Dominant Pathogens Causing Leaf Spot Disease in Oil Palm Plants That Have Not Yet Produced (TBM) Using A Visual Approach and Control Strategy Recommendations

Riki Kurniawan Barus[1]*, Junaidi[2], Nurliana[3]
[1,2]Program Studi Proteksi Tanaman Fakultas Sains dan Teknologi Institut Teknologi Sawit Indonesia
[3]Program Studi Agribisnis, Fakultas Sains dan Teknologi, Institut Teknologi Sawit Indonesia

Corresponding Author's e-mail : *kiibarus@gmail.com*

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Abstract : Leaf spot disease is a major constraint on immature oil palms because it can inhibit growth. This study aimed to identify leaf spot diseases, determine their incidence and prevalence, and establish the dominant disease affecting three-year-old immature oil palms. A descriptive field survey was conducted on 50 sample plants across Block A and Block B. Data were collected through visual observation of disease symptoms and analysed according to incidence, prevalence, severity, and dominance. The results identified two principal pathogens: Curvularia sp., with an incidence of 24%, and Fusarium sp., with 16%. Overall disease incidence reached 40%, while prevalence in both blocks was 100%. Curvularia sp. was the dominant disease, accounting for 60% of all cases. Although the severity of both diseases remained low, control measures are still required through plantation sanitation, routine monitoring, improved drainage, balanced fertilisation, removal of infected leaves, and appropriate fungicide application when necessary.

Keywords : Oil Palm, Leaf Spot Disease, Curvularia Sp, Fusarium Sp, Disease Incidence

Abstrak : *Penyakit bercak daun merupakan salah satu kendala penting pada tanaman kelapa sawit belum menghasilkan (TBM) karena dapat menghambat pertumbuhan. Penelitian ini bertujuan mengidentifikasi jenis penyakit bercak daun, menentukan kejadian dan prevalensinya, serta menetapkan penyakit dominan pada tanaman kelapa sawit TBM berumur tiga tahun. Penelitian menggunakan metode survei lapangan dengan pendekatan deskriptif terhadap 50 tanaman sampel pada Blok A dan Blok B. Data diperoleh melalui pengamatan visual gejala penyakit, kemudian dianalisis berdasarkan kejadian, prevalensi, tingkat serangan, dan dominansi penyakit. Hasil penelitian menunjukkan dua patogen utama, yaitu Curvularia sp. dengan kejadian penyakit 24% dan Fusarium sp. sebesar 16%. Total kejadian penyakit mencapai 40%, sedangkan prevalensi pada kedua blok mencapai 100%. Curvularia sp. menjadi penyakit dominan dengan kontribusi 60% dari total kasus. Meskipun tingkat serangan masih tergolong ringan, pengendalian tetap diperlukan melalui sanitasi kebun, pemantauan rutin, perbaikan drainase, pemupukan berimbang, pemangkasan daun terserang, dan penggunaan fungisida secara tepat apabila diperlukan.*

Kata Kunci *: Kelapa Sawit, Penyakit Bercak Daun, Curvularia Sp., Fusarium Sp., Kejadian Penyakit.*

INTRODUCTION

Oil palm (Elaeis guineensis Jacq.) is one of the leading plantation commodities that plays a strategic role in the Indonesian economy. This commodity contributes significantly to foreign exchange earnings, employment opportunities, and the development of various vegetable oil-based industries. As the world's largest producer of palm oil, Indonesia continues to improve plantation productivity and product quality to meet the growing demand of the global market (Pahan, 2015). Therefore, effective and sustainable oil palm plantation management is essential for ensuring the success of plantation enterprises.

The success of oil palm production is not only determined during the Mature Plant (MP) phase but is also strongly influenced by plant growth conditions during the Immature Plant (IP) phase. The IP phase represents a critical period for the development of vegetative structures, including the root system, stem, and canopy, which determine the plant's ability to produce fresh fruit bunches optimally during the productive stage. Growth disturbances during the IP phase may reduce the plant's future productivity potential (Lubis, 2008). Therefore, proper crop maintenance and the management of various growth-limiting factors, including plant pest and disease attacks, are essential to ensure healthy and productive plant development (Fauzi et al., 2012).

