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Expert System For Diagnostic Disease Of Cultivation Of Cucumber Holticulture Using Certainty Factor Method Based On Web-Based

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Abstract

Indonesia is an agrarian country where most of the population earn a living as farmers, including cucumber farmers. The biggest threat to cucumber farmers is the presence of diseases that attack their cucumber plants. What often happens is that there are many losses due to cucumber plant diseases that are too late to detect and have reached a severe stage, causing crop failure. To identify a disease disorder on cucumber plants, an expert on cucumber plant diseases is needed in diagnosing symptoms of disease disorders that attack cucumber plants. The distance traveled by experts to find out cucumber plant diseases at the Department of Agriculture of Langkat Regency is difficult so that it makes farmers experience losses and it is difficult to diagnose diseases in cucumber horticultural crops. For that reason, so in this study an expert system was built to diagnose diseases in cucumber horticulture crops. This expert system has 7 diseases and 16 symptoms . The Certainty Factor method was chosen because it is able to provide a level of confidenceexpert on the problem at hand. Based on the results of the Certainty Factor calculation, the highest confidence value is found in powdery mildew and rotten fruit with a value of 0.6 with a value of 60%. From the results obtained, the system diagnosed that the plant was affected by powdery mildew and rotten fruit.

Keywords:Cucumber Disease; Expert system; Certainty Factor.

INTRODUCTION

Indonesia is an agrarian country where most of the population earn a living as farmers, including cucumber farmers. The biggest threat to cucumber farmers is the presence of diseases that attack their cucumber plants. What often happens is that there are many losses due to cucumber plant diseases that are too late to detect and have reached a severe stage, causing crop failure. To identify a disease disorder on cucumber plants, an expert on cucumber plant diseases is needed in diagnosing symptoms of disease disorders that attack cucumber plants.

The development of cucumber plants often experiences obstacles, especially in terms of physical and chemical properties of the soil. Infertile soil causes production to decline. For that in planting, it is necessary to cultivate the soil and add nutrients. The incidence of yellow leaf disease in cucumber plants is an example of the incidence of diseases associated with an increase in the population of vector insects (whitefly). Due to viral infection, almost all plant leaves turn yellow or chlorosis so that it certainly affects plant production. Therefore, the identity of the virus associated with the disease needs to be investigated so that appropriate handling measures can be taken. The distance traveled by the expert to find out cucumber plant diseases at the Department of Agriculture, Kab.

According to previous research, the Application of the Certainty Factor Method in the Expert System for Determining the Interests and Talents of Elementary School Students. The Certainty Factor method or certainty factor, is a method to prove whether a fact is certain or uncertain in the form of a metric that is usually used in expert systems (Rachman, 2018).

Application of Certainty Factor Method for Expert System Diagnosis of Pests and Diseases on Tobacco. The Certainty Factor method was chosen because this method is suitable in the process of determining the identification of pests and diseases, and the result of the application of this method is the percentage. The percentage of the system here is the level of accuracy in determining the disease or pest that infects tobacco plants. Determination of the percentage is influenced by the

MB value obtained from the system and the MD value obtained from the assessment of an expert(Arifin, 2017).

Certainy Factor Method in the Application of an Expert System for Diagnosing Children's Diseases. The application of an expert system to diagnose children's diseases with the uncertainty method, namely Certainty Factor (CF) begins with designing a system based on the acquisition of knowledge obtained from pediatricians, then continues by building a knowledge base and assigning CF values to each symptom associated with a child's disease with gives a range of values 0 and 1(Maulina, 2020). In the research of the Expert System Certainy Factor Method for Diagnosing the Type of Schizophrenia. An expert system is a computer system that is able to imitate the reasoning of an expert with expertise in a particular knowledge(Annisa, 2018).

Expert System Diagnosing Cataract Eye Disease With Web-Based Certainy Factor Method. With increasingly sophisticated technological advances and the lack of experts in the field of ophthalmology, an expert system is needed that is able to match the experts in the hope of helping the public to know about cataracts before suffering from cataracts(Girsang, 2019).

