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Analisis Kesesuaian Lahan dan Usahatani Tanaman Serai Wangi di Sub Das Kreung Meueh Provinsi Aceh

Analysis of Land Suitability and Lemongrass Farming In Krueng Meueh Sub-Watershed Aceh Province

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ABSTRACT

Lemongrass is one of agricultural commodities that produce citronella oil, and will be better produce if the cultivation is carried out on the right land in the right way. This study aimed to determine the land suitability classes and farming feasibility for community citronella crops. The research was conducted at the Krueng Meueh Sub-watershed, Aceh from April to June 2019. The research was done in descriptive survey methods of forming land mapping unit (LMU) of the study area. The LMU was obtained from overlay of soil map, slope map, and land use map with software ArcGis version 10.1. The soil characteristic data of each LMU and climate data were used for assessment land suitability classes, and to find out the level of farming feasibility of lemongrass in the study area with calculating values of Benefit Cost Ratio (B/C), Internal Rate of Return (IRR), Net Present Value (NPV) and Break Event Point (BEP). The result showed that the study area was considered suitable for lemongrass (S2 and S3). Classes of S2 were found at LMU 7 and 17 with base saturation (BS), soil pH, slope and erosion hazard (EH) as constraint factors. While the others LMU is S3 class with soil pH, BS, organic-C, and EH as constraint of lemongrass cultivation. Effort of land improvement for lemongrass in the study area such as liming, organic matter, and water-retaining pit or mounds. The lemongrass farming at the study area is feasible and profitable, based on values of NPV Rp.7,076,030, Net B/C 1.2, IRR 16% and BEP 4 years 4.8 months 24 days.

Key words: Lemongrass, land suitability, land qualities, Financial feasibility, Kreung Meueh Sub-Watershed

ABSTRAK

Serai wangi termasuk salah satu komoditas pertanian yang menghasilkan minyak atsiri, dan akan berproduksi baik jika budidayanya dilakukan pada lahan yang sesuai dengan cara yang tepat. Penelitian ini bertujuan untuk mendapatkan kesesuaian lahan dan kelayakan usahatani serai wangi masyarakat di Sub DAS Kreung Meueh berlangsung dari bulan April sampai Juni 2019. Penelitian dilaksanakan menggunakan metode survei dengan membentuk satuan peta lahan (SPL) area studi melalui tumpang-tindih peta jenis tanah, peta lereng, dan peta penggunaan lahan dengan menggunakan *software ArcGis* versi 10.1. Data sifat-sifat tanah dari setiap SPL dan data iklim dari stasiun BMKG Malikussaleh Aceh Utara digunakan sebagai ciri/kualitas lahan guna menetapkan kelas kesesuaian lahan. Tingkat kelayakan finansial pengembangan serai wangi di area studi diperoleh dengan menghitung nilai-nilai NPV (*Net Present Value*), B/C rasio (*Benefit Cost Ratio*), IRR (*Internal Rate of Return*), untuk melihat harga dan produksi terendah dilakukan perhitungan BEP (*Break Event Point*). Hasil menunjukkan area studi termasuk kelas sesuai (S2 dan S3) untuk

pengembangan serai wangi. Kelas S2 ditemukan pada SPL 7 dan 17 dengan faktor pembatas kejenuhan basa (KB), pH, lereng dan bahaya erosi (BE), sementara SPL lainnya masuk kelas S3 dengan faktor pembatasnya pH tanah, KB, C-organik, BE. Usaha perbaikan faktor pembatas budidaya serai wangi di Sub DAS Krueng Meueh pada lahan kelas S3 pengapuran, pemberian bahan organik (BO), pembuatan rorak dan guludan. Usahatani serai wangi di Sub DAS Krueng Meueh layak diusahakan dan menguntungkan secara ekonomi atas dasar nilai-nilai NPV Rp.7.076.030, B/C 1,2, IRR 16% dan BEP 4 tahun 4,8 bulan 24 hari.Kata kunci: kelayakan finansial, kesesusaian lahan, kualitas lahan, serai wangi, sub DAS Kreung Meuh

