

DETERMINATION OF QUALITY COCOA SEEDS

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ABSTRACT

This decision support system is an alternative to assist farmers in determining quality cocoa seedlings ready for planting slits. where cocoa is a crop that can be developed in increasing farmers' income for their daily needs. the farmers themselves want to cultivate cocoa in a more optimal nursery because many cocoa farmers need quality seeds, for this decision support system helps farmers in choosing alternatives and criteria for selecting quality cocoa seeds that are ready to be planted directly on the farmer's land to get results well. The method used is the Fuzzy Multi-Criteria Decision Making (FMCDM). This method is appropriate for the determination of good quality seeds. This decision support system helps farmers cultivating cocoa nurseries that are ready to be developed.

INTRODUCTION

The Fuzzy MCDM model is used in assessing alternatives with criteria determined through the decision-maker single according to alternatives and criteria as well the importance criteria can be evaluated using linguistic values represented by fuzzy numbers. Cacao is a very popular type of plant, the results of the fruit or seeds can be processed into chocolate as a healthy food ingredient. Planting cacao trees is an opportunity for farmers to get large yields and the selling price of cocoa is very high. To increase large and quality production, farmers must carry out routine maintenance and do things like pruning and fertilizing. however farmers in the high king's village are currently experiencing a decline in cocoa production because at the time of planting cacao seedlings did not see good quality seeds, farmers planted seedlings with original seeds.

As for what should be prepared, cocoa cultivation should be started from the preparation of quality cocoa seeds, where quality seeds are produced through the use of seeds of good varieties and proper cultivation techniques, it will produce large production. [1].

Farmers in Raja Tinggi village have a group of farmers by the name of the source group of farmers who develop cacao nurseries, but farmer groups have difficulty in determining good quality seeds, selected seedlings choose good cocoa beans from good trees but do not have to produce quality seeds. The problem of determining the selection of quality seeds can be overcome by the existence of alternatives and solutions

in determining the right and correct decision. Systems that can help by using decision support systems (DSS).

DSS Systems that can produce an alternative interactively can also be used on the user, the solution can be done using the methods used and depends on the number of criteria used. [2]. Systems that help decision-makers by equipping them with information from data that has been processed with relevance and are needed to make decisions about an issue more quickly and accurately. [3], [4]. . An information system that evaluates several different choices to help someone decide a problem, a decision support system (DSS) aims to be a tool for decision-makers to expand their capabilities in making decisions. [5]–[7].

Many methods can be used to help choose decisions for determining the feasibility of alternatives or solutions taken for a problem. The method used is the Fuzzy Multi-Criteria Decision Making (FMCDM) method. The Fuzzy MCDM model is used in assessing alternatives with criteria determined through a single decision-maker according to alternatives and also criteria of importance criteria can be evaluated using the linguistic values represented by fuzzy numbers. [8], [9]. Multi-criteria decision making (MCDM) an effective solution framework can be used systematically and quantitatively in handling the problem of decision making for some alternatives as well as several criteria that can be used to choose more appropriate alternatives.[10]

This method is also the DSS in determining alternatives based on criteria following the size, rules, or standards used for decision-makers. With the Fuzzy Multi-Criteria Decision Making method, younger farmers or farmer resource business groups determine quality Cocoa seedlings for nurseries.

METHOD

This study uses quantitative survey research describing the principles of correlational research effectively in resolving the opinions, thoughts, and feelings of individuals. The method of data collection is done through an approach to the field and direct surveys by taking data in the field. The author also conducted interviews (take and give) to each Cocoa Farmer to obtain more complete information.

The analysis used in determining a decision with the method of Fuzzy Multi-Criteria Decision Making aims to choose the best alternative from several alternatives based on certain criteria. there are 3 (three) important steps that must be done, namely: problem representation, evaluation of the Fuzzy set on each alternative decision, and selecting the optimal alternative.

RESULT AND DISCUSSION

Fuzzy Multi-Criteria Decision Making Concept Analysis in the process of determining the type of quality cocoa seedlings, using the Fuzzy Multi-Criteria Decision Making method. To make decisions in need of analysis by needs. With the alternatives

and several criteria used as sources of decision making. Each criterion weights importance and also the branch has an interest in alternative compatibility with the criteria in carrying out a calculation so that an optimal alternative is obtained. The alternative is quality cocoa seedlings. Alternatives used can be seen in the following table where $A = \{A_1, A_2, A_3, A_4\}$

Table 1. Alternative.

Alternative	Symbol	Sample Remarks
Alternative 1	A_1	Cocoa 1
Alternative 2	A_2	Cocoa 2
Alternative 3	A_3	Cocoa 3
Alternative 4	A_4	Cocoa 4

The criteria used in determining cocoa are shown in the following table, where $C = \{C_1, C_2, C_3, C_4, C_5, C_6\}$.

