Intelligent Decision Support System Model for Determining Horticultural Crop Suitability

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***Abstract* – The productivity of horticultural crops in Sikka Regency is often hindered by land characteristics and quality, leading to suboptimal yields. Key challenges include unsuitable land for horticultural cultivation, limited farmer knowledge about land characteristics and appropriate crop types, as well as difficulties in obtaining accurate land data. In order to solve these problems, this research introduces an intelligent decision support model for determining the suitability of horticultural crops based on climate, soil, and topographic parameters. The model integrates the Analytic Hierarchy Process (AHP) and profile matching. AHP is employed to determine the weights of criteria and sub-criteria as well as to process data by assigning scores for calculations. The profile matching method identifies gap weights and ranks criteria, values, and final results. Additionally, interpolation is used to find interval values for ideal plant profiles and gap weights. By evaluating the model performance, of all the average test priorities, the top five test priorities have the highest test values, namely an accuracy value of 78.79%, a recall of 78.79%, and a precision of 100%. The results suggest that the proposed approach effectively supports decision-making in determining the most suitable horticultural crop types.**

Keywords – Intelligent decision support, suitability of horticultural, analytic hierarchy process, interpolation, profile matching.

DOI: 10.18421/TEM144-32
https://doi.org/10.18421/TEM144-32

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Received: 04 February 2025.
Revised: 07 August 2025.
Accepted: 24 September 2025.
Published: 27 November 2025.

1. Introduction

The global economy greatly benefits from the development of agriculture. Approximately 86% of rural inhabitants rely on agriculture as their main source of income, making it among the most important economic sectors and essential to economic growth. The agricultural sector contributed around 4% of global gross domestic product in 2018, and some developing countries, but that percentage rose to above 25% [1]. Furthermore, the World Bank states that enhancing agriculture is among the most effective means of eradicating extreme poverty, promoting shared prosperity, and providing food for nine billion people by the year 2050 [2].

Indonesia is an agricultural country that has a large agricultural sector, especially in horticultural crops [3], which includes vegetables, fruit, vegetable medicinal ingredients, and floriculture, includes water plants, mosses, and mushrooms that can be used as vegetables, as well as vegetable herbal medicines and decorative elements [4]. Formally identifying Indonesia as an agriculturally productive region with abundant natural resources, where the majority of the people make their living from farming [5].

To achieve sustainable agriculture, sustainable land resources are essential. Sustainable agriculture is desperately needed right now to improve the quality of the soil and increase food production [6]. The land suitability approach is a recommended model for evaluating the level of appropriateness for land use [7]. An approach to determining the value of property that concentrates on the environmental characteristics of individual land parcels is called a land suitability assessment [8]. Sikka Regency is one of the districts in East Nusa Tenggara (NTT) Province, which is included in the Flores island group. The total area of Sikka Regency is 1,731.92 km2 with land use in Sikka Regency dominated by agricultural land, namely 90,138 ha (52.05%), while other land uses are forest areas covering 38,442.43 ha (22.20%), areas covered by bushes covering 23,745 ha (13.71%) and others covering 20,865.57 ha (12.05%) [9].

The area of agricultural land in Sikka Regency means that this region has superior agricultural commodity products, among them horticulture crops.

In the Sikka Regency area, horticultural crops are the most widely grown crop categories, because of their short lifespan, and easier to grow for profit, producing results more quickly from a financial perspective. Horticultural agricultural commodity products in Sikka Regency continue to increase in line with the increase in population and increasing welfare. Meanwhile, the quality of the land used has an impact on the output of horticulture crops. Currently, determining land for cultivating horticultural crops is not suitable, even in the use of land for horticultural cultivation, it is still forced. Furthermore, farmers' inability to determine the suitability of their land may be hampered by their ignorance of the qualities of their land, the horticulture crops that are suitable to grow, and the difficulties in obtaining precise information on land attributes. It takes a lot of time and money to learn. Therefore, it is crucial to set up a decision-making system (DSS) that uses climate, soil, and topography criteria to determine the suitability of horticultural plants based on land conditions in the Sikka Regency area.

DSS is a framework that can handle both unstructured and semi-structured problems [10], while Intelligent Decision Support Systems (IDSS) include knowledge-based components that are designed to construct, represent, and deliver feasible solutions to probabilistic challenges within a complex and evolving environment [11]. Several studies that discuss land suitability include determining the evaluation of land suitability for rice cultivation using ELECTRE [10], which in weighting does not use AHP because it has been determined by experts. Other research [12], [13], [14], the three studies utilize both AHP and geographic information system (GIS) techniques to determine land suitability mapping of apple production watersheds and determine land suitable for sustainable corn production, as well as analysis of land suitability suitable for agriculture in hilly areas. The AHP method, as applied in these three studies, is employed to assign weights to the criteria used in GIS-based spatial data processing. The research by [15] conducted a comparative evaluation of land suitability to increase the productivity of apple orchards using the AHP method and the Most Limiting Characteristic Method (MLCM), where the Analytic Hierarchy Process (AHP) method yielded substantially higher results than the MLCM approach.

This research does not use spatial data or soil maps using GIS, but rather land characteristic data, which is matched with ideal plant growth profiles using AHP, interpolation, and profile match methods.