INTRODUCTION

Lemongrass (Cymbopogon nardus L. Rendle) is known as one of the essential oil-producing plants, which is called as Citronella Oil. This oil contained compounds such as citronellal around 32-45%, geraniol 10-12%, citronellol 11-15%, geranil acetate 3-8%, citronellal acetate 2-4% and a few of sesquiterpenes and other compounds (Pinheiro et al., 2013). Citronella oil has been used for various purposes, especially in the pharmaceutical, detergent and perfume industries (Majewska et al., 2019). Therefore, citronella oil can also be said to be a prospective and well-known component of essential oils along with patchouli, clove, nutmeg and masoi oils. The interests and needs of citronella oil over time continue to increase, both to meet domestic and global markets. Quantitative data on the production and demand of citronella oil both locally and internationally is still difficult to find, however the existing data showed that the volume of citronella oil exports in Indonesia has tended to decline in recent years. The value of oil exports in 2002 reached 142 tons with a value of USD. 1,066,000, while in 2004 only 114 tons were valued at USD. 700,000, and the government continues to encourage increased production of various plantation commodities including citronella as an industrial plant (Dirjenbun, 2006; 2015).

Many factors contribute to the decline in the value of citronella oil exports in Indonesia, one of which is quality. Oil quality can be affected by cultivation systems especially land characteristics and post-harvest handling such as the refining process. Physical and chemical properties of the soil and local climate are characteristics or quality of land that plays an important role in influencing the growth and yield (products) of cultivated plants, including citronella (Wahyunto et al., 2016). This plant can grow at an altitude of 200-1000 m above sea level with 1800-2500 mm year^{-1} amount of rainfall and a temperature of 18-25oC. The desired nature of the soil is relatively fertile and loose, does not have a light texture (clay) and has a pH value of 6.0-7.5 (Suroso, 2018). The value of soil fertility affects the growth and yield of citronella oils as reported by Agegnehu et al. (2019), where the application of biochar is able to change the chemical properties of the soil which then increases the growth and quality of citronella oil yield. The application of a combination of compost, TSP and KCl also increases the growth, yields of dry matter and oil of lemongrass plants (Premathilake et al., 2018).

Lemongrass cultivation in Indonesia is widely spread in Aceh, West Sumatra, Lampung, West Java, and East Java with a total land area of around 3,492 hectares (ha) until the year of 2004 (Dirjenbun, 2006). While in Aceh, it is cultivated in several districts such as Gayo Lues, Southeast Aceh, Aceh Besar, Aceh Jaya and Bener Meriah.

The Krueng Meueh Sub-watershed, which has an area of around 12,255.48 ha, is a part of the Krueng Peusangan Watershed. This Sub-watershed covers three districts, which are North Aceh, Bener Meriah and Bireuen, Aceh Province. Kreung Meueh Sub-watershed has various types of soil, ranging from Brown Podzolic covering 4,552.13 ha (37.44%), Mediterranean area of 3,729.29 ha

(30.44%), Alluvial area of 1,942.6 ha (15.85%), Yellow Red Podzolic covering an area of 1,502.69 ha (12.26%) and Latosol 491.44 (4.01%). The slope of the study area also varies, although it is dominated by moderately sloping (3-8%) which covers an area of 9,898.7 ha (80.7%) (BPDAS Aceh, 2011). The Krueng Meuh Sub-watershed area has the potential for the development of lemongrass plants, even at this time the cultivation of lemongrass plants has been done by the people. However, information about the characteristics, level of land suitability and optimal management actions have not been obtained by farmers. Therefore, this research intends to assess the level of land suitability and feasibility of lemongrass plantations in Krueng Meueh Sub-watershed.