In oil palm cultivation, various constraints may hinder optimal growth during the Immature Plant (IP) phase, one of which is plant disease infection. Plant diseases are disorders caused by pathogenic organisms such as fungi, bacteria, and viruses, or by unfavorable environmental conditions that disrupt normal plant growth (Agrios, 2005). Disease attacks during the IP phase require particular attention because this stage is crucial for vegetative development, which ultimately determines future productivity. Disease incidence can damage plant tissues, inhibit root and canopy development, reduce photosynthetic area, and decrease overall plant vigor (Fauzi et al., 2012). Furthermore, uncontrolled disease outbreaks may increase plant mortality, reduce the population of productive plants, and consequently lower yield potential while increasing maintenance costs for plantation companies (Pahan, 2015). Therefore, early disease identification and appropriate control measures are essential components of maintaining plant health and supporting sustainable oil palm cultivation (Corley & Tinker, 2016).

Several diseases can affect oil palm during the Immature Plant (IP) phase, including leaf spot disease, basal stem rot, frond rot, and other diseases characterized by symptoms on leaves, stems, and roots. These diseases can disrupt plant physiological processes and inhibit vegetative growth, which is essential for supporting productivity during the mature phase. Most plant diseases develop gradually and often do not exhibit clear symptoms during the early stages of infection, making them difficult to detect without routine and systematic monitoring. Therefore, early disease identification is crucial for maintaining plant health, reducing the risk of plant population losses, and preventing wider disease dissemination across plantation areas (Agrios, 2005; Fauzi et al., 2012).

One of the most commonly used methods for plant disease identification is the visual approach through direct observation of symptoms appearing on plants. This method involves observing morphological changes such as leaf discoloration, necrotic lesions, chlorosis, wilting, tissue deformation, and abnormal plant growth. Visual assessment offers several advantages, including ease of application in the field, minimal equipment requirements, and the ability to provide rapid preliminary information regarding plant health conditions. Through systematic and continuous visual monitoring, dominant diseases affecting the crop can be identified, facilitating the development of appropriate and effective control strategies according to field conditions (Semangun, 2007; Corley & Tinker, 2016).

Sei Putih Estate, as one of the oil palm plantation units, has immature plant areas that require continuous plant health monitoring. Environmental factors such as high rainfall, elevated humidity, soil conditions, and crop management practices can significantly influence disease development and spread. Conditions favorable to pathogen growth may increase disease severity if not accompanied by proper management measures. If emerging diseases are not promptly

identified and controlled, economic losses may occur in the form of reduced plant growth quality, declining healthy plant populations, increased maintenance costs, and disruption of future production targets (Pahan, 2015; Fauzi et al., 2012). Therefore, a comprehensive analysis is required to identify the dominant diseases affecting immature oil palm plants at Sei Putih Estate and to determine their distribution levels as a basis for developing effective and sustainable disease management strategies.

The analysis of dominant diseases in immature oil palm plants through a visual assessment approach is an important step toward effective and sustainable plant health management. Information regarding dominant diseases and their distribution levels can serve as the foundation for targeted disease control strategies, thereby suppressing disease development before substantial losses occur. The identification results can be utilized by plantation managers to determine appropriate preventive and curative measures. These strategies may include the implementation of good agricultural practices, enhanced plantation sanitation, the use of healthy planting materials, the application of biological control agents, and the prudent use of pesticides according to the severity of disease incidence (Pahan, 2015; Fauzi et al., 2012). Consequently, this study on the analysis of dominant diseases in immature oil palm plants using a visual approach and their management strategies at Sei Putih Estate is expected to provide valuable scientific information that supports plant health management while enhancing plantation productivity and sustainability.

Numerous studies have been conducted on oil palm diseases, particularly concerning pathogen identification, disease severity, and disease management methods in mature plants. Most previous studies have focused on economically significant diseases such as basal stem rot caused by Ganoderma spp., leaf spot diseases, and other diseases affecting the production stage of oil palm cultivation (Corley & Tinker, 2016). In addition, many studies have emphasized laboratory-based disease identification through microbiological analysis, pathogen morphology observation, molecular techniques, and pathogenicity testing to specifically confirm disease-causing agents (Agrios, 2005; Semangun, 2007).

