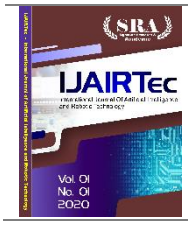

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DECISION SUPPORT SYSTEM FOR DETERMINING THE BEST OIL PALM SEEDS USING THE ANALYTICAL HIERARCHY PROCESS METHOD

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Abstract
The need for the availability of quality oil palm seeds with an increasing quantity is in line with the increasing need of the world's population for palm oil. Good care of seedlings in early nurseries and main nurseries through the right dose of fertilization is one of the efforts to achieve optimal results in the development of oil palm cultivation. Most villagers do not know and can choose and distinguish good types of oil palm seeds, due to lack of knowledge about the types of oil palm seeds. With this method, it will make it easier for ordinary people to choose superior types of oil palm seeds through predetermined criteria and subcriteria. To help and make it easier for the community to choose superior types of oil palm seeds, as well as to increase people's insight into the types of superior seeds of oil palm.

I. INTRODUCTION

Indonesian plantations have gone through a long historical journey. More than five centuries ago the archipelago's oceans have been crowded by trade traffic in the main commodities of plantation products, such as pepper, nutmeg, cloves and spices further developed various additional commodities such as coffee, cocoa, rubber, however, palm oil remains the main product in the national economy (Pahan, 2006) In the plantation sector, "Benua Etam" has the potential of millions of hectares of land for oil palm development. The Provincial Government of East Kalimantan (Kaltim) has determined the potential of oil palm plantation land covering an area of 40.7 million hectares (AntaraKaltim, 2016). Oil palm is an oil-producing industrial plant and is one of the types of plantation crops that occupy an important position in the agricultural sector in general, and the plantation sector

in particular, this is because of the many crops that produce oil, palm oil produces the largest economic value per hectare in the world (Agricultural Information Center, 1990).

Plantations play an important role as a driver of regional development as well as the economic development of the region. So many farmers and entrepreneurs are looking at oil palm plants to be used as a business. And there are still many benefits of oil palm crops for farmers and entrepreneurs, so that oil palm plantations in Indonesia continue to increase. As in riau region alone the area of oil palm land (2001) has reached 956,046 ha, predicted to produce FFB of more than 19 million tons per year and 4.1 million tons of CPO per year. In 2011 oil palm plantations were spread across five districts, namely Rokan Hulu regency, there was a subsidiary of PT Ekadura Indonesia (EDI) with a core land area of 10.00 ha and a primary cooperative credit for members (KKPA) of 3,650 ha. Then there is PT sawit Asanah Indah (SAI) with an area of 6,500 ha. In Siak regency there is PT Kimia Tirta Utama (KTU) with an area of 5,600 ha and KKPA 3,200ha. In Pelalawan regency there is PT Sari Lembah Subur with a plantation area of 7,700 ha, a plasma plantation covering an area of 8,00 ha and a KKPA covering an area of 3,050 ha (Dina Perkebunan Riau, 2011).

So along with the increasing needs of the population, efforts need to be considered to improve the quality and quantity of palm oil products so that the desired goal can be achieved by increasing oil palm yields. So along with the increasing needs of the population, efforts need to be considered to improve the quality and quantity of palm oil products so that the desired goal can be achieved by increasing oil palm yields. In order to achieve a goal to increase palm oil income, a decision support system for selecting the best oil palm seeds was created using the Analytical Hierarchy Process method which is a method for decision making by comparing in pairs between the choice criteria and also the paired comparison between existing choices. With a study on oil palm seeds, farmers can find it easier to determine the best oil palm seeds for them to plant so that the results do not disappoint.

Some of the researches that have been carried out previously are research conducted by Doni Saputra (2017). The research discussed the selection of the best soil conditions for plantations in Keputran Village because with the selection of the best soil, the community can more easily get information about soil conditions so that it can improve the economy [1]. Research conducted by Retno Widodo (2017). This research discusses a decision in determining the best tile because with this decision support system, owners and buyers can more easily determine the best tile in Kalirejo Village [2]. Research conducted by Muslihudin and Adi Sunaryo (2015). This study discusses the diagnosis of pests and diseases of oil palm plants because with this decision system, oil palm plantation farmers can more easily diagnose disease pests that attack oil palm and how to overcome them [3].

Based on this, this study will create a support system for selecting the best oil palm seeds using the Analytical Hierarchy Process method. The Analytical Hierarchy Process method is a decision-making method by comparing oil palm seedlings in order to determine the best oil palm seeds. With this research method, farmers can more easily determine the best oil palm seeds. The purpose and utilization of a support system for selecting oil palm seeds using the Analytical Hierarchy Process (AHP) method is to determine which oil palm seeds are the best for farmers because with this method farmers can more easily determine which oil palm seeds are the best and which are suitable for planting in their area.