MATERIALS AND METHODS

The Study area is located in the Krueng Meueh Sub-watershed (Figure 1), which takes place from April to June 2019. This research area covers North Aceh, Bener Meriah and Bireuen District with an area of 12,255.48 ha. The geographical position of the Krueng Meueh sub-watershed is located at the coordinates of $4^{o}56'0"$ – $5^{o}6'0"$ N dan $96^{o}42'0"$ – $96^{o}52'0"$ E. The north is bordered by Ulee Glee Sub-watershed, south is bordered by the Timang Gajah Sub-watershed, west is bordered by Krueng Simpo Sub-watershed and east is bordered with Krueng Mane Sub-watershed.

The materials used are the soil samples which are taken using a soil auger in a composite manner, taken at each LMU, aquades, and KCl 1N, $K_2Cr_2O_7$ 1N, Dhiphenilamin, concentrated H_2SO_4, 85% H_3PO_7, $FeSO_4$ 1N, and 15% boric acid NH_4OAc 1 N (pH 7.0), red metal indicator, HCl 0.01 N, alcohol 96%, 10% NaCl, and 40% NaOH, 0.1N HCl, PP indicators, 0.1N NaOH and 4% NaF. The tools used are soil augers, hoe, GPS (Global Positioning System), compass, iron ruler, bucket, knife, machete, plastic bag, label paper, suppressor wood, stationery, camera, abney level, soil type map, land use maps, topographic maps, administrative maps and LMU maps, shaker bottles, pH meters, measuring cups, shaker machines, 10 mesh sieve, analytical scales, volumetric pipettes, measuring flasks, erlenmeyers, burettes, water heaters, centrifuge tubes, distillation devices, glass funnels and dropper pipettes.

The research was conducted using a survey method with a parallel land evaluation approach. This approach consists of evaluating land suitability based on physical criteria and farm analysis. Fifteen soil samples were taken at 15 LMUs from the research area using a soil drill. The 15 LMUs were obtained from the overlay of soil types maps, land use maps and slope maps using ArcGis software series 10.1. The results of the maps overlay were all obtained as many as 18 LMUs, however 3 LMUs (SPL 3, 9.18) are secondary forests which therefore can not be a part of this research since they are not possible to be used as land cultivation (Table 1).

The determination of soil sampling points at each LMU is based on the coordinates obtained using a GPS. Each soil sample taken from 15 LMUs were analyzed for its properties in the laboratory, which consists of texture of 3 fractions (piping method), pH H_2O (2.5: 1) (electrometric), organic-C (Walkley & Black), CEC of clay (NH_4OAc pH 7.0), BS (NH_4OAc pH 7.0). For the purposes of soil analysis in the laboratory, the soil is air dried and sieved through a 10 mesh sieve. In addition to analyzing soil properties in the laboratory, the 15 LMUs characteristics/quality are also identified in the field which include the drainage conditions, soil depth (cm), slope (%) (abney level), erosion hazard, stoniness (%) and rock outcrop (%). Climate data in the form of rainfall, temperature and humidity for the past 10 years were compiled from Malikussaleh Climate Station, Aceh Utara.

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The suitability class is obtained by matching the land qualities/characteristics with the criteria of lemongrass land suitability requirements (Wahyunto et al., 2016) which then followed by an assessment of the financial feasibility of lemongrass through the calculation of NPV values, B/C ratio, IRR and BEP (Mahi, 2015).

Figure 1. Map of land mapping unit (LMU) in the Krueng Meueh Sub-Watershed (BPDAS Aceh, 2011-Processed)