However, studies specifically investigating dominant diseases during the Immature Plant (IP) phase remain relatively limited. This is despite the fact that the IP phase represents a critical stage in the oil palm growth cycle that significantly influences future plant performance. Most previous studies have not provided comprehensive information regarding disease distribution and dominance under actual field conditions through a simple, practical, and easily applicable visual approach. Furthermore, studies integrating dominant disease identification with disease management strategies tailored to specific plantation conditions are still scarce, particularly in the oil palm plantation area of Sei Putih Estate. This situation highlights the need for research capable of generating more applicable and field-relevant information for plant health management activities (Fauzi et al., 2012; Pahan, 2015).

Another research gap lies in the limited availability of field data explaining the relationship between visual disease symptoms, disease dominance levels, and practical disease management recommendations that can be directly implemented by plantation practitioners. Previous studies have generally focused on pathogen identification without linking findings to management strategies based on actual plant and environmental conditions. Consequently, existing research outcomes have not fully supported decision-making processes related to effective plant health management in the field (Agrios, 2005; Corley & Tinker, 2016). Therefore, this study was conducted to identify dominant diseases affecting immature oil palm plants through a visual assessment approach, analyze their distribution levels in the field, and formulate disease management recommendations suitable for the actual conditions at Sei Putih Estate. The findings are expected to address existing information gaps and provide a basis for improving plant health and oil palm plantation productivity sustainably.

Based on the identified research gaps, this study offers several novel contributions to the development of plant protection science in oil palm cultivation. First, the study specifically focuses on identifying and analyzing dominant diseases affecting oil palm during the Immature Plant (IP) phase, whereas most previous studies have concentrated on diseases affecting mature plants due to their direct impact on production and economic losses (Corley & Tinker, 2016). Nevertheless, the

IP phase is a critical period that determines vegetative growth quality and future productivity (Pahan, 2015).

Second, this study employs a visual assessment approach as the primary method for disease identification in the field. This approach was selected because it provides rapid, practical, and easily applicable information for routine plant health monitoring without requiring sophisticated laboratory equipment. Visual symptom observation is an essential initial step in plant disease diagnosis because it can indicate pathogen presence and disease distribution levels in the field (Agrios, 2005; Semangun, 2007). Therefore, the findings are expected to generate practical information that can be readily implemented by plantation managers in daily plant health monitoring activities.

Third, this study was conducted specifically in the immature plant areas of Sei Putih Estate, providing an accurate representation of current plant health conditions and disease distribution patterns at the study site. Environmental characteristics such as rainfall, humidity, soil conditions, and crop management practices can influence disease development; therefore, the findings have strong relevance to local field conditions (Fauzi et al., 2012). This information is expected to support the development of more targeted disease monitoring and management programs.

Fourth, the study not only focuses on identifying dominant diseases but also integrates disease identification results with the formulation of management strategies tailored to disease types, severity levels, and plantation environmental conditions. This approach is expected to generate more operational and practical disease management recommendations. Management strategies based on actual field conditions are considered more effective than generalized approaches because they account for factors influencing disease development in specific contexts (Pahan, 2015; Fauzi et al., 2012).

In conclusion, this study is expected to contribute scientifically to the development of an early disease detection system for immature oil palm plants through a simple, effective, and practical visual assessment approach. Furthermore, the findings are anticipated to serve as a basis for developing more effective, efficient, and sustainable disease management strategies to support improved plant health and oil palm plantation productivity. Academically, this research is also expected to enrich the literature on oil palm plant health management, particularly concerning visual symptom-based disease identification and its application in disease management decision-making at the field level (Agrios, 2005; Corley & Tinker, 2016; Fauzi et al., 2012).

