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Expert System for Diagnosing Pests and Diseases on Onion Crops due to Climate Change and Weather using Bayes' Theorem Method

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ABSTRACT

The main purpose of this study is to diagnose the types of pests and diseases on shallot plants due to climate change and weather carried out at the Department of Agriculture, Humbang Hasundutan district. Pests and diseases of shallot plants can be disturbed or infected by pests and diseases to other shallot plants so that farmers need to be wary of. Therefore, the dissemination of information about pests and diseases is very necessary to find out early on the types of pests and diseases in shallot plants due to climate and weather changes. Types of pests and diseases of shallots due to climate and weather changes are onion caterpillar (Spodoptera exiqua), leaf miner fly (Liriomyza chinensis), bodas pest (Thrips tabaci), purple spot (Alternaria porri), anthracnose (Cholletorichum gloesprorioiodes), dew , Mosaic disease or mole. So that it aims to produce an application-based expert system to diagnose pests and diseases on shallot plants due to climate and weather changes through the symptoms that occur in shallot plants. The methodology used for this research is the Bayes Theorem method. References from internet books and experts in their fields are Sumurung Toga Torop, who works at the Humbang Hasundutan Agriculture Service. As for the software using Visual Basic 2010 as its programming language, as well as Microsoft Access 2010.

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1. INTRODUCTION

Indonesia is one of the countries located in the equator so that Indonesia is one of the countries with a tropical climate. Indonesia as a country that produces agricultural products that are able to meet domestic food needs, one of which is onions [1] [2] [3].

Onion (Allium) is one of the many lowland vegetables, which have been intensively cultivated by farmers for a long time to become a quality vegetable, although onions are not a basic need, but are almost always needed by household consumers, restaurants, as a complement. spices every day. Another use of this onion plant can be used as traditional medicine [4]. Onions also have

several types of onions that are consumed in Indonesia, namely Shallots (Allium cepa var. Aggregatum), Garlic (Allium Sativum), Onions (Allium cepa), Onions (Allium fistilosum) [5] [6] [7].

Diseases of shallots due to climate and weather changes have several types of diseases, namely strangulation or "damping off" disease, shoot death, troll disease or downy mildew, purple spot disease, tuber rot, wilt or white rot, nematodes, and In general, the disease that often appears on shallot plants in Humbang Hasundutan is purple spot disease (Alternaria porri). In general, this disease is characterized by the presence of white or yellowish stains on the leaves, then widens and causes the leaves to dry, especially the top leaf shoots, then spread 5-6 days and the onion will die. This disease attacks when the air is humid, especially during the rainy season according to the expert Humbang Hasundutan [8] [9] [10].

The following are some types of pests that attack shallot plants, namely earthworms or cutting caterpillars, white pests or bodas, leaf caterpillars or onion caterpillars. The main pests that generally damage shallot plants are onion caterpillars (Spodoptera exiqua) [11]. This pest attack can cause a decrease in shallot production or significant yield loss if prevention and control efforts are not carried out. This onion caterpillar can lay eggs at the age of 2-10 days, the eggs are round to elliptical, the eggs are laid in groups on the surface of the leaves or stems and covered by white hairs from the mother's body.

Pests and diseases on shallot plants are of course an important problem for farmers that can cause crop failure. Pests and diseases on shallot plants really need to be known and watched out by farmers to minimize the impact of damage to shallot plants. At this time the development of technology and information has had a major impact on various aspects of human life, one of which is in the world/agricultural sector [12] [13] [14].

In today's modern era, the development of technology and information can be felt by farmers, one of which is that farmers can seek information about the development of the world of agriculture, both related to planting, care, disease, and solutions to plant problems [15]. Therefore, the world of agriculture and the world of information technology already have a relationship in terms of providing information that will greatly help farmers. On this occasion, an expert system will be designed to diagnose pests and diseases on shallot plants due to climate and weather changes using the Bayes theorem method.

This expert system is one of the computerized systems that will assist farmers in recognizing various diseases in shallot plants based on the symptoms that appear on shallot plants. This expert system was built by applying the Bayes theorem method.

Bayes theorem method is one approach to an uncertainty that is measured by probability or probability. The Bayes theorem method was chosen in designing an expert system to diagnose pests and diseases on shallot plants due to climate and weather changes, because the Bayes theorem method requires important information in the form of probability values for each alternative that exists in the problem at hand which will result in expected value as the basis for decision making. Various symptoms that appear on shallot plants will be calculated using the formula or provisions of the Bayes theorem method to draw conclusions about diseases in shallot plants due to climate and weather changes.