Table 1. Details of the land map unit (LMU) in the Krueng Meueh sub-watershed

LMU	Slope (%)	Soil Type	Land Use	Area (Ha)
1	0 – 3	Entisols	Shrub	150,02
2	3 – 8	Inceptisols	Shrub	327,91
3	8 – 15	Alfisols/Inceptisols	Secondary Forest	627,83
4	3 – 8	Alfisols/Inceptisols	Secondary Forest	831,64
5	3 – 8	Alfisols/Inceptisols	Shrub	1.412,50
6	8 – 15	Alfisols/Inceptisols	Shrub	183,09
7	3 – 8	Alfisols/Inceptisols	Mix Garden	524,05
8	8 – 15	Alfisols/Inceptisols	Mix Garden	150,18
9	3 – 8	Inceptisols	Secondary Forest	2.478,00
10	3 – 8	Inceptisols	Shrub	1.729,40
11	8 – 15	Inceptisols	Mix Garden	196,11
12	8 – 15	Ultisols	Shrub	893,83
13	3 – 8	Ultisols	Mix Garden	608,86
14	3 – 8	Inceptisols	Shrub	148,62
15	3 – 8	Entisols	Mix Garden	273,08
16	0 – 3	Entisols	Mix Garden	155,62
17	3 – 8	Entisols	Mix Garden	1.363,93
18	3 – 8	Inceptisols	Secondary Forest	200,80

Note: LMU **3**, **4** and **18** are not assessed since it is a secondary forest area (BPDAS Aceh, 2011 Processed)

RESULTS AND DISCUSSION

1. Properties and characteristic of land in study area

The results of the identification and analysis of the morphological, physical and chemical properties of the soil in the research area as well as the climate conditions are presented in Table 2. In Table 2, it can be seen that the climatic conditions, which are the average annual temperature was 26,46^{o}C and the average annual rainfall was 1750.3 mm, whereas the humidity was around 82.4%. The morphological and physical properties of the soil such as drainage was well and somewhat poorly drained, the soil texture was fine, moderately fine to medium, while the soil depth varies from 90 to 120 cm and which is classified as deep. Chemical properties of the soil such as clay CEC was 12.80-44.80 cmol(c)/kg, BS 15,98-56,96%, soil pH 4,20-5,73, organic-C content 0,65-3,29%, slope 2,22-14,44%, criteria of erosion hazard ranged from very low to hight, stoniness conditions and rock outcrops were not found.

In the study area, all climate components, which are the temperature, rainfall and humidity did not differ between the LMUs. Even though, climate is one of the land characteristics/qualities that can be a barrier to crop cultivation including lemongrass (Sys et al., 1991; Fadlalla and Elsheikh, 2016). Soil drainage was generally well, only at LMU 8, 11, 14 and 16 the drainage is somewhat poorly drained. This condition is closely related to the texture and soil water content (Fadlalla and Elsheikh, 2016). In general, the LMUs in the study area are dominated by fine and moderately fine textures, which in turn causes well categorized drainage to dominate the area. In addition, the conditions of the land area can also be influenced by the depth of the soil, all of which are > 90 cm deep.

The dominance of the fine texture in almost all of the LMUs studied is related to the type of soil (Table 1). The types of soil referred to are Entisol (Alluvial), Inceptisol (Latosol), Alfisol/Inceptisol (Mediterranean), Inceptisol (Brown Podzolic) and (Ultisol (Red Yellow Podzolic). These soils generally have fine soil fractions because they are formed as the result of new sedimentation and are old soils or weathered soils (Buol et al., 2011; Fissore et al., 2016). Fine textured soils are suitable for lemongrass cultivation (Wahyunto et al., 2016).

Table 2 also shows that CEC values were low to moderate, BS was very low to moderate, soil pH was very acidic to slightly acidic, and organic-C content ranges from very low to high. The low CEC value is not in line with the dominance of the fine soil fraction, this is reflected in the negative correlation of the two, even though it is not significant (-0.085) and in this case CEC seems to be more influenced by clay mineral type and soil organic matter content. Further weathered soils are generally dominated by oxides-hydroxide minerals and low organic materials (Tan, 2010; Buol et al., 2011). Acidic soil pH value is followed by low BS value and shows a very significant positive correlation (0.726 **), this phenomenon is a property and characteristic of tropical soils that experience intensive weathering and washing (Tan, 2010). Old soils in the tropics generally have low levels of organic-C, as found in almost all LMUs except LMU 10 and 16 which are categorized as high. The low level of organic-C is influenced by the rate of decaying of soil organic matter, where in the warmer regions the process of decaying of organic matter is higher than in cooler climates (Lourenzi et al., 2011). High levels of organic-C in both LMUs are more specific to the location of the LMU, this is related to the results of plant litter and biota activity. The slope of the study area is still <15% which is estimated to be suitable for crop cultivation including lemongrass, while the erosion hazard is relatively diverse; from very low to hight. Hight erosion hazard criteria