According to previous research, the application of the Certainy Factor method in diagnosing diseases of the human eye. Eye disease is an eye disorder that can affect vision and due to limited eye health information services at the Puskesmas or Hospital, the lack of ophthalmologists who can provide information about eye health disorders, and the high cost of consulting specialist doctors, resulting in a lack of public knowledge about the disease. eyes, to help detect these problems, it is necessary to have an expert system that is believed to be able to detect the symptoms of human eye disease(Deslianti, 2021).

RESEARCH METHODS

The research methodology is carried out to search for something systematically using scientific methods and applicable sources. In the process of this research, it is shown to provide more meaningful results for parties in dealing with relationships so that there are no errors in connecting the causes of divorce to reduce errors that occur in seeing the most dominant causes of divorce.
The results of the conceptualization will be poured into a research method that is closely related to the pattern of literature studies, collecting data needed to analyze the prediction system that will be made. On the basis of the research methodology in this researcher, a flow of activities can be made.

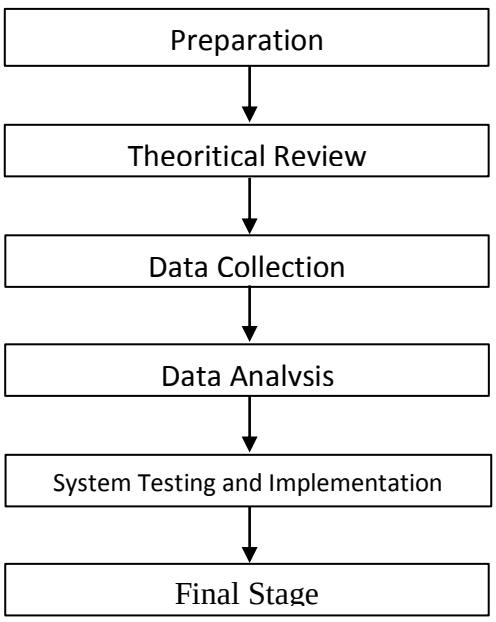

Image 1. Research methodology

Based on the picture above, it can be explained that there are several stages used in making this application program, namely as follows:

1. Preparation
   This stage is the initial activity, namely by determining the research from the background of the problem and then defining the problem and then determining the objectives and benefits carried out in the preparation of the expert system process.
2. Theoritical review
   At this stage, a theoretical study of the existing problems is carried out. The study was conducted to determine the concept to be used in the research.
3. Data collection
   This stage is the collection of expert data needed in the process of designing this decision expert system. These data can be obtained from research results, books, journals and information from the internet.
4. Data analysis
   This stage will analyze the expert data that has been obtained in the previous stage.
5. System Testing and Implementation
   This stage performs validation testing and implementation of data that has been previously analyzed and program preparation.
6. Final Stage
   At this final stage, the design of the decision expert system will discuss the conclusions and suggestions needed for further program development.

RESULTS AND DISCUSSION

Analysis

In the analysis of testing methods, the data needed in the process of analyzing expert systems to diagnose diseases in cucumber plants with the Certainty Factor method are pure data obtained from interviews by agricultural experts by taking diseases and symptoms that are often found in cucumber plants.

Table 1. Disease Table

No	Code	Disease Name
1	P01	rotten leaves
2	P02	powdery mildew
3	P03	anthracnose
4	P04	Leaf spot
5	P05	Virus
6	P06	Scabies
7	P07	Rotten fruit

Table 2. Symptom Table

Code	Symptom Name
G01	Leaves turn yellow
G02	The fruit suddenly rots
G03	Fruits often fall
G04	Hollow leaf
G05	Dried leaves

G06	Moldy leaves
G07	Leaves rot easily
G08	Leaves and stems have flour
G09	Leaves are brown
G10	Yellow stem
G11	Yellow to black fruit
G12	The surface of the striped leaves is dark green and light green
G13	Withered leaves
G14	Dwarf plant
G15	The fruit suddenly releases a clear liquid to brown
G16	The fruit has black and brown spots