2. RESEARCH METHODS

When conducting a research, research methodology is very important as an accurate data collector. The research method is also useful for arranging the stages in order to form a systematic flow so that the goals or results to be achieved do not deviate far from what you want to make. The research method used for accurate data collection is by using the observation method, where the observation method is a data collection technique, where the researcher makes observations directly to the object of research or to the place of research.

In addition to using the observation method to get accurate data collection, it is through direct interviews with onion plant experts at the District Agriculture Office. Public Relations.

2.1 Data analysis

Data analysis is the first step that must be done to solve the problem at hand. This stage is very important because an accurate analysis process will cause the results of the development of the software to satisfy the user.

Data analysis consists of three discussions, namely the place of research, analysis of system requirements and analysis of the system built

2.2 Bayes' Theorem

Bayes' theorem allows one to influence his belief about a parameter after the data has been extracted [16]. So in this case, it is necessary to have prior belief before starting inference. Basically the Prior distribution is obtained based on the subjective belief of the researcher himself regarding the possible values for the estimated, so it is necessary to pay attention to how to determine the priors.

The Bayes theorem method, in addition to utilizing sample data obtained from the population, also takes into account an initial distribution called the distributionprior [17]. The Bayes theorem method views parameters as variables that describe initial knowledge of parameters before observations are made and are expressed in a distribution. After the observations are made, the information in the prior distribution is combined with information with sample data through Bayes' theorem [18].

According to subjective probability, if a person observes event B and believes that there is a possibility that B will occur, then the probability of B is called Prior Probability**.**Once there is additional information that for example event A has occurred, there may be a change to the original estimate of the probability of B occurring. The probability for B is now a conditional probability due to A and is called the Posterioir Probability [18]. Thomas Bayes, describes the relationship between the conditional probabilities of two events A and B with the following formula:

$$P(A|B) = \frac{P(B|A)\,P(A)}{P(B)} \quad \text{..... (1)}$$

Or:

$$P(A|B) = \frac{P(B|A)\,P(A)}{P(B|A)\,P(A)+P(B|A)\,P(A)} \quad \text{.....(2)}$$

3. RESULTS AND DISCUSSION

3.1 System Implementation

System implementation is the stage in implementing the system that has been built, where later it will be known the quality of the system designed, whether it can run well and in accordance with the expected goals. In carrying out the implementation, several facilities related to hardware (hardware) and software (software) are prepared.

3.2 Discussion

The results obtained from the existing discussion are the creation of an application system for Diagnosing Pests and Diseases of Shallots. In the implementation of this desktop program, we can make it easier for shallot farmers to find out the types of pests and diseases suffered on shallot plants by knowing the symptoms that occur. experienced by the onion plant. In addition, the selection of the right application software, which has the ability to solve the problems that exist today. The software used in solving the existing problems are:

a. Microsoft Visual Basic Version 2010, Microsoft Visual Basic (often abbreviated as VB) is a programming language that offers a visual Integrated Development Environment (IDE) for creating software programs based on the Microsoft Windows operating system using a programming model (COM). Visual Basic is a derivative of the BASIC programming language and offers fast graphics-based computer software development. Some scripting languages, such as Visual Basic for Applications (VBA) and Visual Basic Scripting Edition (VBScript), are similar to Visual Basic, but work differently. Programmers can build applications using the components

provided by Microsoft Visual Basic Programs. Programs written in Visual Basic can also use the Windows API,

b. Microsoft Access 2010, is a database application program that is used to design, create and manage databases easily and quickly. This is due to the ease of processing various types of databases and the final result is a report with a more attractive design. The database consists of: Tables, Forms, Reports.

4. CONCLUSION

Based on the results of the theoretical discussion on the design of an expert system to diagnose pests and diseases on shallots due to climate and weather changes, it can be concluded that the application of an expert system designed and built to diagnose pests and diseases on shallot plants due to climate and weather changes using Visual Studio 2010, Microsoft Access 2010 and SAP Crystal Report based on the symptoms experienced through expert calculations using the Bayes theorem method.

The expert system application that is designed and built can facilitate the performance of shallot farmers in diagnosing pests and diseases on shallots due to climate and weather changes by carrying out a diagnostic process in the expert system application and generating a diagnostic report containing the No_Id, Username, Address. users, Diagnostic date, Telephone number, Pest and disease Symptoms, Diagnostic Results, Probability scores, and solutions designed using Sap Crystal Report.

The application of the Bayes theorem method is entered and used in the expert system in diagnosing pests and diseases on shallot plants due to climate and weather changes by calculating a probability value or a probability value from the specified symptom weight value.

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