The AHP method is employed to assign weights to both criteria and sub-criteria as used by [13], [14], [15], and [16], while in this study, the AHP method is further utilized to process text data by scoring so that the value can be calculated on the ideal plant profile. The interpolation approach, which is based on linear interpolation, which guesses a value between two known values, is utilized for data evaluation. Assigning distinct values to a specified range of values is an automatic use of this [16]. This study employs an interpolation method to estimate numerical values at specific intervals within the ideal plant profile. Meanwhile, using the difference between the values of various alternatives and criteria, the profile matching technique is a decision support system approach that makes suggestions for decisions based on how closely the assessed profiles or data match ideal conditions [17].

In this research, the profile matching method is used to determine and evaluate the suitability of horticultural plants based on criteria or parameters of climate conditions, which include temperature, rainfall, air humidity, and land conditions, which include soil type, soil texture, soil pH, land slope, and topography. The suitability of horticultural crops was analyzed on land in 4 sub-districts and 29 villages in Sikka Regency, NTT Province for fourteen alternative types of horticultural crops including red onion, red chilies, chili pepper, tomato, carrots, potato, eggplant, spinach, beans, broccoli, cabbage, mustard, long beans and water spinach [18], [9]. To demonstrate the credibility and good performance at the level of accuracy, the decision model in determining the suitability of horticultural plants, this research was tested through a testing process by carrying out the overall model evaluation process using the confusion matrix method. The final results of this test are accuracy values, precision values , and recall values. The main result of this research is that it is hoped that it will be able to build an IDSS for selecting the best horticultural plants for the Sikka Regency region's suitable land.

2. Methodology

This study proposes an integrated Intelligent Decision Support Systems (IDSS) model using the Analytic Hierarchy Process (AHP), interpolation, and profile-matching method to asses the suitability of horticultural plants. The research flow diagram model (Figure 1) consists of several modules: AHP, Interpolation, Profile Matching, and Testing method.