METHODS

This study was conducted at Sei Putih Estate on immature oil palm plants (*Elaeis guineensis* Jacq.) exhibiting disease symptoms. A descriptive field survey was employed to identify disease types, determine their incidence and distribution, establish the dominant disease, and formulate management strategies appropriate to field conditions. This approach enables plant health conditions to be described systematically, factually, and accurately (Nazir, 2014) and is commonly applied in plant protection studies to support disease-management decisions (Semangun, 2007). Primary data were collected through direct visual observation of symptoms on leaves, fronds, stems, and other plant parts, supported by photographic documentation and interviews with estate assistants, field supervisors, and maintenance personnel. Secondary data were obtained from plant health reports, operational records, and relevant scientific literature (Fauzi et al., 2012). Observations were preceded by a preliminary survey to determine sampling locations, after which symptoms such as chlorosis, leaf spots, necrosis, wilting, rotting, and organ deformation were systematically recorded and identified using established plant disease references (Agrios, 2005; Semangun, 2007).

Data were analysed descriptively using quantitative and qualitative techniques. Disease incidence was calculated using the formula DI (%) = (n/N) × 100, where n represents the number of infected plants and N the total number of plants observed. The results were presented in tables and charts, while qualitative analysis described symptom characteristics, disease distribution, contributing factors, and effects on plant growth (Nazir, 2014; Sugiyono, 2019). Based on these findings, management recommendations were formulated according to Integrated Pest and Disease

Management principles, prioritising preventive, sustainable, environmentally responsible, and economically feasible measures (Untung, 2006). Recommended actions included plantation sanitation, healthy planting materials, improved drainage, balanced fertilisation, routine monitoring, and mechanical, biological, or chemical control adjusted to the disease type and severity (Pahan, 2015; Fauzi et al., 2012).

RESULT AND DISCUSSION

Research on dominant diseases affecting immature oil palm plants (IP 3) (Elaeis guineensis Jacq.) at Sei Putih Estate was conducted using a visual assessment approach by observing disease symptoms that appeared on the plants. Observations were carried out in two plantation blocks, namely Block A and Block B, with a total sample size of 50 plants, consisting of 25 plants from each block. The observed parameters included disease type, visual symptoms, number of infected plants, disease severity, disease incidence, disease distribution between blocks, and determination of the dominant disease. The results showed that two types of diseases were found attacking the IP 3 oil palm plants, namely leaf spot disease identified as Curvularia sp. and yellowing leaf symptoms associated with Fusarium sp. Infection by Curvularia sp. was characterized by the appearance of brown spots on the leaf surface, which in more advanced stages could reduce the photosynthetic area due to damage to leaf tissues. Meanwhile, symptoms associated with Fusarium sp. were characterized by yellowing of the leaves (chlorosis), indicating physiological disturbances within the plant. Of the 50 plants observed, 20 plants exhibited disease symptoms, while the remaining 30 plants were found to be healthy.

These findings indicate that leaf spot disease and yellowing leaf symptoms remain important plant health issues during the Immature Plant (IP) phase. According to Semangun (2007), leaf spot disease caused by pathogenic fungi, including Curvularia sp., is one of the most common diseases found in plantation crops grown in tropical regions with high humidity. These fungi thrive under moist environmental conditions and can cause damage to leaf tissues, thereby reducing the plant's photosynthetic capacity. The results of this study are consistent with the findings of Fauzi et al. (2012), who reported that leaf spot disease is frequently observed in young oil palm plants and is generally associated with environmental conditions favorable for pathogen development, such as high rainfall, poor air circulation, and suboptimal plantation sanitation. The occurrence of Curvularia sp. within the study area suggests that environmental conditions at Sei Putih Estate remain conducive to the development of leaf spot pathogens.

In addition, the presence of yellowing leaf symptoms associated with Fusarium sp. indicates a plant health disorder that requires particular attention. According to Agrios (2005), fungal infections caused by species of the genus Fusarium can disrupt root systems and vascular tissues, thereby impairing the uptake of water and nutrients. Such conditions are commonly expressed through early symptoms of chlorosis or leaf yellowing. This finding is further supported by the work of Corley and Tinker (2016), who explained that disturbances in the root system of oil palm plants can reduce vegetative growth and hinder plant development during the early growth stages. Although both diseases were identified within the study area, the occurrence of Curvularia sp. and Fusarium sp. on IP 3 oil palm plants at Sei Putih Estate provides valuable information regarding plant health conditions during the immature growth phase at the research location. These results demonstrate that visual assessment can serve as an effective preliminary method for detecting disease presence in the field, allowing control measures to be implemented at an earlier stage before disease development becomes more severe. This finding supports the view of Agrios (2005) that visual symptom identification is a crucial step in plant disease diagnosis and serves as the foundation for developing appropriate disease management strategies.