Table 3. Table of Relationship Symptoms and Cucumber Disease

Symptom Code	symptom	P01	P02	P03	P04	P05	P06	P07
		rotten leaves	Powdery mildew disease	anthracnose	Leaf spot	Virus	Scabies	Rotten fruit
G01	Leaves turn yellow	0.2		0.4	0.4			
G02	The fruit suddenly rots						0.6	0.4
G03	Fruits often fall							0.6
G04	Hollow leaf				0.4			
G05	Dried leaves					0.2		
G06	Moldy leaves	0.2						
G07	Leaves rot easily		0.6					
G08	Leaves and stems have flour			0.2				
G09	Leaves are brown			0.2				
G10	Yellow stem			0.2				
G11	Yellow to black fruit				0.4			
G12	The surface of the striped leaves is dark green and light green					0.4		
G13	Withered leaves					0.6		
G14	Dwarf plant						0.4	
G15	The fruit suddenly releases a clear liquid to brown						0.4	

G16	The fruit has black and brown spots							0.4

Table 4. Certainty Factor Value Table

Uncertainty Term	CF
Not	0
Possible	0.4
Most likely	0.6
Almost Sure	0.8
Yes	1

Table 5. Table of Certainty Factor User Values

Provision	CFUser
Not	0
Yes	1

Application of Certainty Factor Method

To further analyze the Certainty Factor method, a Consultation Test is carried out. In the system consultation session, the user is given answers, each of which has the following weights:
Answer choice "No" = 0
Answer options"Yes"= 1
A cucumber has symptoms, then proceed with the user's weight value, for example the user chooses the answer as follows:

1. Fruits often fall = Yes
2. Dried leaves = Yes
3. Leaves rot easily = Yes
4. Yellow stalk = Yes

Then the CF value is calculated by multiplying it by Cfuser:

For calculating the CF value in leaf rot disease

$CF[H,E]_1$ = *$CF[H]_1 * CF[E]_1$
= 0 * 1
= 0
$CF[H,E]_2$ = *$CF[H]_2 * CF[E]_2$
= 0* 1
= 0
$CF[H,E]_3$ = *$CF[H]_3 * CF[E]_3$
= 0 * 1
= 0
$CF[H,E]_4$ = *$CF[H]_4 * CF[E]_4$
= 0 * 1
= 0

Combining CF values in Leaf blight
For calculation:$CF[H,E]_{1,2}$
$CF[H,E]_{1,2}$ = $CF[H,E]_1 + CF[H,E]_2(1-CF[H,E]_1)$
= 0 + 0 (1 – 0)

