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Decision Support System for Determination of Land Suitability of Andaliman Plants Using the Profile Matching Method in Merdeka District, Karo Regency

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ABSTRACT

Andaliman is a commodity plant which has many benefits and high selling power. Andaliman plants are difficult to cultivate because of the difficulty of determining the suitability of land suitable for these plants and the absence of researchers who have conducted research on these plants. Therefore, a decision support system is needed that can assist in determining the suitability of andaliman plantations by using three criteria consisting of each sub-criteria, namely Soil Classification (which consists of soil Ph sub-criteria, soil type and humidity), Land conditions. (which consists of sub-criteria for altitude and light intensity), and climate (which consists of sub-criteria for air temperature and rainfall). A decision support system is a system which able to provide both problem-solving abilities and communication skills for semi-structured problems. This research system aims to design a system in determining the suitability of land for andaliman plants using the Profile Matching method, which is one of the methods in the DSS that uses the GAP weighting method. The programming language used in making the system is PHP with MySQL database. The results of the implementation of the system that have been made show that Jaranguda Village is the most suitable village for planting Andaliman plants.

1. Introduction

The development of Science and Technology (IPTEK), which is increasingly advanced and developing all the time, has a very important role in all aspects of life. It is undeniable that these developments have had a huge impact in various fields, especially in agriculture, such as determining the suitability of land for a crop. Where as we see today, many farmers are aware of a plant that has a high enough selling power but is difficult to cultivate, such as Andaliman. Andaliman has several criteria and sub-criteria to be able to grow and produce fruit well, namely at an altitude of 1,200 - 1,400 masl, soil pH 6-7, temperature 15-18 degrees Celsius, light intensity 1,700-2,000, 223 mm annual rainfall, and species humus soil. Therefore farmers have difficulty being able to cultivate these plants because farmers have to do plant trials without a reference for these plants so that land use cannot be carried out optimally.

Based on the above background, the identification of problems in this study is the difficulty of knowing the level of suitability of land for Andaliman plants, the lack of knowledge of farmers about Andaliman plants, there is no system that can help farmers to find out the suitability of land for Andaliman plants, there are no researchers who research on Andaliman plants.

In this study the authors also limit the problem to be analyzed, namely the method used is the Profile Matching method, the program was built using the PHP programming language with the MySql database, the criteria used in this study were soil classification (which consists of soil Ph sub-criteria, soil type). and humidity), land conditions (consisting of sub-criteria for altitude and light intensity), climate (which consists of sub-criteria for air temperature and rainfall). This research was conducted only in Merdeka District, Karo Regency.

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As for the formulation of the problem is how to design a system in determining land suitability for andaliman plants with the Profile Matching method? How to implement the Profile Matching method in determining land suitability for reliable plants?

The purpose of this research is to be able to design a system to determine the suitability of land for andaliman plants with the Profile Matching method, to implement the Profile Matching method in determining the suitability of land for Andaliman plants.

The benefits of this research are as follows being able to conduct research and design a system using the Profile Matching Method, it can be a reference for students who will conduct research on determining land suitability, making it easier for farmers to know which land is suitable for reliable crops, knowing the level of classification compatibility analysis soil, land conditions, and climate to be taken into consideration before planting andaliman plants. Therefore, a decision support system is needed in making decisions.

A decision support system is a system that is able to provide both problem-solving abilities and communication skills for semi-structured problems (Marbun and Sinaga, 2018: 1).

Profile matching is a decision-making mechanism by assuming that there is an ideal predictor variable level that must be met by the subject under study, not a minimum level that must be met or passed (Kusrini, 2007).

The steps for completing the Profile Matching Method are:

A. Determine the variable data required.
B. Determine the aspects used for the assessment.
C. Mapping profile Gap
   Gap = Minimal profile - Test data profile
D. Calculation and grouping of Core Factors and Secondary Factors
   1) Core Factor (Main Factor).

$$NCF = \frac{\sum NC}{\sum IC} \quad (1)$$

   Note :
   NCF : Average core factor values
   NC : The total number of core factor values
   IC : The number of core factor items

   2) Secondary Factor (supporting factors)

$$NCF = \frac{\sum NS}{\sum IS} \quad (2)$$

   Note :
   NSF : Mean value of secondary factor
   NS : The total number of secondary factor values
   IS : Number of secondary factor items
E. Total Value Calculation

$$N = (x)\%\ NCF + (x)\%\ NSF \quad (3)$$

   Note :
   N : Total value of the criteria
   NFS : Mean value of secondary factor
   NFC : Average core factor value
   (x)% : The percent value entered
F. Calculation of ranking

$$Rank = (x)\%\ NMA + (X)\%\ NSA \quad (4)$$

   Note :
   NMA: Total Score of Main Aspect Criteria
   NSA: Total Score of Supporting Aspect Criteria
   (X)%; The percent value entered