Table 1. Types of Diseases Identified on Immature Oil Palm Plants (TBM 3) at Sei Putih Estate

No.	Disease	Visual Symptoms	Number of Infected Plants	Severity Level
1	*Curvularia* sp.	Leaf spot	12	Mild
2	*Fusarium* sp.	Leaf yellowing (chlorosis)	8	Mild
Total			20	Mild

Source: Primary data processed (2026).

Based on the table above, Curvularia was found in 12 plants, which was higher than the occurrence of Fusarium, which was detected in 8 plants. All infected plants exhibited a mild level of disease severity, indicating that the damage had not yet caused a significant impact on plant growth and development. The calculation of disease incidence showed that Curvularia had a disease incidence of 24%, whereas Fusarium had a disease incidence of 16%. Overall, the disease incidence in IP 3 oil palm plants reached 40%, indicating that 40% of the total sampled plants exhibited symptoms of disease infection.

Table 2. Disease Incidence in Immature Oil Palm Plants (TBM 3)

Disease	Number of Infected Plants	Disease Incidence (%)	Proportion of Diseased Plants (%)
Curvularia sp.	12	24	60
Fusarium sp.	8	16	40
Total	20	40	100

Source: Primary data processed (2026).

Based on the data presented in Table 3.2, leaf spot disease caused by Curvularia sp. exhibited the highest incidence among all diseases identified at the study site. Out of the 20 diseased plants observed, 12 plants were infected by Curvularia sp., representing 60% of the total diseased plants. In contrast, leaf yellowing symptoms associated with Fusarium sp. were found in 8 plants, accounting for 40% of the total infected plants. These results indicate that Curvularia sp. was the dominant disease affecting immature oil palm plants (IP 3) at Sei Putih Estate.

The dominance of Curvularia sp. infection at the study site is likely related to environmental conditions that favor pathogen development, particularly high humidity and rainfall, which can increase the likelihood of infection in leaf tissues. According to Fauzi et al. (2012), leaf spot diseases in oil palm generally develop more rapidly under humid environmental conditions because high moisture levels promote spore germination and pathogen dissemination. In addition, inadequate plantation sanitation and dense vegetation cover may further increase the risk of leaf disease development in young oil palm plants.

The contribution of Curvularia sp. to 60% of the total diseased plants indicates that this pathogen had a higher level of dominance compared to Fusarium sp. This finding suggests that the leaf spot pathogen possesses a strong capacity to adapt to the environmental conditions prevailing at Sei Putih Estate. The results are consistent with the findings of Fauzi et al. (2012), who reported that leaf spot disease is among the most frequently encountered diseases in young oil palm plants, particularly during the Immature Plant (IP) phase, because actively growing leaf tissues tend to be more susceptible to pathogen infection.

Overall, disease incidence at the study site reached 40% of the total plants observed. This value indicates that nearly half of the sampled plant population had experienced plant health disturbances. The relatively high disease incidence suggests the existence of favorable interactions among the host plant, pathogen, and environmental conditions, enabling disease development and spread within the study area. According to Agrios (2005), plant disease development is strongly influenced by the compatibility between the pathogen, a susceptible host plant, and conducive environmental conditions. When these three factors occur simultaneously, the risk of disease epidemics increases substantially.

Observations conducted in the two study blocks revealed a relatively uniform distribution of disease. Both Block A and Block B had 10 diseased plants out of the 25 plants observed, resulting in a disease incidence of 40% in each block. The similarity in disease incidence values indicates that environmental conditions and crop management practices were relatively uniform across both blocks. According to Corley and Tinker (2016), a uniform distribution of disease within a plantation area is generally associated with similar microclimatic conditions, crop management practices, and land characteristics that allow pathogens to develop at comparable levels throughout the plantation.