was found in LMU 6 and 12 with a slope position of 14.44% and the land use was bushes. This condition allows for greater erosion potential. All LMUs in the study area were not found stoniness and rock outcrops.

2. Land suitability classes of the study area

Table 3 presents the suitability class of lemongrass crops in Krueng Meueh Sub-watershed obtained by matching each of the characteristics or quality values of the study area with the land quality requirements for lemongrass plants (Wahyunto et al., 2016). Assessment of land suitability classes is determined up to the unit level, the results obtained are moderately suitable (S2) (1,887.97 ha) and marginally suitable (S3) (8,707.22 ha) (Table 3 and Figure 2). Class S3 has more area, therefore it dominates the study area, while class S2 is only found on LMU 7 and 17.

The limiting factor of the growth of lemongrass plants in Krueng Meueh Sub-watershed is dominated by nutrient retension (nr) in the form of BS and soil pH, both for S2 and S3 classes. Limiting growth from erosion hazards (EH) with slope management and EH units are only found in LMU 17 and it is included in class S2. Whereas the limitation of EH management unit is also found in LMU 6 (S3) and LMU 7 (S2). In general, it can be said that all LMUs studied have the same limiting factors, which are BS and soil pH, only on two LMUs have erosion hazard as the limiting factors and one LMU has the limiting factors of organic matters. Therefore, limiting factors for the growth of lemongrass in this area can be cultivated by repairing or providing liming, organic matterl and conservation technology in the form of making water-retaining pits or mounds (Table 3). Efforts to improve the growth limiting factors are considered important to be done so that the system of cultivation and yield of lemongrass plants is maximized.

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Table 2. Properties and characteristics of land in each LMU in Krueng Meueh Sub-watershed

Land Characteristics	**LMU 1**	**LMU 2**	**LMU 5**	**LMU 6**	**LMU 7**	**LMU 8**	**LMU 9**	**LMU 10**	**LMU 11**	**LMU 12**	**LMU 13**	**LMU 14**	**LMU 15**	**LMU 16**	**LMU 17**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Temperature (tc)															
Avg. temperature (°C)	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,6
Water availability (wa)															
Rainfall (mm)	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3	1.750,3
Humidity (%)	82,4	82,4	82,4	82,4	82,4	82,4	82,4	82,4	82,4	82,4	82,4	82,4	82,4	82,4	82,4
Oxygen availability															
Drainage	b	b	b	b	at	at	b	b	at	b	b	at	b	at	b
Rooting media (rc)															
Texture	ah	ah	ah	h	s	ah	h	ah	h	ah	ah	h	ah	ah	ah
Soil depth (cm)	100	110	90	120	90	105	120	105	90	120	100	90	90	120	120
Nutrient retention (nr)															
Clay CEC (cmol)	24,40	24,00	21,60	22,80	16,80	19,60	16,80	12,80	14,40	24,00	24,80	13,20	24,00	44,80	24,80
Base Saturation (%)	15,98	29,67	26,90	25,79	37,26	34,23	20,54	16,41	16,60	29,25	20,04	19,92	56,96	54,35	67,66
pH H_2O	5,15	4,84	4,67	4,30	5,73	5,20	4,66	5,07	4,30	4,78	4,20	4,48	5,37	5,25	5,90
C-organic (%)	1,11	1,35	0,65	1,91	1,23	1,86	2,79	3,20	2,23	1,00	1,27	2,10	1,37	3,29	1.41
Erosion hazard (eh)															
Slope (%)	2,22	13,33	8,89	14,44	6,67	12,22	7,78	6,67	14,44	14,44	5,56	6,67	66,67	2,22	12,22
Erosion hazard	Sd	Sd	Sd	Ba	Re	Sd	Sr	Sd	Sd	Ba	Sd	Sd	Sd	Sr	Re
Land preparation (lp)															
Surface rock (%)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Rock outcrops (%)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Note: Texture (h = fine; ah = moderately fine; s = medium). Erosion Hazard (Sd = moderate, Sr = very low; Re = low; Ba = hight). Drainage (b = well; at = somewhat poorly drained)