2. Research methods

The research carried out can be described in a research work activity flow as follows:

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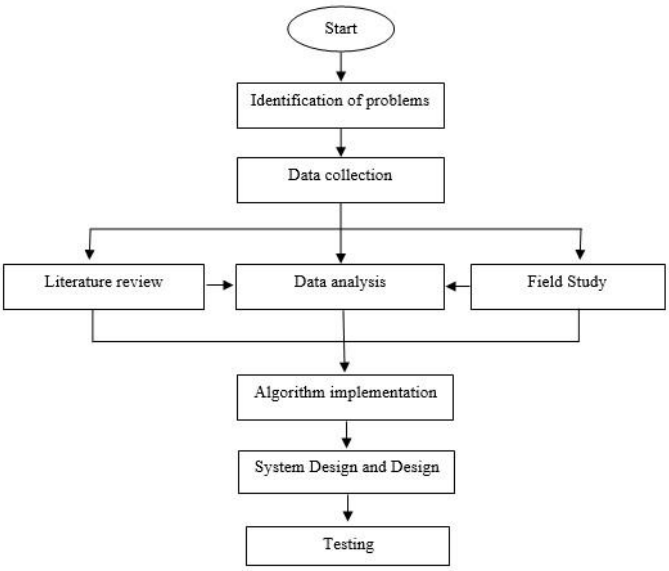

Fig 1. Research Framework

3. Results and Analysis

The system was created to overcome problems in determining the suitability of andaliman plantations. The ability of decision support system makers to solve these problems depends on the growth specifications of Andaliman plants. Knowledge of the land suitability specification for Andiman plants can be seen from journals or the internet that discusses andaliman land and plants so that based on several journals used as a reference for decision makers, it can determine several criteria for the growth of Andiman plants, where the output is only a recommendation for system users, not decision makers.

Table 1.
Land Characteristics

Sub Criteria Name	Jaranguda Village (A1)	Gongsol Village (A2)	Merdeka Village (A3)
Soil pH (C1.1)	7	11	5
Soil type (C1.2)	Humus soil	Alluvial soil	Andosol soil
Air humidity (C1.3)	85	78	81
Altitude (C2.1)	1,200	1,200	1,200
Light intensity (C2.2)	1,850	1,200	600
Air temperature (C3.1)	16 ºC -18ºC	16 ºC -18ºC	16 ºC -18ºC
Rainfall (C3.2)	1,600mm / th	1,600mm / th	1,600mm / th

Table 2.
Weight Value of Land Suitability Determination Criteria

No.	Name Criteria	Profile Criteria	Weight Value Criteria	Sub Weight Value Criteria
1	Soil Classification (C1)	5	40%	
	Soil pH (Sub C1.1)			50% (CF)
	Soil Type (Sub C1.2)			30% (SF)
	Humidity (Sub C1.3)			20% (SF)
2	Land Condition (C2)	4	30%	
	Altitude Place (Sub C2.1)			60% (CF)
	Light intensity (Sub C2.2)			40% (SF)
3	Climate (C3)	4	30%	
	Air Temperature (Sub C3.1)			70% (CF)
	Annual Rainfall (Sub C3.2)			30% (SF)

Note :
The percentage of criterion weight value and sub-criterion value percentage is made based on the importance level of each criterion and sub-criteria.

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Table 3.
Data Criteria 1 (Classification of Land)

No.	Alternative Name	Sub C1.1	Sub C1.2	Sub C1.3
1	Jaranguda Village (A1)	Very suitable	Very suitable	Perfectly fit
2	Gongsol Village (A2)	S Does not match	Corresponding	It is not in accordance with
3	Merdeka Village (A3)	Quite Suitable	Quite Suitable	Corresponding

Table 4.
Data Criteria 2 (Land Condition)

No.	Alternative Name	Sub C2.1	Sub C2.2
1	Jaranguda Village (A)	Very suitable	Very suitable
2	Gongsol Village (A2)	Very suitable	It is not in accordance with
3	Merdeka Village (A3)	Very suitable	It is not in accordance with

Table 5.
Data Criteria 3 (Climate)

No.	Alternative name	Sub C3.1	Sub C3.2
1	Jaranguda Village (A1)	Very suitable	Corresponding
2	Gongsol Village (A2)	Very suitable	Corresponding
3	Merdeka Village (A3)	Very suitable	Corresponding

Table 6.
Weight Normalization Value

No.	Alternative name	C1.1	C1.2	C1.3	C2.1	C2.2	C3.1	C3.2
1	Jaranguda Village	5	5	5	5	5	5	4
2	Gongsol Village	1	4	2	5	2	5	4
3	Merdeka Village	3	3	4	5	1	5	4

Note :
The weight normalization value is obtained by normalizing each criterion data with the weighted assumption value.