The relatively homogeneous disease distribution pattern further indicates that pathogen spread was not confined to a specific location but had occurred throughout all observation blocks. This condition suggests that disease management measures should be implemented comprehensively across the entire plantation area rather than being limited to locations exhibiting higher disease severity. Fauzi et al. (2012) emphasized that disease control in oil palm plantations is more effective when conducted through an integrated approach involving routine monitoring, plantation sanitation, drainage maintenance, and improvements in plant growth conditions to minimize opportunities for pathogen development.

Based on the results of this study, Curvularia sp. was identified as the dominant disease affecting immature oil palm plants (IP 3) at Sei Putih Estate, contributing 60% of the total diseased plants. This finding indicates that leaf spot disease remains one of the major constraints during the immature plant phase and requires special attention within plant health monitoring programs. Furthermore, the uniform distribution of the disease across both observation blocks suggests that environmental factors and cultivation practices play important roles in supporting disease development. The results of this study provide valuable information regarding the health status of immature oil palm plants at Sei Putih Estate, which can serve as a basis for developing more effective and sustainable disease management strategies.

Table 3. Disease Distribution by Observation Block in Immature Oil Palm Plants (TBM 3)

Observation Block	Total Plants Observed	Healthy Plants	Diseased Plants	Disease Incidence (%)
A	25	15	10	40
B	25	15	10	40
Total	50	30	20	40

Source: Primary data processed (2026).

The distribution of disease types across the two observation blocks showed a relatively uniform pattern. In Block A, 6 plants were infected by Curvularia sp., while 4 plants exhibited symptoms associated with Fusarium sp. A similar pattern was observed in Block B, where 6 plants were infected by Curvularia sp. and 4 plants were affected by Fusarium sp. The identical number of infected plants in both blocks indicates that disease spread within the study area occurred uniformly and was not concentrated in a particular location. This condition suggests that factors influencing disease development, such as environmental humidity, soil conditions, plant age, and plantation management practices, tended to exhibit similar characteristics across both observation blocks.

Although both diseases were detected in all observation blocks, Curvularia sp. exhibited a higher frequency of infection than Fusarium sp. The dominance of Curvularia sp. indicates that the leaf spot pathogen possesses a greater capacity to adapt to the environmental conditions of the study site. According to Fauzi et al. (2012), leaf spot diseases in oil palm generally develop more rapidly under conditions of high humidity because fungal spores can easily germinate and spread through rain splash and wind dispersal. Furthermore, the presence of overlapping leaves in young oil palm plants may accelerate pathogen transmission from one plant to another.

The uniform distribution pattern between Block A and Block B also indicates that there was no significant difference in disease risk levels between the two blocks. This finding suggests that the pathogen inoculum source was likely distributed evenly throughout the study area. According to Agrios (2005), a uniform distribution of disease within a plant population generally indicates that environmental conditions broadly and continuously support pathogen development. Such conditions enable pathogens to infect plants at various locations with relatively similar levels of disease incidence.

The findings of this study are consistent with those reported by Susanto et al. (2013), who observed that leaf diseases in oil palm plantations tend to exhibit widespread distribution patterns in areas with homogeneous environmental conditions. Uniformity of microclimatic factors, particularly air humidity and rainfall intensity, plays a crucial role in influencing pathogen infection and dissemination in the field. Therefore, the dominance of Curvularia sp. in both

observation blocks indicates that leaf spot disease remains a major disease requiring special attention within the plant health monitoring program for immature oil palm plants at Sei Putih Estate.

Given the similar distribution pattern observed in both blocks, disease management efforts should be implemented comprehensively across the entire plantation area. A control strategy focused solely on one block may be less effective because sources of pathogen inoculum may still originate from the other block. Therefore, plantation sanitation, regular plant health monitoring, and environmental management practices that support healthy plant growth should be applied consistently throughout all blocks to suppress disease development and prevent an increase in disease severity in the future (Fauzi et al., 2012).

Table 4. Distribution of *Curvularia* sp. and *Fusarium* sp. Across Observation Blocks

Observation Block	*Curvularia* sp. (Plants)	Disease Incidence (%)	*Fusarium* sp. (Plants)	Disease Incidence (%)
A	6	24	4	16
B	6	24	4	16
Total	12	24	8	16

Source: Primary data processed (2026).

