CHAPTER 1 INTRODUCTION

1.1. Research Background

Sugarcane (Saccharum officinarum L.) is an industrial crop with considerable economic value, making its cultivation a significant source of income for communities[1]. Sugarcane is characterized by its stalks, which contain glucose and are cultivated for processing into sugar.[2] Cane sugar is the primary sugar source globally. According to Consumer News and Business Channel (CNBC) Indonesia, over the past decade, sugar production has steadily declined, in contrast to sugar consumption, which continues to rise. Sugar production stands at 2.4 million tons, far from sugar consumption, which reaches 3.21 million tons[3]. This discrepancy has led the government to import sugar to cover the domestic supply deficit. According to sugarcane statistics published by Indonesia's Central Bureau of Statistics *(Badan Pusat Statistik or BPS)*, the country imported up to 6 million tons of sugar by the end of 2022[4].

According to data reported at the National Summit on Sugar held on 13 December 2023, the area of sugarcane plantations has increased over the past 10 years. In 2022, the total sugarcane plantation area across Indonesia reached 490,000 hectares, and in 2023, it is estimated to continue increasing to 505,000 hectares. Expanding plantation areas should ideally align with an increase in the number of plants, thereby boosting harvest yields to meet production demands. However, in reality, this rise in production has not materialized due to the declining quality of

[1] Dentin Queentiara Moelyaandani dan S Setiyono, "Kompetisi beberapa jenis gulma terhadap pertumbuhan awal beberapa varietas tanaman tebu (Saccharum officinarum L.)," *Jurnal Proteksi Tanaman Tropis* 1, no. 1 (6 Januari 2020): 21, https://doi.org/10.19184/jptt.v1i1.15585.

[2] Simping Yuliatun dkk., "Pengaruh Penggunaan Pupuk Silikat (BioSilAc dan SiAbate) Terhadap Pertumbuhan Agrononi, Serapan Silika dan Ketahanan pada Serangan Hama dan Penyakit Tanaman Tebu Varietas PSJK 922," *Indonesian Sugar Research Journal* 3, no. 1 (7 Juli 2023): 12–24, https://doi.org/10.54256/isrj.v3i1.92.

[3] Tasya Natalia, "Kondisi Gula RI Ngeri-Ngeri Sedap, Begini Fakta Pahitnya," CNBC Indonesia, 2024, https://www.cnbcindonesia.com/research/20240315114941-128-522244/kondisi-gula-ri-ngeri-ngeri-sedap-begini-fakta-pahitnya.

[4] Badan Pusat Statistik Indonesia, "Impor Gula menurut Negara Asal Utama, 2017-2023 - Tabel Statistik," 2024, https://www.bps.go.id/id/statistics-table/1/MjAxNCMx/impor-gula-menurut-negara-asal-utama--2017-2022.html.

sugarcane[5]. This issue inevitably impacts efforts to achieve self-sufficiency in sugar production[6].

One of the factors affecting the quality of sugarcane crops is disease infestation.[7]. The impact of such diseases results in significant losses, with a reduction in harvest weight ranging from 18.01%–28.73% and sucrose loss estimated between 9.74%–15.93%.[8]. Ratoon stunting disease, fire blight, mosaic, blendok, pokkah boeng, ring spot, leaf scorch, root and stem rot are among the diseases that frequently attack sugarcane crops. The presence of these diseases inevitably causes substantial losses for sugarcane farmers and the processing industry. This concern is the primary reason for conducting this research.

In line with this, the Prophet Muhammad (peace be upon him) said in his hadith:

مَا أَنْزَلَ اللهُ دَاءً إِلَّا أَنْزَلَ لَهُ شِفَاءً

This hadith says, "Allah has not sent down a disease except that He has also sent down its cure" (Narrated by Bukhari). This hadith explains that every disease indeed has a remedy. Discovering the right cure requires hard work, experimentation, and research to achieve optimal results[9].