= 0

For calculation:$CF[H, E]_3$

$CF[H, E]_3 = CF[H, E]_2 + CF[H, E]_3(1\text{-}CF[H, E]_2)$

$= 0 + 0\ (1 - 0)$

= 0

For calculation:$CF[H, E]_4$

$CF[H, E]_4 = CF[H, E]_3 + CF[H, E]_4(1\text{-}CF[H, E]_3)$

$= 0 + 0\ (1 - 0)$

= 0

So, the CF value of leaf rot disease is

Confidence percentage = CF * 100%

= 0* 100%

= 0%

For calculating the CF value in Powdery mildew

$CF[H, E]_1 = *CF[H]_1 * CF[E]_1$

$= 0 * 1$

= 0

$CF[H, E]_2 = *CF[H]_2 * CF[E]_2$

= 0* 1

= 0

$CF[H, E]_3 = *CF[H]_3 * CF[E]_3$

$= 0 * 6$

= 6

$CF[H, E]_4 = *CF[H]_4 * CF[E]_4$

$= 0 * 1$

= 0

Combining CF values in Leaf blight

For calculation:$CF[H, E]_{1,2}$

$CF[H, E]_{1,2} = CF[H, E]_1 + CF[H, E]_2(1\text{-}CF[H, E]_1)$

$= 0 + 0\ (1 - 0)$

= 0

For calculation:$CF[H, E]_3$

$CF[H, E]_3 = CF[H, E]_2 + CF[H, E]_3(1\text{-}CF[H, E]_2)$

$= 0 + 0{,}6\ (1 - 0)$

= 0,6

For calculation:$CF[H, E]_4$

$CF[H, E]_4 = CF[H, E]_3 + CF[H, E]_4(1\text{-}CF[H, E]_3)$

$= 0{,}6 + 0\ (1 - 0{,}6)$

= 0,6

So, the CF value of leaf rot disease is

Confidence percentage = CF * 100%

= 0,6* 100%

= 60%

For calculation of CF value in Anthracnose Disease

$CF[H, E]_1 = *CF[H]_1 * CF[E]_1$

$= 0 * 1$

= 0

$CF[H,E]_2$ = *$CF[H]_2$ * $CF[E]_2$
= 0* 1
= 0
$CF[H,E]_3$ = *$CF[H]_3$ * $CF[E]_3$
= 0 * 1
= 0
$CF[H,E]_4$ = *$CF[H]_4$ * $CF[E]_4$
= 0,2* 1
= 0,2

Combining CF values in Leaf blight
For calculation:$CF[H,E]_{1,2}$
$CF[H,E]_{1,2}$ = $CF[H,E]_1$ + $CF[H,E]_2$(1-$CF[H,E]_1$)
= 0 + 0 (1 – 0)
= 0

For calculation:$CF[H,E]_3$
$CF[H,E]_3$ = $CF[H,E]_2$ + $CF[H,E]_3$(1-$CF[H,E]_2$)
= 0 + 0 (1 – 0)
= 0

For calculation:$CF[H,E]_4$
$CF[H,E]_4$ = $CF[H,E]_3$ + $CF[H,E]_4$(1-$CF[H,E]_3$)
= 0 + 0,2 (1 – 0)
= 0,2

So, the CF value of leaf rot disease is
Confidence percentage = CF * 100%
= 0,2* 100%
= 20%

To calculate the CF value in leaf spot disease

$CF[H,E]_1$ = *$CF[H]_1$ * $CF[E]_1$
= 0 * 1
= 0
$CF[H,E]_2$ = *$CF[H]_2$ * $CF[E]_2$
= 0* 1
= 0
$CF[H,E]_3$ = *$CF[H]_3$ * $CF[E]_3$
= 0 * 1
= 0
$CF[H,E]_4$ = *$CF[H]_4$ * $CF[E]_4$
= 0 * 1
= 0

Combining CF values in Leaf blight
For calculation:$CF[H,E]_{1,2}$
$CF[H,E]_{1,2}$ = $CF[H,E]_1$ + $CF[H,E]_2$(1-$CF[H,E]_1$)
= 0 + 0 (1 – 0)
= 0

For calculation:$CF[H,E]_3$
$CF[H,E]_3$ = $CF[H,E]_2$ + $CF[H,E]_3$(1-$CF[H,E]_2$)

= 0 + 0 (1 – 0)
= 0
For calculation:$CF[H, E]_4$
$CF[H, E]_4 = CF[H, E]_3 + CF[H, E]_4(1\text{-}CF[H, E]_3)$
= 0 + 0 (1 – 0)
= 0
So, the CF value of leaf rot disease is
Confidence percentage = CF * 100%
= 0* 100%
= 0%

For calculation of CF value in virus disease

$CF[H, E]_1 = *CF[H]_1 * CF[E]_1$
= 0 * 1
= 0
$CF[H, E]_2 = *CF[H]_2 * CF[E]_2$
= 0,2* 1
= 0,2
$CF[H, E]_3 = *CF[H]_3 * CF[E]_3$
= 0 * 1
= 0
$CF[H, E]_4 = *CF[H]_4 * CF[E]_4$
= 0 * 1
= 0
Combining CF values in Leaf blight
For calculation:$CF[H, E]_{1,2}$
$CF[H, E]_{1,2} = CF[H, E]_1 + CF[H, E]_2(1\text{-}CF[H, E]_1)$
= 0 + 0,2 (1 – 0)
= 0,2
For calculation:$CF[H, E]_3$
$CF[H, E]_3 = CF[H, E]_2 + CF[H, E]_3(1\text{-}CF[H, E]_2)$
= 0,2+ 0 (1 – 0,2)
= 0,2
For calculation:$CF[H, E]_4$
$CF[H, E]_4 = CF[H, E]_3 + CF[H, E]_4(1\text{-}CF[H, E]_3)$
= 0,2+ 0 (1 – 0,2)
= 0,2
So, the CF value of leaf rot disease is
Confidence percentage = CF * 100%
= 0,2* 100%
=2 0%

