance of the soil to the force that will change the shape such as grafting, piracy and others. Soil that has good consistency is generally easy to process and not attached to the tool.

The consistency of the soil is generally classified as loose - firm in humid conditions. The soil depth of the research location varied from 70 cm - 150 cm; Soil characteristics depth are one of the important things in soil suitability evaluation. According to Sys et al (1991), the optimum soil depth for annual crops is> 75 cm and for annual plants> 150 cm. Based on the results of observations of the rough fragments of the study locations, rough surface fragments ranging from 5-10% and 5% internal fragments.

Soil fertility characteristics

The results of soil analysis in the laboratory showed that CEC were between 16.16 - 18.34 cmol (+) kg¹. According to Sys et al (1993), soils that have CEC <16 cmol / kg clay are grouped with advanced weathering levels, in Banda islands as the highest producing nutmeg has CEC> 16 cmol (+) kg¹ and <24 cmol (+) kg as soil clay mineral l with moderate weathering. In annual plants to grow optimally, it requires CEC to be around > 16 (cmol (+) / kg clay (Sys et al, 1993); Soil KB values range from 84%. According to Sys et al (1993) Soil base saturation (KB) are optimal for annual crops > 50%; the amount of base can exchange indicates the cation or nutrient quantity available to the plant. The results of the study through Laboratory analysis showed that the number of bases (Ca + Mg + K + Na) varied between 7 - 12 cmol (+) kg¹.

According to Sys et al (1993) the optimal amount of exchangeable bases for annual plants> 4 cmol (+) / kg clay; The results of soil analysis in the laboratory showed that the pH value of H_2O varied between pH 6.3 - 6.7. According to Sys et al (1993) the optimal percentage of soil organic carbon for annual crops ranges from c-organic 2 - 1.2%.

Laboratory analysis results of soil organic matter showed 1.50 - 2.62% with organic C-on average 2.06%; the weathered minerals that are commonly found include plagioclase (45-65%) and weathered resistant minerals, including opaque (15-30%)

Determination of land index and land suitability class for nutmeg

Based on the results of the analysis climatic and soil data, all land suitability requirements were tested to determine the land suitability index using the Storie method (1978) with the following equation:

$$IL = Rc \times A \times \frac{B}{100} \times \frac{C}{100} \times \frac{D}{100}$$

Where,

IL = Land Index
Rc = Climatic Reting
A, B, C ……= Scale value of land characteristics

The results of the regression analysis, which resulted from land characteristics (soil and climate) that significantly influence the productivity of nutmeg, then determined the range of land characteristics the optimal, marginal and inappropriate categories. as land use requirements as shown in Tables 2 and 3.

Table 2. Climatic suitability for nutmeg plant.

No.	Requirements use/ Land characteristic	Climatic class, limit level andscale value							Banda Island			
		S1		S2		S3	N		Climatic value	Scale value		
		100	95	85	60	40	25	0				
I.	**Climatic**										**Climatic index**	
1	Annual rainfall	2.000 - 2.500		2.500 - 3.000		3.000 - 3.500	< 1.500 > 3.500		2.406, 56	95.93	Banda Climatic index	**91.79**
2	Rainfall growing seasen	2.000 - 2.600		2.600 - 3.000		3.000 - 3.500	> 3.500		2.049.93	99.58		
3	Climatic maximum annual	30 - 32		29 - 30			< 29		31.01	97.48	Rc	**99.285**
4	Annual degree day (°C)	>9.900		9.700 - 9.900		9.600 - 9.700	< 9.600		9.969.09	99.68	Class	**S1**
5	Potential evapotranspiration	800 -900		900 - 1.000		500 - 700	< 500		890.82	95.46		
6	Humidity Index	2.5 - 4.0		4.0 - 7.0		> 7			2.74	99.2		

Table 3. Characteristic suitability of physical and soil fertility in Banda Island.

II.	**Soil physical characteristic (s)**						**Scale value**	**Climatic index**	
1	Topography (t) Slope (%)	3 - 25	0 - 3	25 - 45	> 45 < 3	8 - 25	97.95	Banda L. Index	**95.86225**
2	Wetness (w) - Erosion	F0			> F1	F0			
	- Drainage	Good			Hamperet			Class	**S1**
3	- Texture/structure	Sandy clay loam	Clay loan	Sandy loam	Sand Liat	Sandy clay loam			
4	- Rough fragment (%)	5 - 15	15 - 30	30 – 50	>50	5 – 10	99.00		
5	- Soil depth	70 - 150	60 - 70	< 60		70 – 150	94.38		
III	**Fertility characteristic Tanah (t)**								
6	- CEC	16 - 24	> 24 < 16				97.5		
7	- KB	40 - 84	> 84 < 40			84	97.5		
8	- C-organik	2 - 3	1 - 2	< 1		2,06	99.7		
9	- pH H2O	6 - 7	< 6 > 7			6.3 - 6.7	97.5		
10	- Weadhered easy mineralogy	40 - 65	30 - 40	< 30		45 – 65	97.00		

Based on the calculation of the land characteristic index (soil and climate), the climate index (Ic) = 91.79 is obtained and is very suitable in the class of climatic suitability (S1) with Climate Rating (Rc) = 99.285 While Land Index (IL) = 95.86 enter the land suitability class is very suitable (S1).