Lestari Sugar Factory is a business unit under PT Sinergi Gula Nusantara, producing SHS sugar as its main product[10]. As a sugar producer, Lestari Sugar Factory plays a significant role in processing sugarcane into sugar. The factory

[5] Natalia, "Kondisi Gula RI Ngeri-Ngeri Sedap, Begini Fakta Pahitnya."
[6] Natalia.
[7] Andre Rahmat Kurniawan, Gunadi Dwi Nurcahyo, dan Yuhandri, "Sistem Pakar Dengan Metode Forward Chaining Untuk Diagnosis Penyakit dan Hama Tanaman Tebu," *INTEK : Jurnal Informatika dan Teknologi Informasi* 6, no. 1 (28 Mei 2023): 49–57, https://doi.org/10.37729/intek.v6i1.3029.
[8] Nurindah Nurindah dan Titiek Yulianti, "Strategi Pengelolaan Serangga Hama dan Penyakit Tebu dalam Menghadapi Perubahan Iklim," *Buletin Tanaman Tembakau, Serat & Minyak Industri* 10, no. 1 (31 Agustus 2018): 39, https://doi.org/10.21082/btsm.v10n1.2018.39-53.
[9] Mutiara Fahmi, "Penggunaan Manusia Sebagai Relawan dalam Ujicoba Obat Baru: Kajian Alquran, Hadis dan Kaedah Fiqih," *El-Usrah: Jurnal Hukum Keluarga* 4, no. 1 (11 Maret 2021): 64, https://doi.org/10.22373/ujhk.v4i1.9004.
[10] Meda Dwi Jayanti, Arief Budiono, dan Antonius Junet, "Pengaruh Penambahan Air Imbibisi Terhadap Kehilangan Gula Dalam Ampas Di Pabrik Gula Lestari," *DISTILAT: Jurnal Teknologi Separasi* 8, no. 3 (22 Mei 2023): 480–84, https://doi.org/10.33795/distilat.v8i3.497.

manages several sugarcane plantations spread across the Nganjuk region and its surroundings. Lestari Sugar Factory currently employs manual methods to monitor these plantations. However, the number of experts is not proportional to the number of plantations managed, and the plantations are located at a considerable distance from the research site.

An expert system for diagnosing sugarcane diseases is needed to assist plantation managers in identifying existing problems. An expert system is a system that adopts human knowledge into a computer, enabling the computer to solve problems that experts typically resolve. The goal of an expert system is to transfer the expertise commonly possessed by an expert into a computer.[11].

An example of research related to expert systems using the Naïve Bayes method is the Expert System for Diagnosing Diseases and Pests in Corn Plants. The accuracy level of the testing conducted by comparing expert diagnoses with system diagnoses for diseases and pests in corn plants was 90%[12]. Another study using the Naïve Bayes method produced an expert system capable of diagnosing pests and diseases in ornamental plants (Aglaonema sp.), achieving an accuracy rate of 90% from 30 test data samples.[13]. Additionally, research on expert systems for diagnosing pests and diseases in papaya plants using the Naïve Bayes method resulted in 95% accuracy from 24 test trials.[14].

Based on the studies mentioned earlier, it is evident that the Naïve Bayes method can be utilized to develop an expert system for identifying sugarcane diseases, with the expectation of achieving high accuracy. This research aims to build an expert system for diagnosing sugarcane diseases using the Naïve Bayes

[11] Nurliani Br Saragih, "Sistem Pakar Mendiagnosa Penyakit Gangguan Hati Pada Manusia Menggunakan Metode Naïve Bayes Berbasis WEB," *Jurnal Ilmu Komputer Dan Sistem Informasi (JIKOMSI)* 5, no. 1 (17 Februari 2022): 11–19, https://doi.org/10.55338/jikomsi.v5i1.202.
[12] Bayu Bastiyan Suherman, "Sistem Pakar Diagnosa Penyakit Dan Hama Pada Tanaman Jagung Menggunakan Metode Naive Bayes," *Jurnal Informatika dan Rekayasa Perangkat Lunak* 2, no. 3 (20 Oktober 2021): 390–98, https://doi.org/10.33365/jatika.v2i3.1251.
[13] Mia Martha Amalia, Ernawati Ernawati, dan Andang Wijanarko, "Implementasi Metode Naïve Bayes Dalam Sistem Pakar Diagnosis Hama dan Penyakit Pada Tanaman Hias Aglaonema SP.," *Rekursif: Jurnal Informatika* 10, no. 1 (24 April 2022): 23–39, https://doi.org/10.33369/rekursif.v10i1.18953.
[14] Aldo Rio Prayoga dan M Iwan Wahyuddin, "Sistem Pakar Diagnosa Penyakit dan Hama Tanaman Pepaya Menggunakan Metode Forward Chaining dan Naïve Bayes" 5 (2021).