For calculation of CF value in scurvy

$CF[H, E]_1 = *CF[H]_1 * CF[E]_1$
= 0 * 1
= 0
$CF[H, E]_2 = *CF[H]_2 * CF[E]_2$

= 0* 1
= 0
$CF[H,E]_3$ = *$CF[H]_3$ * $CF[E]_3$
= 0 * 1
= 0
$CF[H,E]_4$ = *$CF[H]_4$ * $CF[E]_4$
= 0 * 1
= 0
Combining CF values in Leaf blight
For calculation:$CF[H,E]_{1,2}$
$CF[H,E]_{1,2}$ = $CF[H,E]_1$ + $CF[H,E]_2$(1-$CF[H,E]_1$)
= 0 + 0 (1 – 0)
= 0
For calculation:$CF[H,E]_3$
$CF[H,E]_3$ = $CF[H,E]_2$ + $CF[H,E]_3$(1-$CF[H,E]_2$)
= 0 + 0 (1 – 0)
= 0
For calculation:$CF[H,E]_4$
$CF[H,E]_4$ = $CF[H,E]_3$ + $CF[H,E]_4$(1-$CF[H,E]_3$)
= 0 + 0 (1 – 0)
= 0
So, the CF value of leaf rot disease is
Confidence percentage = CF * 100%
= 0* 100%
= 0%

To calculate the CF value on rotten fruit disease

$CF[H,E]_1$ = *$CF[H]_1$ * $CF[E]_1$
= 0,6 * 1
= 0,6
$CF[H,E]_2$ = *$CF[H]_2$ * $CF[E]_2$
= 0* 1
= 0
$CF[H,E]_3$ = *$CF[H]_3$ * $CF[E]_3$
= 0 * 1
= 0
$CF[H,E]_4$ = *$CF[H]_4$ * $CF[E]_4$
= 0 * 1
= 0
Combining CF values in Leaf blight
For calculation:$CF[H,E]_{1,2}$
$CF[H,E]_{1,2}$ = $CF[H,E]_1$ + $CF[H,E]_2$(1-$CF[H,E]_1$)
= 0,6 + 0 (1 – 0,6)
= 0,6
For calculation:$CF[H,E]_3$
$CF[H,E]_3$ = $CF[H,E]_2$ + $CF[H,E]_3$(1-$CF[H,E]_2$)
= 0,6 + 0 (1 – 0,6)

= 0,6

For calculation:$CF[H, E]_4$

$CF[H, E]_4 = CF[H, E]_3 + CF[H, E]_4(1\text{-}CF[H, E]_3)$

= 0,6+ 0 (1 – 0,6)

= 0,6

So, the CF value of leaf rot disease is

Confidence percentage = CF * 100%

= 0,6* 100%

= 60%

Based on the results of the certainty factor calculation, the highest confidence value is found in Powdery mildew and Rotten Fruit with a value of 0.6 with a value of 60%. From the results obtained, the system diagnosed that the plant was affected by powdery mildew and rotten fruit

CONCLUSION

From the results of research on an expert system for diagnosing diseases in cucumber horticultural crops using a web-based certainty factor method, it can be concluded that it can help farmers find out from the beginning the diagnosis of cucumber disease when experts are not available, farmers can use this system to find out the types of plant diseases. Cucumber based on the existing symptoms, can help the public know the cucumber plant disease based on symptoms, This system can analyze the type of cucumber disease based on the results of the certainty factor calculation, the highest confidence value is found in Powdery mildew and rotten fruit with a value of 0.6 the value of 60% . From the results obtained, the system diagnosed that the plant was affected by powdery mildew and rotten fruit.

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