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Table 3. Land suitability units classes, constraint of lemongrass crops growth and land improvement efforts in Krueng Meueh Sub-watershed

LMU	Land Suitability Classes	Limiting Factor	Improvement Effort
1	S3nr-2,3	BS; soil pH	Liming
2	S3nr-2,3	BS; soil pH	Liming
5	S3nr-2,3,4	BS; soil pH; organic-C	Liming; Organic Matter
6	S3nr-2,3;eh-2	BS; soil pH; EH	Liming; WRp/Mounds
7	S2nr-2;eh-2	BS; EH	Liming; WRp/Mounds
8	S3nr-2,3	BS; soil pH	Liming
9	S3nr-2,3	BS; soil pH	Liming
10	S3nr-2,3	BS; soil pH	Liming
11	S3nr-2,3	BS; soil pH	Liming
12	S3nr-2,3;eh-2	BS; soil pH; EH	Liming; WRp/Mounds
13	S3nr-2,3	BS; soil pH	Liming
14	S3nr-2,3	BS; soil pH	Liming
15	S3nr-3	Soil pH	Liming
16	S3nr-3	Soil pH	Liming
17	S2eh-1,2	Slope; EH	WRp/Mounds

Note: BS (Base Saturation); EH (Erosion Hazard); WRp (Water-retaining pits)

Financial feasibility of lemongrass farming

The financial feasibility analysis for the lemongrass plants in Krueng Meueh Sub-watershed is only as information for local farmers who have done farming. The calculated cost component is the cost of production consisting of fixed costs and variable costs. Fixed costs are in the form of land and equipment rent, while variable costs consist of seed, fertilizer and labor costs. In addition, there are also investment and operational costs. Investment costs are costs incurred for the initial needs (start up cost) of building a business. The initial investment cost in this study is Rp. 15,050,000 in the first year and next will be charged Rp. 5,000,000 per year. Meanwhile, operational costs are costs incurred periodically in order to meet production inputs and production process activities so that farming operations run smoothly. The operational cost incurred is Rp. 16,790,000 in the first year and next will be charged Rp. 14,380,000 per year (Table 4).

The level of feasibility of lemongrass cultivation in Krueng Meueh Sub-watershed is known by analyzing NPV, Net B / C, IRR and BEP through various cost components as presented in Table 4. The results of the calculation of the NPV value at an interest rate of 10% per year is Rp.7,076,030 (> 0). This number means that the present value of the income received is positive, which is Rp. 7,076,030. The Net B/C value at a loan interest rate of 10% per annum is 1.2% (> 1). This value indicates that the net income received by farmers is 1.2 times greater than the costs incurred, this

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means that from every Rp. 100,- that the farmers invest in lemongrass, they will receive a net benefit of Rp. 120,-. The calculation of the IRR value on the loan interest rate of 10% per year is 16% (> 10%). This value indicates the ability of the farm to return the capital used is greater than the level of interest to be paid (10%). This means that if a farmer lends farming capital to a bank or other financial entity with an interest rate of 10% per year, the farmer is able to pay it and the farmer still gets a profit. An IRR value of 16% indicates that the revenue received by the lemongrass farmers in Krueng Meueh Sub-watershed is greater than the opportunity cost of capital (10%), therefore farming is feasible to be continued.