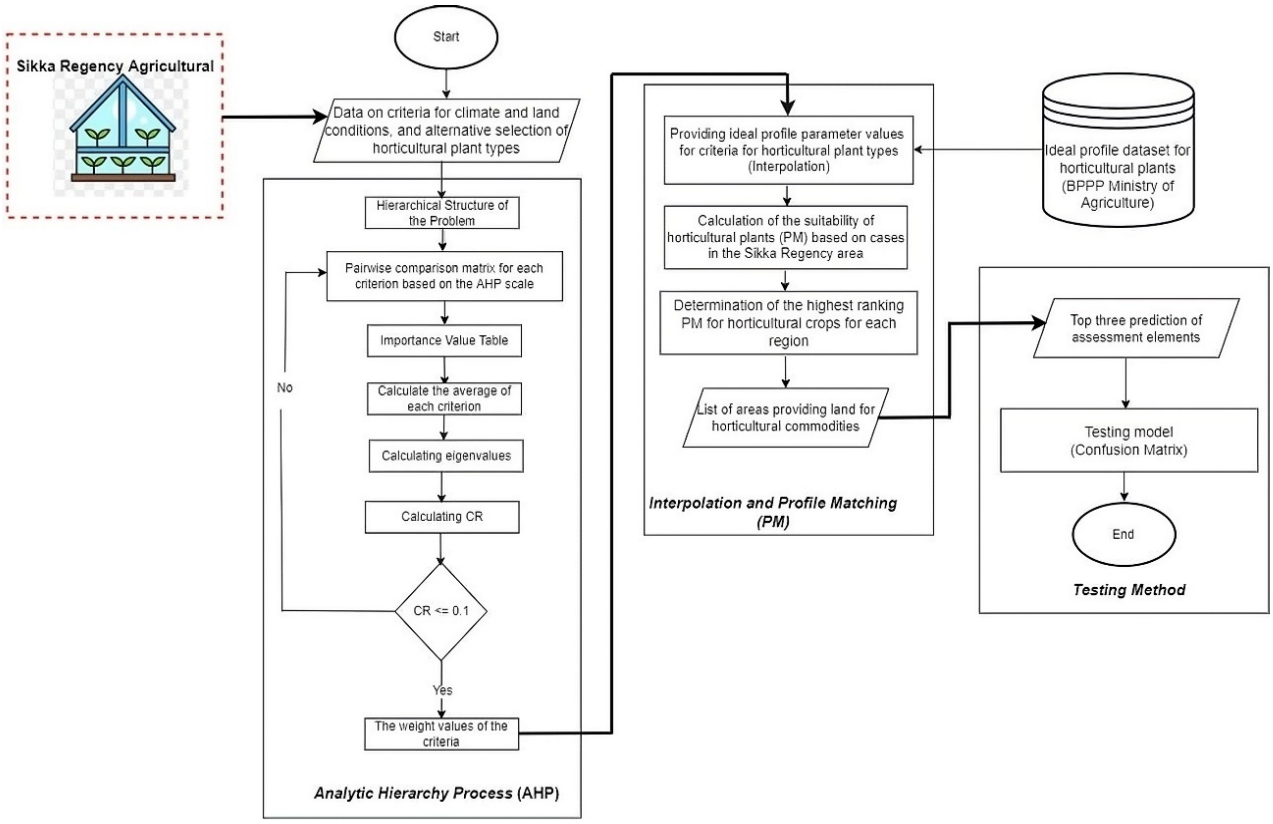

Figure 1. Research flow diagram model

2.1. Analytic Hierarchy Process

AHP (**Analytic Hierarchy Process*)*** constitutes a structured methodology for decision-making that takes into account several goals and variables, enabling a more thorough analysis of the characteristics, determining factors, and relationships of complicated decision-making problems. It makes use of sparse quantitative data to support a mathematical decision-making process, providing a useful method for complicated issues with several objectives, multiple variables, or an unclear structure [19]. Using the AHP method consists of several steps that must be carried out [20].

a. By comparing each criterion to the others in pairs, determined is the factor weights.

A scale from 1 to 9 works well for assessing the qualifying element for various difficulties [21].

b. Multiplies each element in each row of the comparison matrix, using equation (1)

$$M_i = \prod_{j=1}^{n} bij, \quad i = 1,2,\ldots,n \tag{1}$$

c. Calculating n square roots, M_i using equation (2)

$$\overline{Wi} = \sqrt[n]{M_i}, \quad i = 1,2,\ldots,n \tag{2}$$

d. Normalizing $\overline{W_i}$ with equation (3)

$$W_i = \overline{W_i} / \sum_{j=1}^{n} \overline{W_j}, \quad i = 1,2,\ldots,n \tag{3}$$

e. Calculate the consistency of the comparison evaluation factors are consistent

- Determine the maximum eigenvalue

$$\lambda\, maks = \sum_{i=0}^{1} a_{ij}.w_i \tag{4}$$

- Calculate the Consistency Index (CI)

$$CI = \frac{(\lambda\, maks) - n}{n-1} \tag{5}$$

- Consistency Ratio (CR)

$$CR = \frac{(\lambda\, maks) - n}{n-1} \tag{6}$$

If the CR value of ≤ 0.1 indicates that the pairwise comparison matrix is consistent. However, if the CR value is > 0.1, then the priority assessment must be corrected [20]. The corresponding Random Index (RI) values are presented in Table 1.

Table 1. Random index consistency

N	2	3	4	5	6	7	8	9	10
RI_n	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

2.2. Profile Matching

The profile matching approach is one of the techniques commonly employed in decision support systems. In essence, this method makes recommendations for decisions based on how well the data or profile under test matches ideal circumstances.

For each profile, the degree to which the test profile resembles the ideal profile is measured and added up [17]. Below are some steps and the development of the calculation approach for profile matching [22].

a. Determine the weight value of each aspect using the weight gap

The gap refers to the discrepancy between the current state of the aspect and its intended target.

The equation (7) illustrates the gap calculation [23].

$$Gap = Value\ attribute - Value\ Target \quad (7)$$

The value is a collection of required values, whereas the value attribute shows the candidate's true worth. After evaluating the different values of the obtained Candidate Profile and Target Profile, weighting is carried out. The weights assigned to each aspect are derived from the differences in gap values. Table 2 presents the gap and weight mapping. Only integer GAP values are used when translating the competency GAP values based on Table 2. Decimal GAP values, however, use a linear interpolation approach [24].

Table 2. Value gap weight

Gap Differences	Weight Value
0	6
1	6.5
-1	5
2	4.5
-2	4
3	3.5
-3	3
4	2.5
-4	2
5	1.5
-5	1

b. Stages of determining factor values

The aggregate importance of each criterion is determined by computing the total factor value as defined in Equation (8).

$$NK = \sum(SK \times X) \quad (8)$$

In this case, SK stands for the variable value obtained from the interpolation results and the gap weights, whereas NK is the total value applied to each criterion, and X is the preference weight of the variable from the results of the AHP method.

c. Stages of determining the ranking

The final result of the profile-matching process is the ranking of each alternative. The ranking calculations refer to equation (9).

$$NA = (A1 \times NK1) \ldots + (AN \times NKN) \quad (9)$$

Where NA is the final value of each alternative, A is the preference weight for each criterion from the results of the AHP method, and NK is the total value of each criterion.

2.3. Interpolation

Using a functional equation, interpolation is a technique for determining values that fall between two known values. One type of interpolation theorem is linear interpolation [25]. Finding values that fall between two known quantities using linear equations (equations that create a straight line) is known as linear interpolation [26].

Assessment for each parameter uses increasing and decreasing interpolation. In Figure 2, interpolation is increasing, and as x approaches d2, the parameter x will reach its maximum value, whereas in Figure 3, it can be seen that interpolation is decreasing, and that parameter x approaches the minimum value when the value of x moves away from d2. The weight value x can be calculated using (10) for increasing interpolation and (11) for decreasing interpolation.