The prevalence analysis showed that both diseases were present in all observation blocks, with an inter-block prevalence value of 100%. This indicates that both Curvularia and Fusarium were uniformly distributed throughout the study area.

Table 5. Disease Prevalence Across Observation Blocks

Disease	Number of Infected Blocks	Total Observation Blocks	Disease Prevalence (%)
Curvularia sp.	2	2	100
Fusarium sp.	2	2	100

Source: Primary data processed (2026).

Based on disease severity assessment, all diseased plants were classified within the mild severity category. No plants exhibiting moderate or severe disease symptoms were observed during the study period.

Table 6. Disease Severity Levels

Severity Level	Number of Plants	Percentage (%)
Mild	20	100
Moderate	0	0
Severe	0	0
Total	20	100

Source: Primary data processed (2026).

The determination of the dominant disease in this study was based on several parameters, including disease incidence, the proportion of infected plants, inter-block prevalence, and disease severity levels observed in immature oil palm plants (IP 3). Based on the analysis results, Curvularia sp. was identified as the dominant disease because it exhibited the highest disease incidence, reaching 24%, was found in 12 out of the 50 plants observed, and accounted for 60% of the total diseased plants. Furthermore, this disease was detected in all observation blocks, resulting in a prevalence value of 100%. In contrast, symptoms associated with Fusarium sp. showed a disease incidence of 16% and represented 40% of the total diseased plants. Overall, disease incidence at the study site reached 40%, indicating that nearly half of the sampled plant population had experienced plant health disturbances.

The dominance of Curvularia sp. at the study site indicates that leaf spot disease remains one of the major diseases with the potential to interfere with the growth of oil palm plants during the immature phase. The findings of this study are consistent with those reported by Fauzi et al. (2012), who stated that leaf spot disease is commonly found in young oil palm plants, particularly under

environmental conditions characterized by high humidity and poor air circulation. According to Agrios (2005), the development of diseases caused by pathogenic fungi is strongly influenced by the interaction among the host plant, the pathogen, and the environment. Favorable environmental conditions enhance the pathogen's ability to develop, infect plant tissues, and spread to other plants within the plantation area.

The occurrence of Curvularia sp. in IP 3 oil palm plants is likely closely associated with the plantation microclimate, which favors pathogen development. High rainfall, relatively high air humidity, and the presence of dense plant canopies and ground vegetation can create ideal conditions for spore germination and fungal infection of leaf tissues. Semangun (2007) explained that leaf spot diseases in plantation crops generally develop more rapidly under humid environmental conditions because water serves as both a medium for spore dissemination and a factor facilitating pathogen penetration into plant tissues. As a result, leaf lesions may expand and reduce the active photosynthetic area of the plant.

From a plant physiological perspective, leaf spot disease has the potential to inhibit vegetative growth due to a reduction in the leaf's ability to perform photosynthesis efficiently. According to Corley and Tinker (2016), the Immature Plant (IP) phase is a critical period for the development of the root system, stem, and canopy, which ultimately determine productivity during the mature phase. Therefore, although the severity of Curvularia sp. infection observed in this study was classified as mild, its presence still requires attention because it may affect long-term plant growth if appropriate control measures are not implemented.

In addition to Curvularia sp., this study also identified leaf yellowing symptoms associated with Fusarium sp., with a disease incidence of 16%. Although the number of infected plants was lower than that of Curvularia sp., the presence of Fusarium sp. should not be overlooked because this pathogen is recognized as a soil-borne fungus capable of surviving for extended periods in plantation environments. Agrios (2005) stated that Fusarium infections are generally associated with disturbances in the root system and vascular tissues, resulting in impaired water and nutrient uptake. Early symptoms commonly include chlorosis or leaf yellowing, which may subsequently lead to reduced plant vigor if the infection persists over time.