Table 7.
Gap Criteria 1 (Land Classification)

Alternative	Land Ph	Type of soil	Air humidity
A1	5	5	5
A2	1	4	2
A3	3	3	4
GAP value	**5**	**5**	**5**
A1	0	0	0
A2	-4	-3	-1
A3	-2	-1	-2

Table 8.
Gap Criteria 2 (Land Condition)

Alternative	Altitude Place	Light intensity
A1	5	5
A2	5	2
A3	5	1
GAP value	**4**	**4**
A1	1	1
A2	1	-2
A3	1	-3

Table 9.
Criteria 3 (Climate) Gap Score

Alternative	Air temperature	Annual Rainfall
A1	5	4
A2	5	4
A3	5	4
GAP value	**4**	**4**
A1	1	0
A2	1	0
A3	1	0

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Table 10.
Mapping Gap

Alternative	Soil Classification			Land Conditions		Climate	
	Land Ph	Type of soil	Air humidity	Altitude Place	Light Intentsity	Air temperature	Annual Rainfall
A1	6	6	6	5.5	5.5	5.5	6
A2	2	3	5	5.5	4	5.5	6
A3	4	5	4	5.5	3	5.5	6

Note :
Calculating the value of the GAP mapping comes from the value of the GAP analysis (Table 4.1 the weight of the GAP Value).

Table 11.
Calculation of Core Factor Value and Secondary Factor's Value

Alternative	Soil Classification			Land Conditions		Climate	
	Land Ph	Type of soil	Air humidity	Altitude Place	Light Intentsity	Air temperature	Annual Rainfall
A1	6	6	6	5.5	5.5	5.5	6
A2	2	3	5	5.5	4	5.5	6
A3	4	5	4	5.5	3	5.5	6
Number of Factor Items	1	2		1	1	1	1
A1	6	6		5.5	5.5	5.5	6
A2	2	4		5.5	4	5.5	6
A3	4	4.5		5.5	3	5.5	6
Information	*Core Factors*	*Secondary Factors*		*Core Factors*	*Secondary Factors*	*Core Factors*	*Secondary Factors*

Table 12.
Results of Total Value Calculations

Alternative	Soil Classification			Land Conditions		Climate	
	Land Ph	Type of soil	Air humidity	Altitude Place	Light Intentsity	Air temperature	Annual Rainfall
A1	6	6		5.5	5.5	5.5	6
A2	2	4		5.5	4	5.5	6
A3	4	4.5		5.5	3	5.5	6
X%	**50**	**20**	**30**	**60**	**40**	**70**	**30**
A1	4.8			5.5		5.65	
A2	2.2			4.9		5.65	
A3	3.35			4.5		5.65	

Table 13.
Final Score

Alternative	Total Land Classification (40%)	Total Land Condition (30%)	Total Climate (30%)	Result
D. Rarely young	4.8	5.5	5.65	0.491
D. Gongsol	2.2	4.9	5.65	0.406
D. Freedom	3.35	4.5	5.65	0.422

Table 14.
Rating

No.	Alternative	Final score	Information
1	Jaranguda Village (A1)	0.491	Rank 1
2	Gongsol Village (A2)	0.406	Rank 3
3	Merdeka Village (A3)	0.422	Rank 2

After the application of the profile matching method is carried out the implementation of a system that functions to present the program results from the writing of a thesis to determine the suitability of the Andaliman plant land using the profile matching method.
The steps for using the application are:

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The login form is the initial step that must be done in using the system.

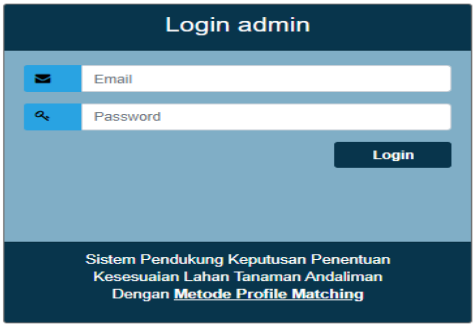

Fig 2. Login page

The main page is the initial page / initial display that we see when successfully logged in.