II. RESEARCH METHODS

2.1. Analytical Hierarchy Process Method

The Analytical Hierarchy Process (AHP) method is one of the models for decision making that can help the human framework of thinking. Steps in the AHP method according to Kusrini (2007:135)[4]:

1. Define the problem in determining the desired solution, then compile a hierarchy of the problems faced. The drafting of the hierarchy is to set goals that are the goals of the system as a whole at the top level.
2. Determine the priority of elements
   a. The first step in determining the priority of elements is to make a comparison of pairs, that is, to compare the elements in pairs according to the given criteria.
   b. Pairwise comparison matrices are filled using numbers to represent the relative importance of an element to another.
3. Considerations of pairwise comparisons are synthesized to obtain overall priority. The things done in this step are:
   a. Summing the values of each column of the matrix.
   b. Divide each value of a column by the total of the corresponding column to obtain matrix normalization.
   c. Sum the values of each row and divide them by the number of elements to get the average value.
4. In decision making, it is important to know how good consistency there is because we do not want decisions based on considerations with low consistency. The things done in this step are:
   a. Multiply each value in the first column by the relative priority of the first element, the value in the second column by the relative priority of the second element, and so on.
   b. Sum each row.
   c. The result of the summation of rows divided by the corresponding relative priority element.
   d. The sum of the quotients above with the number of elements that have a result is called max.
   5. Calculate Consistency Index (CI) with formula: CI = (maks-n)/n.
   6. Calculate Consistency Ratio (CR) with formula: CR= CI/RC Where: CR = Consistency Ratio CI = Consistency Index IR=IndeksRandom Consistency
   7. Check the consistency of the hierarchy. If the value is more than 0.1 or 10% then the judgement data assessment should be corrected. However, if the consistency ratio is less or equal to 10% or 0.1 then the calculation results can be declared correct.

Define problems and set goals. If AHP is used to choose alternatives or arrange alternative priorities. This stage is carried out in order to express the development in an alternative way[5]–[9].

Table 1. AHP Importance

Importance Level	Information
1	Both elements are equally important
3	One element is slightly more important than another element
5	One element is more important than the other
7	One element is definitely absolutely important than another
9	One absolutely essential element of another
2,4,6,8	Values between two adjacent values

A list of Random Consistency (IR) Indices can be seen in Table 2Tabel 2. Daftar Indeks Random Konsistensi

Matrix Size	R value
1,2	0,00

3	0,58
4	0,90
5	1,12
6	1,24
7	1,32
8	1,41
9	1,45
10	1,49
11	1,51
12	1,48
13	1,56
14	1,57
15	1,59

In this study, criteria are needed that will be calculated in determining the best oil palm seeds for farmers.

C1 Bud shape
C2 The state of the shell of the oil palm seedlings
C3 The condition of the roots of the seedlings of the palm
C4 Soil type
C5 The color of the prospective roots, stems and leaves
C6 Size or anjang of prospective palm trunks
C7 Forms of oil palm seedlings

Tested alternatives

The research was conducted to determine the selection of the best oil palm seeds for farmers based on these criteria

1. Types of Superior seedlings
2. Types of tissue culture seedlings
3. Types of wild seedlings

2.2. Frame of Mind

The framework in this study explains how to select or select the best oil palm seeds for farmers using the analytical hierarchy process method. This identification is carried out with an assessment form then the data collection process, then the next process, namely the support system for selecting oil palm seeds. In designing this palm seed decision support system, an analysis is carried out first as well as collecting data from farmers so that we know that in the selection of oil palm seeds there are criteria and weight values that can prove quality oil palm seeds. Here is an overview of the process in the assessment of oil palm seed hatchery with a flowchat diagram.

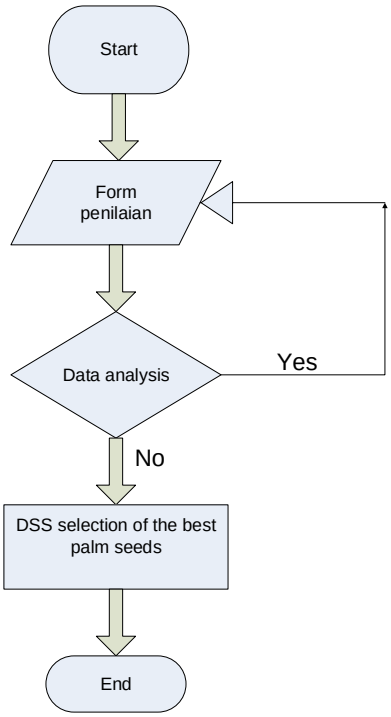

Figure 3. Research Flow

III. RESULTS AND DISCUSSION

3.1. Comparison Matrix

The calculation table to be listed to calculate the comparison between a criterion.