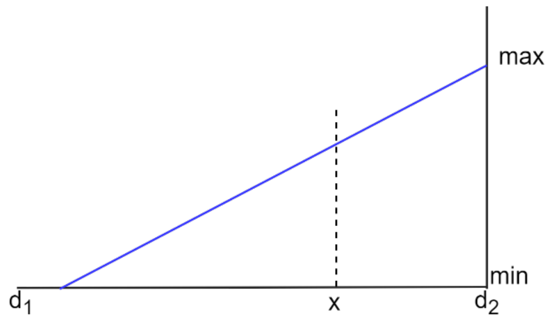

Figure 2. The interpolation curve increases

$$W\ (x) = \frac{X-d_1}{d_2-d_1} * (max - min) + min \quad (10)$$

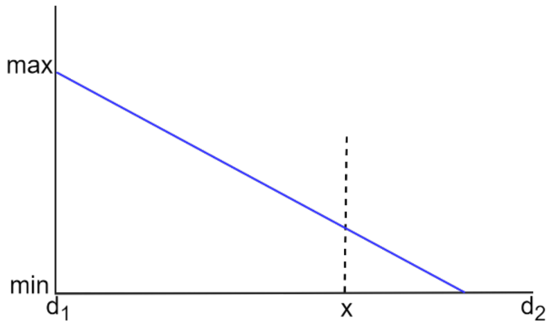

Figure 3. The interpolation curve decreases

$$W(x) = \frac{X-d_1}{d_2-d_1} * (min - max) + max \quad (11)$$

with:

- the function W(x) represents the weight corresponding to the input x
- x represents the parameter value used for the test dataset
- d1 denotes the minimum limit of the parameter's range
- d2 denotes the maximum value within the parameter's range
- max represents the upper limit of the assigned weight value
- min refers to the predefined minimum value of the weight

2.4. Test and Evaluate Models

Model testing and evaluation involve the process of measuring the performance of a statistical or machine learning model to determine the extent to which the model meets the desired objectives by involving the confusion matrix method, which is a table that can be used to evaluate the effectiveness of the classification model being built. The confusion matrix table contains information about the classification of data that is predicted to be correct and incorrect, as presented in Table 3 [27].

Based on Table 3, the confusion matrix can be completed by calculating accuracy, sensitivity, and specificity. Accuracy is a comparison of correct predictions (TP (true positive) and TN (true negative)) with the entire data. Accuracy can be used to determine the overall performance of the classifier in predicting data correctly. Sensitivity is the ratio between TP and the amount of data that is positive. Sensitivity is useful for knowing how good the classifier is at predicting positive values. Meanwhile, specificity is the ratio between TN and the amount of data that is negative.

Specificity is useful for knowing how good the classifier is at predicting negative values. Accuracy, recall, and precision can be calculated using the equation:

$$Accuracy = \frac{TP+TN}{TP+FN+FP+TN} * 100\% \quad (12)$$

$$Recall = \frac{TP}{TP+FN} * 100\% \quad (13)$$

$$Precision = \frac{TP}{TP+FP} * 100\% \quad (14)$$

Table 3. Confusion matrix

		Predicted Class	
		Positive	Negative
Actual Class	Positive	Correctly Identified as Positive (True Positive - TP)	Incorrectly Identified as Positive (False Positive - FP)
	Negative	Incorrectly Identified as Negative (False Negative - FN)	Correctly Identified as Negative (True Negative -TN)

3. Results and Discussions

Based on the best qualities of many types of horticulture plants and land conditions, data on the suitability of horticultural plant types was calculated based on the characteristics and land needs of the Sikka Regency area using the AHP (Analytic Hierarchy Process), interpolation, and profile matching methods, which resulted in Figure 4. After that, testing was carried out by carrying out the overall model evaluation process using the confusion matrix method. The final results of this test are accuracy values, recall values, and precision values.