Conclusion

Based on data land characteristics (soil and climate) using a parametric approach Banda islands are included in the category of highly land suitable (S1). One of the supporting factors for the high nutmeg production in Banda Island is the presence of a high Plagioclase mineral content due to the presence of volcanic rocks from the volcano on the Banda Naire Island,. CEC> 16 cmol (+) kg¹, KB (84%), C-organic> 2.0%, maximum annual average temperature (31.01°C), total degree of day (9,969.09 ° C) and Humidity Index (2.74%).

Conflict of interest statement

Authors declare that they have no conflict of interest.

References

Badan Meteorologi Klimatologi dan Geofisika, 2017. Rata-rata Curah HujanBulananProvinsi Maluku PeriodeTahun 1999 – 2016. Stasiun Ambon, Amahai dan Banda.

Baja, S., 2012a. Perencanaan Tata Guna Lahandalam Pengembangan Wilayah, Pendekatan Spasial dan Aplikasinya. CV. Andi, Yogyakarta.

Baja, S., 2012b. Metode Analitik Evaluasi Sumber Daya Lahan. Aplikasi GIS, Fuzzy Set dan MCDM. Identitas Universitas Hasanudin.

Bustaman, S., 2007. Prospek dan strategi pengem bangan paladin Maluku. *Perspektif*. 6 (2): l68–74.

Hadad, M. E.A., 1990. *Mengenalberbagai plasmanutfah paladi daerah Maluku Utara.* Balai Penelitian Tanaman Rempahdan Obat. Bogor.

Hadad, M.E.A, E.Randriani, C. Firmandan T. Sugandi, 2006. *Budidayatanamanpala.* Balai Penelitian Tanaman Rempah dan Aneka Tanaman Industri, Bogor.

Hadad, M.E.A., M.Assagaf, I.M.J. Mejaya, N.R.Ahmadidan, T.Octivia, 2007. *Pemanfaatansumber dayagenetik palamelalui eksplorasi dan pemili hanblokpeng hasilting gitanaman paladi Maluku Utara.* Lokakarya Nasional Pengelolaan dan Perlindungan Sumber Daya Genetik di Indonesia.Bogor.

Hadad, M.E.A., R. Andari, W.E.K. Yudiwantidan, N.R. Ahmadi, 2009. Karakter dan hubungankekera batan 27 aksesipala (*Myristica fragrans* Houtt) di KPC icurug. *Bul. Ristri*.1(3): 113-127.

Hadad,M.E.A.,1991. *Statustanah dan regimiklimdi Maluku: Asaldansentra produksitanaman paladancengkeh.* Prosiding Simposium Meteorologi Pertanian III. Iklim, Teknologi dan Pembangunan Pertanian Berkelanjutandi Indonesia Bagian Timur. Malang, 20-22 Agustus.

Hafif, Mawardi and Utomo, 2017. Analysis of land characteristics and nutmeg (*Myristica fragran*s Houtt) seed quality of Lampung. *J. Littri, BPTIP Sukabumi.*

Kementerian Pertanian (Kementan), 2017. *Eksporpalaper negaratujuan.* http://database.deptan.go.id.diakses,3 Maret2018.

Khiddir, S. M., 1986. A Statistical Approach in the Use of Parametric System Applied to the FAO Framework for Land Evaluation. State University of Ghent, Belgium. P.144.

Lopulisa, C dan Husni, H., 2011. EvaluasiLahan Prinsip Dasar dan Kalkulasi Produksi Tanaman, LP2M Universitas Hasanudin, Makassar.

Maluku, BPS., 2017.*Malukudalam Angka*. Ambon: Badan Pusat Statistik Provinsi Maluku.

Rismaneswati, 2013. IndeksKesesuaian Lahan Sebagai Penduga Daya Hasil Jagung di Daerah Tropika Basah. Pasca Sarjana Universitas Hasanuddin, Makasar.

Sangadji, S., Kaimuddin, Alla, A., Paembonan, S.A., 2015. The Effect of Climate to the Fruit set of Nutmeg Plant, Hasanudin University.

Sys, C., 1985. Land Evaluation. State University of Ghent, Belgium.

Sys, C., E Van Ranst, J. Debaveye, F. Beernaert, 1993. Land Evaluation, part I, II, III. Agricultural Publication-No.7 State University of Ghent, Belgium General Administration for Development Coorperation Place du Champ de Mars 5 bte 57-1050 Brussels – Belgium.

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