Table 3. Kritian Weight Value

Criteria	Value
Not Good	1
Not Good Enough	3
Good	6
Very Good	7
Absolutely Good	9

Pairwise comparison is performed on the first line of a pairwise comparison matrix. For example, in the first row there are criteria with a comparison value of 9/9 = 1, because both have an Absolute Good criteria value (MB). And so on until the criteria value on the table is obtained a comparison. Here is a table matrix in pairs:

Criteria	Bud shape	State of the Shell	Seedling Root Conditions	Soil Type	Color of Prospective Roots, Stems	Length of Prospective Bars	Seedling Shape
Bud shape	1	3	9	1,8	1,8	1,28	1,28
State of the Shell	0,33	1	3	0,6	0,6	0,42	0,42
Seedling Root Conditions	0,11	0,33	1	0,2	0,2	0,14	0,14
Soil Type	0,56	1,67	5	1	1	0,71	0,71
Color of Prospective Roots, Stems	0,56	1,67	5	1	1	0,71	0,71

Length of Prospective Bars	0,78	2,33	7	1,4	1,4	1	1
Seedling Shape	0,78	2,33	7	1,4	1,4	1	1
Sum	4,11	12,3	37	7,4	5,6	5,28	5,28

The next step is to determine the normalized value of the comparison in pairs between criteria, by dividing the value in each matrix box divided by the total columns. Example 1/4.11111 = 0.24324 and so on.

Criteria	Bud shape	State of the Shell	Seedling Root Conditions	Soil Type	Color of Prospective Roots, Stems	Length of Prospective Bars	Seedling Shape
Bud shape	0,24	0,24	0,24	0,24	0,24	0,24	0,24
State of the Shell	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Seedling Root Conditions	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Soil Type	0,13	0,13	0,13	0,13	0,13	0,13	0,13
Color of Prospective Roots, Stems	0,13	0,13	0,13	0,13	0,13	0,13	0,13
Length of Prospective Bars	0,18	0,18	0,18	0,18	0,18	0,18	0,18
Seedling Shape	0,18	0,18	0,18	0,18	0,18	0,18	0,18
Sum	1	1	1	1	1	1	1

Table 6. Priority Criteria

Priority criteria	Criteria weighting
Bud shape	0.24
The state of the shell of the oil palm seedlings	0.08
The condition of the roots of the seedlings of the palm	0.02
Soil type	0.13
The color of the prospective roots, stems, leaves	0.13
The length of the prospective stem of the palm seedling	0.18
Forms of oil palm seedlings	0.18

Then to determine the previous calculation is consistent or not then it is necessary to calculate $\lambda_{maks.}$

λmaks = (4.111111 x 0.2432432)+(12.33333333 x 0.0810811)+(37 x 0.027027)+(7.4 x 0.1351351)+(7.4 x 0.1351351)+(5.285714286 x 0.1891892)+(5.2857143 x 0.1891892)

=0.999999795 + 1.0000002331 + 0.999999 + 0.99999974 + 0.99999974 + 1.0000000572 + 1.0000000572

= 6.9999986225 = 7

C1 = (λmaks-n) / (n-1)

(7-7) / (7-1)

= 0

CR = C1/RI

0

Since the values of the CR are 0 and 0 ≤ 0.1 then this comparison is acceptable. So with this, the weight of each criterion used is the average weight result in the following table.

1. Calculation of alternative weights for the criteria of the shape of the bud.

Alternative	Bentuk tunas	Bobot
High-yielding types of seedlings	Usual	9
Types of tissue culture seedlings	Pure white	7
Types of wild seedlings	Disabled	5

Comparison of pairs

Bud shape	High-yielding	seedlings Tissue culture seeds	Wild seedlings
High-yielding seedlings	1	1.285714286	1.8
Tissue culture seedlings	0.77778	1	1.4
Wild seedlings	0.55556	0.714285714	1
Sum	2.33333	3	4.2

Tabel normalisasi

Bud shape	High-yielding	seedlings Tissue culture	Wild seedlings	Average weight
High-yielding seedlings	0.4285714	0.428571	0.4286	0.42857
Tissue culture seedlings	0.3333333	0.333333	0.3333	0.33333
Wild seedlings	0.2380952	0.238095	0.2381	0.2381

Calculation of the final result by calculating the priority =(0.243243 x 0.428571) + (0.081081 x 0.538462) + (0.0270727 x 0.473684) + (0.135135 x 0.409091) + (0.189189189 x 0.544430538) + (0.189189 x 0.428571) = 0.452625 = 45%

Table 7. The Value of the Results of Measuring the Selection of Sawait Coconut Seeds

Alternative	Result	
High-yielding types of seedlings	0.452625	45%
Types of tissue culture seedlings	0.330552	33%
Types of wild seedlings	0.216823	22%

IV. CONCLUSION

The conclusion that can be obtained in the development of a decision support system for selecting superior types of oil palm seeds using the AHP (Analytic HierarchiProcces) method is that the provision of criteria in determining oil palm seeds can help in making decisions to determine superior oil palm seeds. AHP (Analytic Hierarchi Procces) has been successfully implemented in the decision support system for selecting superior types of oil palm seeds. So that it can help farmers in determining superior oil palm seeds through the stages that have been set in the AHP method. From the calculation results supported by determining the previous criteria, it is known that the best palm seeds are the types of superior seeds with the highest value of 0.45 or 45%.

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