Horticultural agricultural land	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Rank 9	Rank 10	Rank 11	Rank 12	Rank 13	Rank 14
Bangkoor	Spinach	Mustard	Red Onion	Water Spinach	Eggplant	Beans	Broccoli	Cabbage	Red Chili	Chili Pepper	Tomatoo	Carrot	Potato	Long Bean
Bloro	Water Spinach	Shallots	Mustard	Tomato	Spinach	Eggplant	Beans	Chili Pepper	Broccoli	Cabbage	Red Chilies	Carrots	Potatoes	Long Beans
Kloangpopot	Tomato	eggplant	Spinach	Water Spinach	Mustard	long beans	shallots	Beans	Broccoli	cabbage	red chilies	carrots	potatoes	Chili Pepper
Kolidetung	Mustard	Spinach	Red Onion	Water Spinach	Eggplant	Chili Pepper	Beans	Tomato	Red Chili	Broccoli	Cabbage	Carrot	Potato	Long Beans
Kolisia	Water Spinach	Mustard	Red Onion	Spinach	Tomato	Chili Pepper	Red Chili	Eggplant	Long Beans	Broccoli	Cabbage	Beans	Carrot	Potato
Kolisia B	Water Spinach	Mustard	Red Onion	Spinach	Tomato	Chili Pepper	Red Chili	Eggplant	Long Beans	Broccoli	Cabbage	Beans	Carrot	Potato
Korowuwu	Mustard	Spinach	Red Onion	Water Spinach	Eggplant	Chili Pepper	Tomato	Beans	Red Chili	Broccoli	Cabbage	Carrot	Potato	Long Beans
Kota Uneng	Spinach	Mustard	Eggplant	Water Spinach	Red Onion	Broccoli	Cabbage	Beans	Red Chili	Chili Pepper	Tomato	Long Beans	Carrot	Potato
Koting A	Mustard	Water Spinach	Spinach	Eggplant	Red Onion	Tomato	Beans	Broccoli	Cabbage	Long Beans	Carrot	Potato	Red Chili	Chili Pepper
Koting B	Mustard	Water Spinach	Spinach	Eggplant	Red Onion	Tomato	Beans	Broccoli	Cabbage	Long Beans	Carrot	Potato	Red Chili	Chili Pepper
Koting C	Mustard	Red Onion	Water Spinach	Spinach	Eggplant	Tomato	Beans	Broccoli	Cabbage	Long Beans	Carrot	Potato	Chili Pepper	Red Chilies
Ladogahar	Water Spinach	Mustard	Red Onion	Spinach	Eggplant	Tomato	Beans	Chili Pepper	Broccoli	Cabbage	Carrot	Potato	Red Chili	Long Beans
Lusitada	Water Spinach	Red Onion	Mustard	Tomato	Spinach	Eggplant	Beans	Chili Pepper	Broccoli	Cabbage	Red Chili	Carrot	Potato	Long Beans
Mahebora	Water Spinach	Mustard	Red Onion	Spinach	Eggplant	Tomato	Beans	Chili Pepper	Broccoli	Cabbage	Red Chili	Carrot	Potato	Long Beans
Nangahale	Spinach	Mustard	Red Onion	Water Spinach	Eggplant	Beans	Broccoli	Cabbage	Red Chili	Chili Pepper	Tomato	Carrot	Potato	Long Beans
Nangalimang	Spinach	Mustard	Eggplant	Water Spinach	Red Onion	Broccoli	Cabbage	Beans	Red Chili	Chili Pepper	Tomato	Long Beans	Carrot	Potato
Nebe	Spinach	Mustard	Red Onion	Water Spinach	Eggplant	Beans	Broccoli	Cabbage	Red Chili	Chili Pepper	Tomato	Carrot	Potato	Long Beans
Nirangkliung	Water Spinach	Mustard	Red Onion	Spinach	Eggplant	Tomato	Beans	Chili Pepper	Broccoli	Cabbage	Carrot	Potato	Red Chilies	Long Beans
Nita	Water Spinach	Red Onion	Mustard	Spinach	Eggplant	Tomato	Beans	Chili Pepper	Broccoli	Cabbage	Red Chilies	Carrot	Potato	Long Beans
Nitakloang	Water Spinach	Red Onion	Mustard	Tomato	Spinach	Eggplant	Beans	Chili Pepper	Broccoli	Cabbage	Red Chilies	Carrot	Potato	Long Beans
Paubekor	Mustard	Red Onion	Water Spinach	Spinach	Eggplant	Tomato	Beans	Broccoli	Cabbage	Long Beans	Red Chilies	Carrot	Potato	Chili Pepper
Peli baler	Tomato	Eggplant	Spinach	Water Spinach	Mustard	Long Beans	Red Onion	Beans	Broccoli	Cabbage	Red Chilies	Carrot	Potato	Chili Pepper
Riit	Water Spinach	Red Onion	Mustard	Spinach	Eggplant	Tomato	Beans	Chili Pepper	Broccoli	Cabbage	Red Chilies	Carrot	Potato	Long Beans
Takaplager	Water Spinach	Red Onion	Mustard	Tomato	Spinach	Eggplant	Beans	Chili Pepper	Broccoli	Cabbage	Red Chilies	Carrot	Potato	Long Beans
Talibura	Spinach	Mustard	Water Spinach	Eggplant	Red Onion	Beans	Broccoli	Cabbage	Chili Pepper	Red Chilies	Tomato	Carrot	Potato	Long Beans
Tebuk	Water Spinach	Red Onion	Mustard	Spinach	Eggplant	Tomato	Beans	Chili Pepper	Broccoli	Cabbage	Red Chilies	Carrot	Potato	Long Beans
Tilang	Water Spinach	Red Onion	Mustard	Tomato	Spinach	Eggplant	Beans	Chili Pepper	Broccoli	Cabbage	Red Chilies	Carrot	Potato	Long Beans
Wairbeler	Spinach	Water Spinach	Tomato	Red Onion	Eggplant	Beans	Mustard	Broccoli	Cabbage	Chili Pepper	Red Chilies	Long Beans	Potato	Carrot
Watumerak	Tomato	Eggplant	Spinach	Water Spinach	Mustard	Long Beans	Red Onion	Beans	Broccoli	Cabbage	Red Chilies	Carrot	Potato	Chili Pepper
Wolomarang	Spinach	Mustard	Water Spinach	Tomato	Red Onion	Broccoli	Cabbage	Eggplant	Beans	Chili Pepper	Red Chilies	Long Beans	Carrot	Potato
Wolomotong	Tomato	Eggplant	Spinach	Water Spinach	Mustard	Long Beans	Red Onion	Beans	Broccoli	Cabbage	Red Chilies	Carrot	Potato	Chili Pepper
Wuliwutik	Water Spinach	Mustard	Red Onion	Spinach	Eggplant	Tomato	Beans	Chili Pepper	Broccoli	Cabbage	Carrot	Potato	Red Chilies	Long Beans
Wuring	Spinach	Mustard	Water Spinach	Tomato	Red Onion	Broccoli	Cabbage	Terung	Beans	Chili Pepper	Red Chilies	Long Beans	Carrot	Potato

Figure 4. IDSS results for the suitability of horticultural plant types based on land characteristics

The comparison results stage between the Intelligent Decision Support Systems (IDSS) recommendations and the types of horticultural plants from the Sikka Regency Agricultural Service was carried out by taking the top one results, three results, top four results, and top five results from 14 types of horticultural plants on 33 fields, presented in Figure 5.