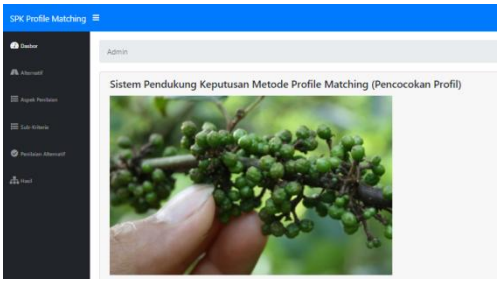

Fig 3. Main page

Alternative data menu display page that is, it contains all the data that will be used as an alternative choice, including the criteria used in running the system.

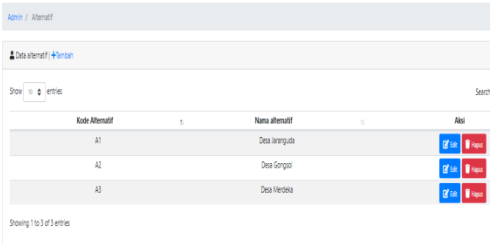

Fig 4. Alternative Data Menu

Display Menu Data Criteria / Assessment Aspects, namely the criteria menu used to input the criteria code, criteria name and criteria weights.

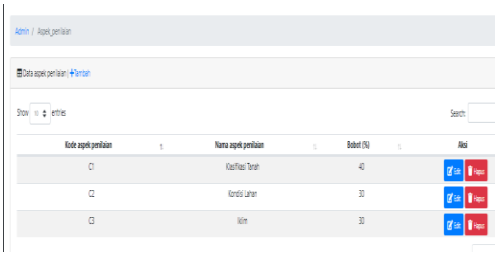

Fig 5. Criteria Data Menu

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The sub criteria display page is used to add criteria, sub criteria code, sub criteria names, users can add, edit, delete, save sub criteria data.

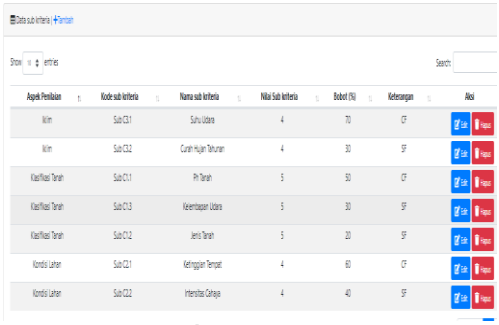

Fig 6. Sub Criteria Data Menu

The alternative / process assessment page contains an analysis of the Profile Matching method such as calculating the gap value, calculating the weight of the gap value, calculating the value of the core factor and secondary factor, the total criteria value and ranking.

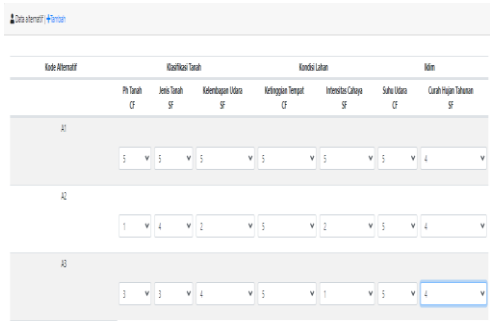

Fig 7. Alternative Assessment / *Profile Matching* Process

The output display is a display of the results of the Profie Matching process. On the output display page, we can see the output of the data that we input previously.

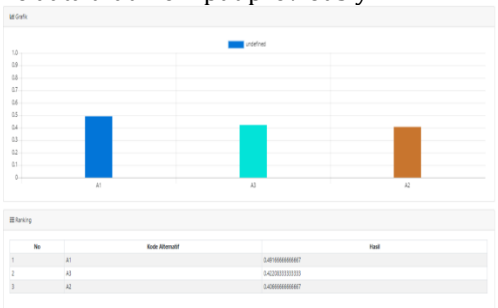

Fig 8. Output Display

4. Conclusion

Based on research conducted on the decision support system for determining the suitability of andaliman plant land with the Profile Matching method in Merdeka Sub-district, Karo Regency, the following conclusions can be drawn:

1) The decision support system for determining the suitability of andaliman plant land is designed using UML (Unified Modeling Language), namely use case diagrams, activity diagrams, class diagrams and sequence diagrams. This decision support system was built using the PHP programming language, PHP MySQL database with a system implementation consisting of a login form, main page form, alternative form, criteria and sub-criteria form, profile matching process method form, output display form.
2) Application of the profile matching method in making a decision support system for determining the suitability of reliable plant land by determining the criteria used, namely soil classification (soil pH,

soil type, humidity), land conditions (altitude, light intensity), climate (air temperature, rainfall), then determines the required data variables, determines the assessment aspects, mapping the profile gap, assigning weight to each gap value, calculating and grouping the core factor and secondary factor, calculating the total value and ranking. Of the 3 alternative calculations, the Jaranguda Village alternative is the most suitable alternative for planting andaliman.

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