method to address the existing issues. This method was selected due to the ease of implementing Naïve Bayes and its ability to function independently, meaning that a feature within a dataset is not dependent on the presence or absence of other features in the same dataset[15]. Thus, this research on an expert system for identifying sugarcane diseases is expected to assist sugarcane plantation managers in quickly detecting the types of diseases based on observed symptoms and in obtaining solutions to these problems.

1.2. Research Problem

The problem statement derived from the background description is that the monitoring of the PT. Sinergi Gula Nusantara Lestari Sugar Factory plantation still relies on manual methods. At the same time, the number of experts is limited compared to the vast plantation area being managed. The long-distance between plantations further slows the handling process, making it necessary to develop an expert system to accelerate and optimize the diagnosis of diseases in sugarcane plants.

1.3. Research Limitation

The scope of this research is defined as follows:

1. The method to be used is the Naïve Bayes method.
2. The system will be web-based.
3. The study will focus on a limited number of sugarcane diseases, namely Ratoon Stunting Disease, Fire Blight, Mosaic, Blendok, Pokkah Boeng, Ring Spot, Leaf Scorch, Root and Stem Rot.
4. The information provided will include diagnosis results, descriptions, prevention suggestions, and recommendations for further management.
5. The programming language will be PHP, and the database will use MySQL.
6. The expert system under development will be designed specifically PT. Sinergi Gula Nusantara, Lestari Sugar Factory in Nganjuk.

[15] Muhammad Ridho Handoko dan Neneng Neneng, "Sistem Pakar Diagnosa Penyakit Selama Kehamilan Menggunakan Metode Naive Bayes Berbasis Web," *Jurnal Teknologi Dan Sistem Informasi* 2, no. 1 (29 Maret 2021): 50–58, https://doi.org/10.33365/jtsi.v2i1.739.

1.4. Research Objectives

This study aims to develop an expert system capable of detecting and diagnosing diseases in sugarcane plants quickly and accurately using the Naïve Bayes method. The system is expected to improve the efficiency of sugarcane plantation monitoring and accelerate the disease management process.

1.5. Research Benefits

The expected benefits of this research are as follows:

1. For Students
    - To fulfil the requirements for completing the final project in their studies.
    - To serve as a benchmark for assessing the student's knowledge and abilities throughout their studies and their application in real-life situations.
    - To enhance the student's experience and broaden their knowledge.
2. For the University
    - To assess student's abilities in applying the material taught during their academic program.
    - To evaluate student's problem-solving skills using appropriate techniques and methods.
3. For the Community
    - To provide ease to sugarcane farmers in addressing sugarcane disease problems quickly and efficiently, thereby improving the quality of sugarcane crops.

1.6. Systematics of Discussion

This section outlines the structure of the thesis, from the introduction to the conclusion, along with a brief explanation for each chapter. This explanation is expected to help readers understand the flow of the discussion in this thesis.

This research will follow the writing systematics as outlined below:

CHAPTER 1 INTRODUCTION

This chapter provides a general overview of the research, consisting of:

1.1 Research Background

1.2 Research Problem

1.3 Research Limitation

1.4 Research Objectives

1.5 Research Benefits

1.6 Systematics of Discussion

CHAPTER 2 LITERATURE REVIEW

This chapter discusses the definitions and theories used as the foundation for this research, which include:

2.1 Previous Research

2.2 Theoretical Study

CHAPTER 3 RESEARCH METHODS

This chapter discusses the methods used in this research, which are as follows:

3.1 Time and Location Research

3.2 Research Tools and Material

3.3 Research Model

3.4 Research Stages

CHAPTER 4 RESULTS AND DISCUSSION

This chapter presents an explanation of the results and a discussion of the research, which includes:

4.1 Results

4.2 Verification

4.3 Discussion

CHAPTER 5 CONCLUSION

This is the final chapter, containing the research conclusions and recommendations for future research.

5.1 Conclusion

5.2 Suggestion

References

Appendices