The results of the BEP calculation on the loan interest rate of 10% will occur in the 4th year, 4th month and 24th day which means the break-even point (return on capital and other costs) will be obtained in 4 years and 4.8 months. A relatively similar BEP value was also reported by Farrasky (2017) that lemongrass farming in the city of Solok, West Sumatra, the BEP value would be achieved in a period of 4 years, 5 months and 7 days. Therefore, the cultivation of lemongrass plants in Krueng Meueh Sub-watershed will provide benefits to farmers and is very feasible to be developed.

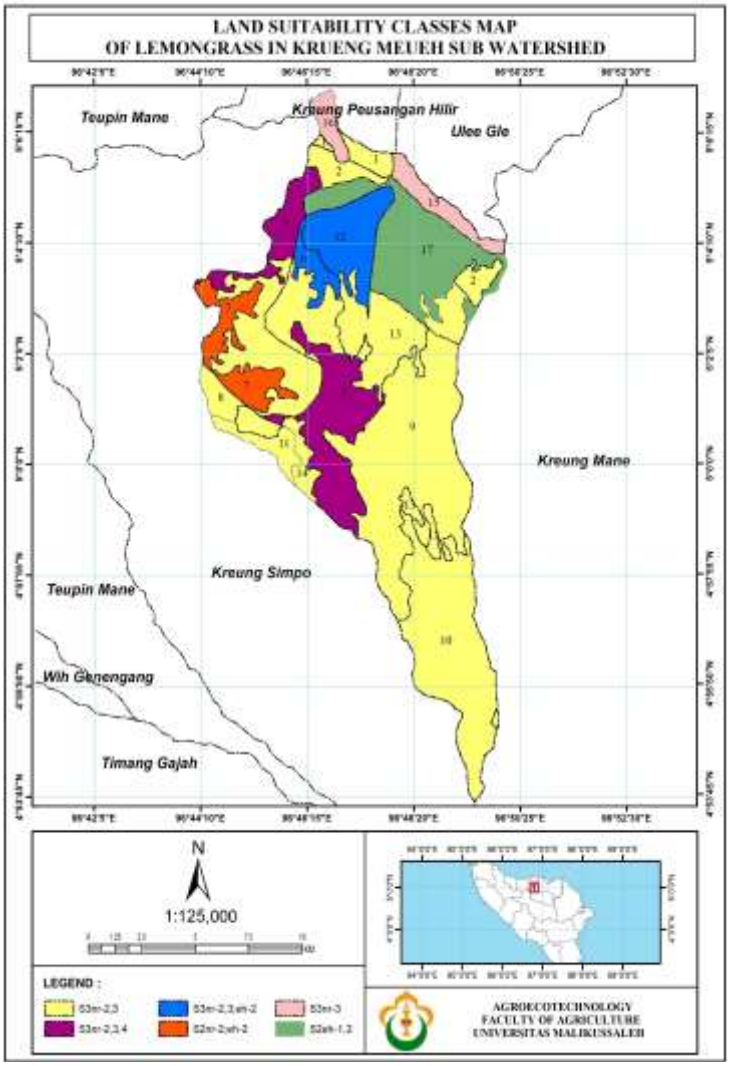

Figure 2. Map of land suitability classes of lemongrass in the Krueng Meueh Sub-Watershed

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Table 4. Feasibility analysis of lemongrass (*Cymbopogon nadrus L.*) farming in Krueng Meueh Sub-watershed