The study also revealed that disease distribution in Block A and Block B was relatively uniform, with disease incidence values of 40% in each block. Furthermore, both diseases exhibited an inter-block prevalence of 100%, indicating that they were present in all observation blocks. The uniformity of disease distribution suggests that environmental conditions, cultivation practices, and crop maintenance factors were relatively similar across both blocks, thereby supporting pathogen development evenly throughout the study area. According to Susanto et al. (2013), a uniform disease distribution pattern within a plantation generally indicates that pathogen inoculum sources have become widely dispersed and are supported by environmental conditions favorable for disease development. Such conditions increase the risk of disease spread to healthy plants if integrated management measures are not implemented.

Although the overall disease incidence reached 40%, all infected plants were classified within the mild severity category. This finding indicates that the diseases identified were still in the early stages of development, suggesting that the likelihood of successful control remains relatively high. Mild disease severity also indicates that plant tissue damage had not yet become extensive and that normal physiological functions were still largely maintained. This situation provides plantation managers with an opportunity to prioritize preventive measures rather than curative actions, which generally require greater financial resources.

Based on the findings of this study, the recommended disease management strategy is the implementation of Integrated Pest and Disease Management (IPDM). This approach was selected because it combines multiple control methods in a sustainable manner while considering economic, environmental, and effectiveness aspects of disease management (Untung, 2006). The first step should involve improving plantation sanitation through the removal of weeds, old fronds, and plant debris that may serve as sources of pathogen inoculum. In addition, improvements to the drainage system are necessary to reduce excessive moisture levels that favor the development of pathogenic fungi.

Regular plant health monitoring should also be an essential component of the disease management program, as it enables early detection of disease symptoms. For plants already showing symptoms of infection, control measures may include pruning infected plant parts and destroying diseased tissues that could act as sources of pathogen spread. Fungicide application may be considered if disease intensity increases and poses a risk of economic losses. However, fungicides should be applied using the appropriate product, dosage, and timing to ensure effectiveness while minimizing negative environmental impacts (Fauzi et al., 2012).

Overall, the results of this study demonstrate that Curvularia sp. is the dominant disease affecting IP 3 oil palm plants at Sei Putih Estate. Its dominance is reflected by a higher disease incidence, a greater proportion of infected plants, and its occurrence across all observation blocks. Although disease severity remained within the mild category, the relatively high disease incidence indicates that the pathogen has already become widely distributed throughout the study area. Therefore, the early implementation of integrated disease management strategies is essential to maintain plant health, support optimal vegetative growth, and prevent an increase in disease severity in the future.

CONCLUSIONS

Based on the results of this study on the analysis of dominant diseases affecting immature oil palm plants (IP 3) (Elaeis guineensis Jacq.) at Sei Putih Estate using a visual assessment approach, two major diseases were identified, namely leaf spot disease associated with Curvularia sp. and leaf yellowing symptoms associated with Fusarium sp. Out of the 50 plants observed, 20 plants exhibited disease symptoms, resulting in an overall disease incidence of 40%, while the remaining 30 plants were found to be healthy. The disease incidence analysis revealed that Curvularia sp. was the dominant disease at the study site, with a disease incidence of 24%, affecting 12 plants and accounting for 60% of the total diseased plants. In contrast, Fusarium sp. had a disease incidence of 16%, affecting 8 plants and contributing 40% of the total infected plants. Both diseases were detected in all observation blocks, with an inter-block prevalence of 100%, indicating that disease distribution had occurred uniformly throughout the study area.

Although the overall disease incidence was relatively high, all infected plants were classified within the mild severity category. This finding indicates that the diseases were still at an early stage of development, suggesting that the likelihood of successful disease control remains relatively high. High environmental humidity, the presence of pathogen inoculum sources, and plantation sanitation conditions were considered to be the main factors contributing to disease development in the IP 3 oil palm plants. Based on the findings of this study, the implementation of Integrated Pest and Disease Management (IPDM) is recommended as the primary strategy for suppressing disease development. The recommended measures include improving plantation sanitation, conducting regular plant health monitoring, enhancing drainage systems, pruning infected plant parts, applying balanced fertilization, and using fungicides appropriately and only when necessary. The implementation of these strategies is expected to reduce the development of Curvularia sp. and Fusarium sp., maintain plant health during the immature phase, and support optimal vegetative growth as a foundation for achieving sustainable productivity during the mature production phase.

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