

EXPERT SYSTEM FOR DIAGNOSING TOMATO PESTS AND DISEASES USING FORWARD CHAINING METHOD

Aqilla Fadia Haya^a,

^aProgram Studi Ilmu Komputer, , STIMIK ESQ
a.fadia.h@students.esqbs.ac.id

Hafizh Al Karim^b,

^bProgram Studi Ilmu Komputer, , STIMIK ESQ
hafizh.a.k@students.esqbs.ac.id

Muhammad Rizky Perdana^c,

^cProgram Studi Ilmu Komputer, , STIMIK ESQ
m.rizky.p@students.ac.id

Andika Sundawijaya^d

^dProgram Studi Ilmu Komputer, , STIMIK ESQ
sundawijaya@students.ac.id

ABSTRAK

Tomato (*solanum lyco persicum*) is a plant from the solanceae family, native to Central and South America, from Mexico and Peru. Tomatoes have a short life cycle and a height ranging from 1 to 3 meters. Currently, farmers often experience disturbances from pests and diseases of tomatoes due to a lack of knowledge. They do not know how to control it and to eliminate pests that reduce productivity. In identifying diseases in tomato plants we use the Forward Chaining method which is a description that starts from knowing the facts and then matching them with IF and IF-THEN rules. Diseases with a high prevalence in tomatoes are: fruit worms, earthworms, green aphids, white flies, fruit flies (bractrotera) and the diseases are: fusarium wilt, leaf spot disease, bacterial spot, fruit rot. This expert system application provides tomato disease information and disease diagnosis, including control solutions that can be used to reduce the risk of tomato crop damage

Keywords: *Expert System, Diagnoses Pert and Diseases, Tomato, Forward Chaining.*

1. INTRODUCTION

Tomato (*Solanum lycopersicum*) is a plant from the Solanaceae family, native to Central and South America, from Mexico until Peru. The tomatoes themselves have a short life cycle and range from 1 to 3 meters in height. Increasing tomato production in Indonesia is the control of pests (Plant Destruction Organisms), especially late blight (*Phytophthora infestans*). Some of the pests that often attack plants in the Solanaceae family (flowering plant tribe) are also found in tomato plants.

Types can be caterpillars, fleas and flies. While tomato plant diseases can include wilt, rot, virus attack and bacteria. So far, what has happened to farmers, farmers have often ignored the pests and diseases of tomatoes because of their ignorance, they think that these symptoms are common during the planting period, so farmers do not know how to control it, which causes a decrease in tomato productivity itself.

Therefore an expert system application is needed that provides information regarding diagnosis of pests and diseases of tomato plants, which later can be used to reduce or minimize the risk of damage to tomato plants. The implementation of this expert system is made on a Web-based basis so that it can be accessed and utilized by farmers and the wider community

2. TINJAUAN PUSTAKA

2.1. Artificial Intelligence

Artificial intelligence or Artificial Intelligence (AI) is a simulation of human intelligence that is modeled in a machine and programmed to think like humans. In other words, AI is a computer system that can do jobs that require human labor or human intelligence to complete the job. AI itself is a technology that requires information to be made into knowledge, just like humans

2.2. Expert System

In general, an expert system (Expert System) is a system that tries to hide human knowledge to a computer, so that the computer can solve problems, while an expert for Knowledge Assistant. This expert system will also be able to assist the activities of experts as assistants who are experienced and have the required knowledge. In its preparation, an expert system combines inference rules with a certain knowledge base provided by one or more experts in a particular field. The combination of these two things is stored on a computer, which is then used in the decision-making process to solve certain problems.

2.3. Forward Chaining

Forward Chaining is a knowledge technique with known facts, then matching the facts or starting from the left side (first IF). In other words, punishment starts from the facts first to test the truth of the hypothesis.

3. RESEARCH METHOD

In developing expert systems, what we do is look for references in various trusted sources and we take forward chaining techniques in building expert systems. The expert system that we have developed only functions to determine the symptoms and diseases of tomato plants. In building our expert system we use Python and HTML. The research flow as follows

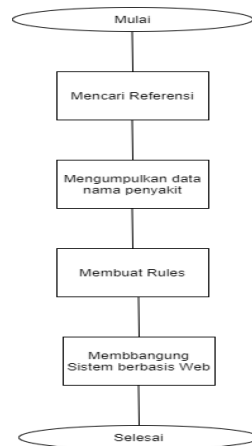


Figure 1. Research flow

The main advantage of forward chaining is that this method will work very well when the problem starts from collecting or combining information and then looking for conclusions obtained from that information. This method is able to provide a lot of information from information that only states small.

4. RESULT

Tomato (*Solanum Lycopersicum*) is a plant from the solanaceae family, native to South Central America, from Mexico to Peru. The tomatoes themselves have a short life cycle and range from 1 to 3 meters in height. Tomato plant diseases give different symptoms so that they are handled differently. Types of disease attacking tomato plants that can cause damage to tomato plants are described in the following table. Save on network setup costs