Year	**Investment Cost**	**Operating costs**	**Total cost**	**Gross Benefits**	**Net benefits**	**10% DF**	**Fee at 10% DF**	**Gross Benefits at 10% DF**	**NPV at 10% DF**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
0	Rp. 15.050.000	Rp. 16.790.000	Rp. 31.840.000	0	- Rp. 31.840.000	1	Rp. 33.340.000	0	-Rp. 31.840.000
1	Rp. 5.000.000	Rp. 14.380.000	Rp. 19.380.000	Rp. 22.050.000	Rp. 2.670.000	0,909	Rp. 17.616.420	Rp. 20.043.450	Rp. 2.427.030
2	Rp. 5.000.000	Rp. 14.380.000	Rp. 19.380.000	Rp. 26.250.000	Rp. 6.870.000	0,.826	Rp. 18.403.280	Rp. 21.682.500	Rp. 5.674.620
3	Rp. 5.000.000	Rp. 14.380.000	Rp. 19.380.000	Rp. 30.450.000	Rp. 11.070.000	0,751	Rp. 14.554.380	Rp. 22.867.950	Rp. 8.313.570
4	Rp. 5.000.000	Rp. 14.380.000	Rp. 19.380.000	Rp. 34.650.000	Rp. 15.270.000	0,683	Rp. 15.217.240	Rp. 23.665.950	Rp. 10.429.410
5	Rp. 5.000.000	Rp. 14.380.000	Rp. 19.380.000	Rp. 38.850.000	Rp. 19.470.000	0,620	Rp. 12.015.600	Rp. 24.087.000	Rp. 12.071.400
Total	Rp. 40.050.000	Rp. 88.690.000	Rp. 128.740.000	Rp. 152.250.000	Rp. 23.510.000		Rp. 111.146.920	Rp. 112.346.850	Rp. 7.076.030
NPV+									Rp. 38.916.030
NPV-									-Rp. 31.840.000

Table 4 Continuation.

Year	**Net Benefits**	**16% DF**	**17% DF**	**NPV at 16% DF**	**NPV at 17% DF**
(1)	(11)	(12)	(13	(14)	(15)
0	- Rp. 31.840.000	1	1	Rp. 31.840.000	Rp. 31.840.000
1	Rp. 2.670.000	0,862	0,854	Rp. 2.301.540	Rp. 2.280.180
2	Rp. 6.870.000	0,743	0,730	Rp. 5.104.410	Rp. 5.015.100
3	Rp. 11.070.000	0,640	0,618	Rp. 7.084.800	Rp. 6.841.260
4	Rp. 15.270.000	0,552	0,533	Rp. 8.429.040	Rp. 8.138.910
5	Rp. 19.470.000	0,476	0,456	Rp. 9.267.720	Rp. 8.878.320
Total	Rp. 23.510.000			Rp. 347.510	-Rp. 686.330
NPV+				Rp. 347.510	
NPV-					-Rp. 686.330

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CONCLUSIONS AND RECOMMENDATION

Based on the land qualities, the study area was suitable in agriculture cultivation, because the study area has a mean temperature of around 24,6^{o}C, with an average rainfall and humidity of 1,750.3 mm and 82.4% per year, respectively. Physically is good too, because the texture of the soil was dominated by fine fractions, the depth of the soil was categorized as deep with generally well drained. But the chemical properties were marginally categories, the soil has BS values were low to high, while the CEC was low to very high. Soil pH values were acidic to slightly acidic and organic-C content was ranged from very low to high. The slope class was ranged from flat to moderately sloping.

The land suitability level for lemongrass crops was dominated by S3 classes (marginally suitable) and only 2 LMUs were in S2 classes (moderately suitable). The limiting factors for the growth of lemongrass in the study area were BS, soil pH, organic matter, slope and EH. Improvement efforts needed are providing liming, organic matter and input WRp or mounds technology.

Lemongrass farming in Krueng Meueh Sub-watershed is feasible and profitable, this refers to the NPV value of Rp.7,076,030 (> 0), Net B/C 1.2 years^{-1} (1), IRR of 16% (> 10%) and BEP that occur in 4th year, 5th month, and 24th day.

Improving the limiting factor of lemongrass growth we need input of liming, organic matter, soil conservation technology such as water-retaining pits and mounds.

Dosage of liming to increase soil pH in 1.0 unit needed the dolomite around 2 tons/ha, and to increase the soil organic matter in 1%, required input the material reached of 24 tons/ha.

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