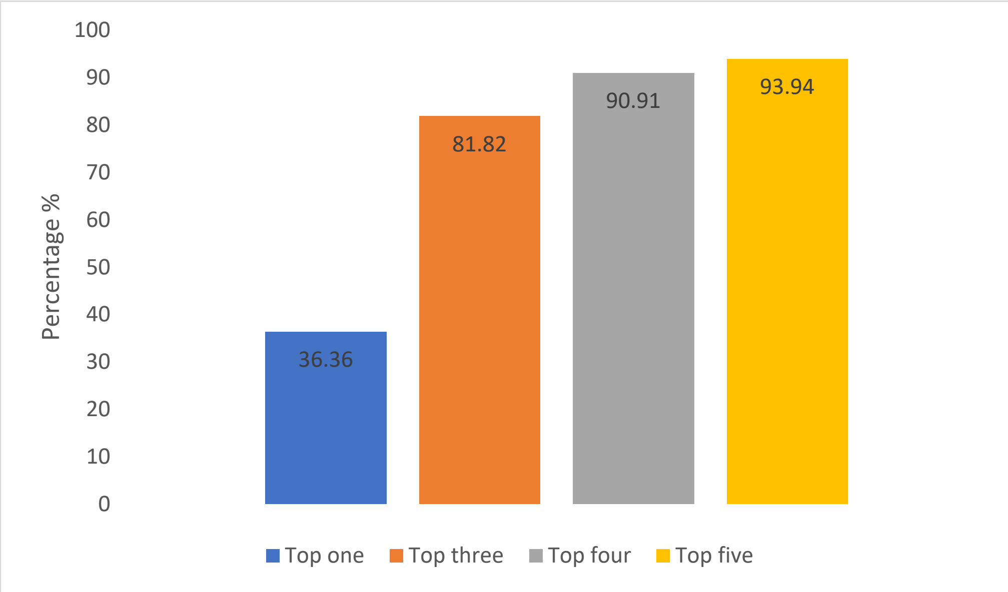

Figure 5. Comparison of IDSS recommendation results and Sikka Regency agricultural service data

Based on Figure 5, a comparison has been made between the results of the IDSS recommendations and data on commodity yields planted on agricultural land in Sikka Regency, where the comparison was determined for each of the top one, top three, top four, and top five priorities for 33 lands using the binary number 0 false or inappropriate and 1 represents true or appropriate. Direct analysis of the commodity categories that rank in the top one, top three, top four, and top five is the method used to determine priority comparisons for the top one, top three, top four, and top five in each land from the IDSS recommendation results and then compared with all types of commodities which is planted on agricultural land in Sikka Regency. If one of the types of commodities planted has suitability or is true, the value is 1, but if none of them has suitability or is true, the value is 0. After each land has carried out a comparison process, the final process continues, namely by adding up all the top-priority comparison results. One, top three, top four, and top five from each land, then the total average is calculated.

In general, from the 33 fields, the total average yield compared to the IDSS recommendations with data on commodity results planted on agricultural land in Sikka Regency was obtained as a top three priority of 81.82% or 27 fields, top four 90.91% or 30 fields and top five 93.94% or 31 fields have similarities with the commodity products grown on agricultural land in Sikka Regency.

Meanwhile, the IDSS recommendation results for the top one priority are only 36.36% or 12 fields that are similar to the agricultural land commodity results in Sikka Regency.

Determining comparisons of several lands does not comply with the IDSS recommendation results, because not all agricultural land is the result of research conducted by the Department of Agriculture in determining the type of commodity that is suitable for a land. Some of the commodities planted on agricultural land in Sikka Regency are the result of planting patterns by farmers based on prices and market demand.

Based on the results of the comparison of IDSS recommendations and data from the Sikka Regency Agricultural Service, the next stage was testing using the confusion matrix model by focusing on the performance of the top one, top three, top four, and top five evaluation results, which are presented in Table 4. The final test outcomes reflect accuracy based on the resemblance of conclusions, rather than on misleading truths. Similarly, recall and precision are determined by conclusions that share similarities.

Table 4. Confusion matrix model results

Metrics	Top One	Top Three	Top Four	Top Five
TP	1	8	16	26
TN	0	0	0	0
FP	0	0	0	0
FN	32	25	17	7
SUM	33	33	33	33

It is evident from Table 4 that in the top one, there is 1 suitable data (TP) and 32 unsuitable data (FN), top three there are 8 suitable data (TP) and 25 unsuitable data (FN), top four there are 16 suitable data (TP) and 17 unsuitable data (FN) and in the top five, there are 26 suitable data (TP) and 7 unsuitable data (FN) with a total of 33 data in each priority.