Tabel 2. Kriteria

Criteria	Symbol	Sample Remarks
Criteria 1	C_1	Age
Criteria 2	C_2	Plant height
Criteria 3	C_3	Number of leaves
Criteria 4	C_4	Leaf color
Criteria 5	C_5	Leaf shape
Criteria 6	C_6	Rod Diameter

In determining each alternative to each criterion, a degree of importance is needed. To determine the degree of importance of each alternative to the criteria, the fuzzy number membership function used is the triangle fuzzy number function, the membership function of which has been stated in the equation.

$$\text{Namely: } \mu_A[x] = \begin{cases} 0 & ; x < a \text{ or } x > c \\ (x - a) / (b - a) & ; a \leq x \leq b \\ (x - c) / (b - c) & ; b \leq x \leq c \end{cases} \quad (1)$$

The linguistic variables that represent the weight of importance for each criterion are: T (Interest) $W = \{SR, R, C, T, ST\}$ each of which is represented by triangular fuzzy numbers as follows:

$$SR = (0, 0, 0.25)$$

$$R = (0, 0.25, 0.5)$$

$$C = (0.25, 0.5, 0.75)$$

$$T = (0.5, 0.75, 1)$$

$$ST = (0.75, 1, 1)$$

The degree of compatibility between the alternatives and the decision criteria is: T (compatibility) $S = \{SK, K, C, B, SB\}$, each of which is represented by triangular fuzzy numbers as follows: $SK = (0, 0, 0.25)$

$K = (0, 0.25, 0.5)$

$C = (0.25, 0.5, 0.75)$

$B = (0.5, 0.75, 1)$

$SB = (0.75, 1, 1)$

Table 3. Branches of Interest For Each criterion

Branch of Interest						
Criteria	C_1	C_2	C_3	C_4	C_5	C_6
Branches	C	ST	T	C	C	ST

Dimensions of table 3 for criteria C_1 (Age), $T C_2$ (Plant Height), $J C_3$ (Number of leaves), $W C_4$ (Leaf color), $B C_5$ (Leaf shape), and $D C_6$ (Stem diameter), Where the important criteria, there are two criteria namely $C_1, C_4 C_5$ has enough importance weight (C), one C_3 criterion which has High importance weight (T), and criteria C_2, C_6 ie, which has Very High importance weight (ST).

Table 4. Match Ratings of Each Alternative Against Each criterion

Alternative	Match Branches					
	C_1	C_2	C_3	C_4	C_5	C_6
A_1	B	C	C	B	C	B
A_2	C	C	B	C	C	B
A_3	B	C	C	B	B	B
A_4	B	SB	B	SB	B	B

By substituting the fuzzy triangle numbers into each linguistic variable into the equation we get the fuzzy match value in the table with the following details:

Table 5. Branches of Interest and Matching of Each criterion for Alternative A_1 (Cocoa 1)

Alternative	Criteria	C_1	C_2	C_3	C_4	C_5	C_6
	A_1	Branch of Interest	C	ST	T	C	C
	Match Branches	B	C	C	B	C	B

Information on table 5. for criteria $U C_1$ (Age), $T C_2$ (Plant Height), $J C_3$ (Number of leaves), C_4 (Leaf color), $B C_5$ (Leaf shape), and $D C_6$ (Leaf diameter). Match Branch C (Fair), B (Good), SB (Good). Where to find matching index values for each alternative $Y_1, Q_1,$ and Z_1 , for each branch value is taken from the fuzzy triangle.

Where in the alternatives, A₁, A₂, A₃, and A₄, to find a match index for each alternative Y, Q, and Z are taken from Table 4 Matching Ratings and tables Branch of Interest.

Table 6. Matching Index results for each alternative

Alternative	Fuzzy Match Index		
	Y	Q	Z
A₁	0.1667	0.4792	0.7604
A₂	0.1458	0.4375	0.7396
A₃	0.2083	0.5000	0.8333
A₄	0.2708	0.5938	0.8750

By distributing the fuzzy match index in table 6 by taking the degree of optimism (α) = 0 (not optimistic), $\alpha = 0.5$ and $\alpha = 1$ (very optimistic), an integral value for each alternative will be obtained.

The calculation for the value (α) = 0 is taken from Table 6. Match Index For Each Alternative.

Where the results of the calculations are carried out above, then the alternative determination of quality cocoa seedlings ready to be planted with flakes, namely Alternative A₄ SK4 (Cocoa Sample4) is the best alternative to be cultivated in cocoa nurseries. Because it has the largest total integrality and degree of optimism, from this point cocoa farmers can decide to determine quality cocoa seedlings.

Table 7. Integral F Value Calculation Ranking Ranking

Alternative	Integral Total Value			Information
	$\alpha = 0$	$\alpha = 0,5$	$\alpha = 1$	
A₄	0.43215	0.58320	0.73425	Cocoa 4
A₃	0.35415	0.51040	0.66665	Cocoa 3
A₁	0.32295	0.47138	0.61980	Cocoa 1
A₂	0.29165	0.44010	0.58855	Cocoa 2

From the calculation of ranking the total integral value of all alternatives, it appears that Alternative A₄ SK4 (cocoa4) has the highest value, so it can be concluded that the alternative is the best alternative.

CONCLUSION

With the implementation of this decision support system, it can help farmers to determine quality cocoa seedlings in the cocoa seed selection process which will be planted following the ranking of the analysis test results.

After re-analysis and testing of the results of manual calculations using fuzzy total integral values, it turns out that the results of the manual calculations that were reaffirmed were confirmed by the researcher, in which the results of the calculations were carried out, then an alternative determination of quality cocoa seedlings ready for planting, namely alternative A₄ SK4 (Cocoa Sample4) is the best alternative to be cultivated in cocoa nurseries.

Fuzzy Multi-Criteria decision-making method (FMCDM) can be used to make it easier to solve problems that multiply the criteria in the Decision Support System for the determination of quality cocoa seedlings that are ready to be planted in gaps.

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