Tabel 1. Diseases name and description

**EXPERT SYSTEM FOR DIAGNOSING TOMATO PESTS AND DISEASES USING
FORWARD CHAINING METHOD**

Kode	Jenis Penyakit	Penjelasan
A1	Layu Fusarium	Disebabkan oleh jamur fusarium oxysporum. Jamur ini menyerang bagian jaringan pembuluh tanaman tomat, sehingga jaringan pembuluh akan berubah warna menjadi cokelat dan mengakibatkan terhambatnya aliran air dari akar ke daun.
A2	Bercak Cokelat	Ditandai dengan daun tomat yang terserang tampak bulat cokelat atau bersudut dan berwarna cokelat sampai hitam.
A3	Busuk Daun	Daun tomat yang terserang berbercak cokelat sampai hitam.
A4	Penyakit busuk buah Rhizoctonia	Penyakit busuk buah Rhizoctonia ini disebabkan oleh jamur.
A5	Busuk buah antraknosa	Penyakit ini dapat menyerang buah, batang, dan akar tanaman tomat.
A6	Penyakit Layu	Tanaman yang diserang penyakit ini lebih cepat layu.
A7	Bercak bakteri	Timbulnya bercak-bercak pada daun-daun, batang dan buah tomat.
A8	Penyakit bercak daun	Disebabkan oleh kondisi lingkungan yang terdapat beberapa jenis tanaman lain selain tomat, yaitu cabai dan jagung.
A9	Mozaik	Gabungan berbagai jenis virus seperti virus tomat mozaik
A10	Penyakit kerdil	Jarak antara tangkai daun yang satu dengan yang lainnya sangat pendek.
A11	Bercak kering dan Mati urat	Virus ini disebarkan oleh kutu daun secara non-persisten (melalui stilet atau alat mulutnya).
A12	Kuning dan Daun Menggugul	Tanaman yang terserang menjadi kerdil dengan arah cabang dan tangkai daun cenderung tegak.

A13	Bengkak Akar	Penyakit Bengkak akar ini membentuk "gall" benjolan benjolan pada xylem akar akar tanaman yang terserang.
A14	Blossom End Rot	Kekurangan unsur hara mikro Ca [kalsium).
A15	Busuk Batang Didymella sp	Serangannya bisa menyeluruh pada bagian tanaman baik daun maupun batang.
A16	Tomato Yellow Leaf Curl Virus	Virus kuning-keriting pada daun tanaman tomat.

After identified types of disease attacking tomatoplants, then we set up Disease Symptoms And Codes

Tabel 2. Diseases symptoms and codes

Kode	Gejala Penyakit
B1	Jaringan pembuluh berubah warna menjadi cokelat.
B2	Terjadinya hambatan aliran air dari akar ke daun.
B3	Terdapat jamur.
B4	Daun tampak bulat cokelat.
B5	Berubah warna cokelat menjadi hitam.
B6	Terdapat bercak-bercak.
B7	Terdapat kutu daun.
B8	Tanaman kekurangan unsur hara mikro Ca (kalsium). Buah tomat terdapat bercak sirkules kecil.
B9	Daun tomat menjadi kuning
B10	Jarak antara tangkai daun dengan yang lainnya pendek. Tanaman lebih cepat layu.
B11	Buah tomat termakan oleh ulat tanah.
B12	Buah tomat diselimuti tepung putih dikarenakan lalat putih. Pertumbuhan buah tomat terhambat.
B13	Daun tomat menjadi keriting.
B14	Akar tomat busuk.
B15	Timbulnya bercak-bercak pada batang dan buah tomat.

**EXPERT SYSTEM FOR DIAGNOSING TOMATO PESTS AND DISEASES USING
FORWARD CHAINING METHOD**

B16	Tunas tomat besar.
B17	Terdapat jamur putih pada batang buah tomat.
B18	Buah tomat memiliki banyak titik hitam.
B19	Tanaman buah tomat disekelilingi dengan berbagai macam tanaman lain.
B20	Buah Tomat menguning.
B21	Lingkungan kurang kondusif.
B22	Akar membengkak
B23	Jaringan pembuluh berubah warna menjadi cokelat.
B24	Terjadinya hambatan aliran air dari akar ke daun.
B25	Terdapat jamur.

Rules that use in the system

Tabel 3. Rules

Rule	IF	THEN
1	B1,B2	A1
2	B4,B5,B6	A2
3	B5,B6	A3
4	B3	A4
5	B3,B5	A5
6	B10,B12	A6
7	B6,B9,B17	A7
8	B21,B24	A8
9	B7,B12,B13,B14	A9
10	B11,B15	A10
11	B6,B10,B16,B17	A11
12	B16	A12
13	B18,B19,B25	A13
14	B8	A14
15	B19,B20	A15
16	B10,B16	A16

5. KESIMPULAN DAN SARAN

From the results of research using the Expert System for Determining Pests and Diseases of Tomato Plants Forward Chaining method, conclusions and suggestions can be drawn. Based on the existing problems, discussion, and testing it can be concluded that this application can run and assist users in detecting pests and knowing tomato plant diseases, the use of forward chaining is in accordance with the application of an expert diagnosis of tomato plant pests, and the results of this system test help users diagnose pests found in tomato plants

DAFTAR PUSTAKA

- [1] Ilham Insani, M., Alamsyah, A., & Putra, A. "Implementation of Expert System for Diabetes Diseases using Naïve Bayes and Certainty Factor Methods". *Scientific Journal of Informatics*, 5(2), 185-193. 2018. doi:<https://doi.org/10.15294/sji.v5i2.16143>
- [2] Franz, A., Ngapiyatun, S., & Sulpiana. "Expert System for Tomato Plant Pest Diagnosis Using the Certainty Factor Method". *TEPIAN*, 1(2), 67-73, 2020. <https://doi.org/10.51967/tepiian.v1i2.97>
- [3] Liu J and Wang X. "Tomato Diseases and Pests Detection Based on Improved Yolo V3 Convolutional Neural Network. Front". *Plant Sci.* 11:898. 2020. doi: 10.3389/fpls.2020.00898
- [4] Putri, R., Morita, K. M., & Yusman, Y. "Penerapan Metode Forward Chaining Pada Sistem Pakar Untuk Mengetahui Kepribadian Seseorang". *INTECOMS: Journal of Information Technology and Computer Science*, 3(1), 60-66. 2020. <https://doi.org/https://doi.org/10.31539/intecom.v3i1.1332>