Next, the calculation of accuracy, recall, and precision for each top one, top three, top four, and top five priority is carried out using equations (1), (2), and (3). The calculation results can be seen in Figure 6.

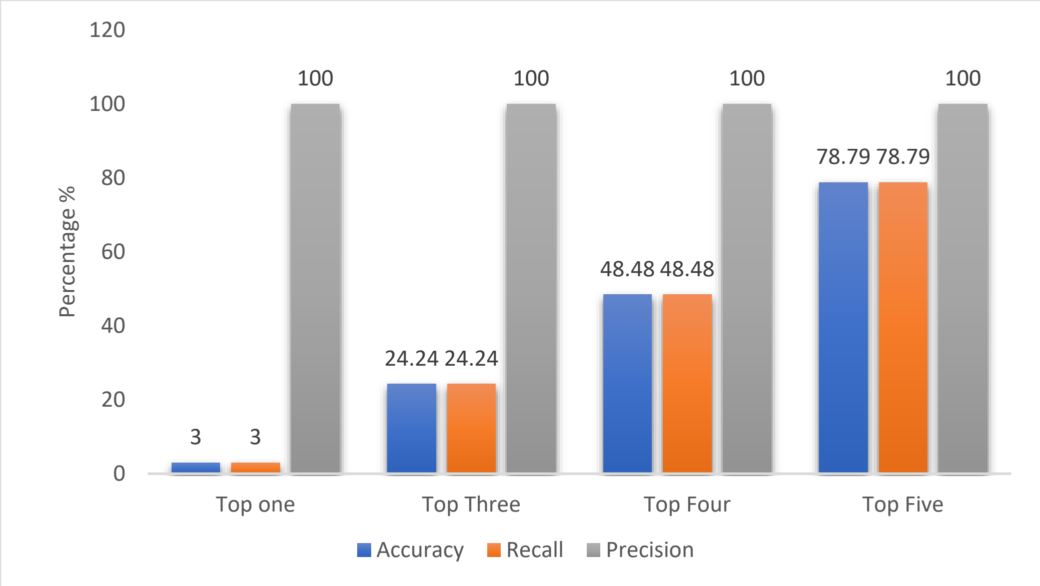

Figure 6. Testing of model evaluation performance results

Based on Figure 6, the results of the top one, top three, top four, and top five tests were obtained with accuracy values of 3%, 24.24%, 48.48%, 78.79%, recall values of 3%, 24.24%, 48, 48%, 78.79% and precision 100%, 100%, 100%, 100%. The results of these accuracy values show that the system can provide the same recommendations as the results of commodities grown on agricultural land in Sikka Regency. The recall value is also at the same value as the accuracy value, and the precision value also shows that all predictions are positive. This shows that the commodities to be planted must be adapted to the land.

4. Conclusion

This research has developed a model for integrating AHP (**Analytic Hierarchy Process**), interpolation, and profile matching, which is needed to support IDSS in determining the suitability of horticultural plant types based on agricultural land conditions. Based on the evaluation results of model performance testing, of all the average test priorities, the top five test priorities have high test scores, namely 78.79% accuracy, 78.79% recall, and 100% precision. These findings indicate that the IDSS recommendation system consistently suggests crop types that align with actual cropping patterns in Sikka Regency.

However, the similarity in these recommendations also highlights the potential risk of surplus production due to simultaneous planting patterns.

Therefore, an important implication of this study is the need for further research that considers the integration of crop diversification or rotation aspects to support sustainable crop distribution.

Acknowledgments

This work was supported by the Department of Computer Science and Electronics, Universitas Gadjah Mada, under the Publication Funding Year 2025, in accordance with Announcement Letter Number 227/UN1/FMIPA.2.2/IKE/KU.02.02/2025 dated January 6, 2025.

References:

[1]. World Bank Group. (2025). *Agriculture and Food*. World Bank. Retrieved form: https://www.worldbank.org/en/topic/agriculture/overview [accessed: 19 June 2025].

[2]. World Bank Group. (2024). *Climate-smart agriculture*. World Bank. Retrieved form: https://www.worldbank.org/en/topic/climate-smart-agriculture [accessed: 20 June 2025].

[3]. Kementerian Pertanian Republik Indonesia. (2018). *Revisi Rencana Strategis Direktorat Jenderal Hortikultura (2015-2019)*. Direktorat Jenderal Hortikultura. Retrieved from: https://hortikultura.pertanian.go.id/wp-content/uploads/2022/12/RENSTRA-STO-2015-2019.pdf [accessed: 21 June 2025]

[4]. Pemerintah Republik Indonesia. (2010). *Undang-Undang Nomor 13 Tahun 2010 tentang Hortikultura*. PBK RI.

[5]. Noviyanto, F., Tarmuji, A., & Hardianto, H. (2020). Food crops planting recommendation using analytic hierarchy process (AHP) and simple additive weighting (SAW) methods. *International Journal of Scientific & Technology Research*, *9*(2).

[6]. Food and Agriculture Organization of the United Nations. (2018). *Transforming food and agriculture to achieve the SDGs: 20 interconnected actions to guide decision-makers*. FAO.

[7]. Rossiter, D. G. (2009). *Land evaluation: Towards a revised framework* (Land and Water Discussion Paper 6, FAO). *Geoderma*, *148*(3–4), 428–429. Doi: 10.1016/j.geoderma.2008.11.001.

[8]. Food and Agriculture Organization of the United Nations. (1976). *A framework for land evaluation* (FAO Soils Bulletin No. 32). FAO.

[9]. Badan Pusat Statistik Kabupaten Sikka. (2021). *Sikka Regency in Figures 2021*. BPS.

[10]. Ali, I., Gunawan, V., & Adi, K. (2020). Decision Support Systems for Land Suitability Evaluation on Rice Cultivation using ELECTRE Method. *E3S Web of Conferences*, *202*. Doi: 10.1051/e3sconf/202020214004

[11]. Ahmad, A., et al. (2024). Fuzzy knowledge based intelligent decision support system for ground based air defence. *Journal of Ambient Intelligence and Humanized Computing*, *15*(4), 2317-2340. Doi: 10.1007/s12652-024-04757-3

[12]. Beyene, G., et al. (2022). Land suitability assessment for apple (Malus domestica) production in Sentele watershed in Hadiya zone, southern Ethiopia. *Applied and Environmental Soil Science*, *2022*(1), 4436417. Doi: 10.1155/2022/4436417

[13]. Habibie, M. I., et al. (2021). Land suitability analysis for maize production in Indonesia using satellite remote sensing and GIS-based multicriteria decision support system. *GeoJournal*, *86*(2), 777-807. Doi: 10.1007/s10708-019-10091-5

[14]. Pramanik, M. K. (2016). Site suitability analysis for agricultural land use of Darjeeling district using AHP and GIS techniques. *Modeling Earth Systems and Environment*, *2*(2), 56. Doi: 10.1007/s40808-016-0116-8

[15]. Kim, H., & Shim, K. (2018). Land suitability assessment for apple (Malus domestica) in the Republic of Korea using integrated soil and climate information, MLCM, and AHP. *International Journal of Agricultural and Biological Engineering*, *11*(2), 139-144. Doi: 10.25165/j.ijabe.20181102.2522

[16]. Prasetyo, N. A., & Wardoyo, R. (2022). Decision Support System to Prioritize Ventilators for COVID-19 Patients using AHP , Interpolation , and SAW. *IJCCS (Indonesian Journal of Computing and Cybernetics Systems*), 16(1), 35–44. Doi: 10.22146/ijccs.70985

[17]. Soetanto, H., et al. (2018). Hypertension drug suitability evaluation based on patient condition with improved profile matching. *Indonesian Journal of Electrical Engineering and Computer Science*, *11*(2), 453-461. Doi: 10.11591/ijeecs.v11.i2.pp453-461

[18]. Sys, C., et al. (1993). *Land evaluation. Part III: Crop requirements (Agricultural Publications No. 7).* General Administration for Development Cooperation.

[19]. Liu, Y. K., Feng, X. P., & Chen, Y. L. (2013). The evaluation of green university based on analysis hierarchy process. *Advanced Materials Research*, *726*, 1054-1058. Doi: 10.4028/www.scientific.net/AMR.726-731.1054

[20]. Saaty, T. L., & Vargas, L. G. (2012). *Models, methods, concepts & applications of the analytic hierarchy process* (2nd ed.). Springer.

[21]. Saaty, T. L. (2005). The analytic hierarchy and analytic network processes for the measurement of intangible criteria and for decision-making. *Multiple criteria decision analysis: state of the art surveys*, 363-419. Springer. Doi: 10.1007/978-1-4939-3094-4_10

[22]. Soares, T. G., Abidin, A. Z., & Wahyuningrum, T. (2022). Combining Analytical Hierarchy Process Method-Profile Matching Method for the Best Dean’s List Selection. *Prim. Sci. Eng*, *2*(1), 34-46. Doi: 10.56831/psen-02-026

[23]. Sutedi, S., Purnomo, H., & Handayani, N. (2019). The Application of Profile Matching Method in Decision Support System for Selection of Training Instructors (Case Study at IIB Darmajaya's Training Center). *Proceeding International Conference on Information Technology and Business*, 164-174.

[24]. Epperson, J. F. (2013). *An introduction to numerical methods and analysis*. John Wiley & Sons.

[25]. Meijering, E. (2002). A chronology of interpolation: from ancient astronomy to modern signal and image processing. *Proceedings of the IEEE*, *90*(3), 319-342. Doi: 10.1109/5.993400

[26]. Alam, M. M., & Nuruzzaman, M. (2025). Comparative analysis of interpolation methods commonly used in bathymetric data generation. *World Journal of Advanced Research and Reviews*, *25*(3), 2018–2029. Doi: 10.30574/wjarr.2025.25.3.0835

[27]. Han, J., Kamber, M., & Pei, J. (2011). *Data Mining Concepts and Techniques Third Edition*. Morgan Kaufmann.