



Inventory of Cacao Diseases in Kulon Progo Regency

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Abstract

Cocoa (*Theobroma cacao* L.) is a strategic plantation commodity that significantly contributes to Indonesia's national economy. However, national cocoa productivity has declined in recent years, mainly due to inadequate management of plant diseases. This study aims to profile and characterize the pathogenic microorganisms associated with disease symptoms and determine the effect of cultivation methods on the incidence of disease in cocoa plants in Kulon Progo Regency, Special Region of Yogyakarta. The research employed a field survey method with purposive sampling and a diagonal pattern to collect symptomatic plant samples. The result is the disease that appears in cacao plantations in Kulon Progo, including vascular strike dieback, black pod rot, and cocoa swollen shoot virus (CSSV), with a tendency for lower damage intensity on intensively managed plantations.

Keywords: *cacao, Oncobasidium theobromae, fungi, Kulon Progo, plant disease*

INTRODUCTION

The cacao plant (*Theobroma cacao* L.) is one of the most important plantation commodities in Indonesia, with high economic value. In addition to contributing to the national economy, cacao provides employment opportunities. It is the primary source of income for many farmers (Sari et al., 2015). Despite its economic importance, national cocoa production has declined in recent years. According to Badan Pusat Statistik (2023), production decreased from 767,280 tons in 2018 to 650,612 tons in 2022. Indonesia, once the third-largest cocoa producer after the Ivory Coast and Ghana, fell to sixth place in 2018, overtaken by Ecuador, Cameroon, and Nigeria (ICCO, 2019; Karmawati et al., 2010, as cited in Ariningsih et al., 2021). In contrast, cocoa production in the Special Region of Yogyakarta has shown stability, with Kulon Progo Regency emerging as a significant production center. However, fluctuations in yield have been observed, partly due to high disease incidence (Siregar et al., 2021).

Diseases such as black pod, stem canker, wilting, and vascular streak dieback (VSD) are significant constraints on cocoa productivity. Smallholder farmers cultivate most of the cocoa in Indonesia, often with limited knowledge of intensive cultivation practices, particularly those related to Good Agricultural Practices (GAP). As a result, disease control is often delayed or ineffective, resulting in reduced yield and quality. Proper management practices, including sanitation, pruning, organic fertilization, and frequent harvesting, can reduce disease incidence by modifying the microclimate around the plants (Rohmando & Hartini, 2024).

Identifying plant diseases based on symptoms is a crucial first step in determining appropriate management strategies. Characteristic symptoms provide initial information about the type of pathogen involved. With a better understanding of the type and severity of the disease, appropriate control measures can be implemented, including the use of specific pesticides or

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suitable organic control methods (Ndamung et al., 2023).

In the context of differences between intensive and non-intensive management systems, farmers whose cocoa plants were severely affected by pests and diseases were generally those who did not carry out proper maintenance practices, such as fertilization, pruning, and sanitation. As a result, their cocoa plants became more vulnerable to pest and disease attacks. Incidence of several cocoa diseases was closely related to poorly managed plantations, characterized by inadequate field sanitation, improper planting distances, and insufficient disease control measures (Defitri, 2017). On the other hand, demonstrated that intensive cocoa maintenance using Good Agricultural Practices (GAP) significantly improved production components, including an increase of 91.41% in the number of flowers/pods, 51.95% in the number of fruits/trees, 66.45% in the number of seeds/fruit, and 47.64% in the number of seeds per 100 g (Wahyuni & Ndewes, 2023). It is important to conduct an inventory of cocoa plant diseases in the Kulon Progo region. The results of this inventory will serve as a basis for developing appropriate and efficient control strategies, as well as supporting efforts to improve cocoa productivity.

LITERATURE REVIEW

Cocoa (*Theobroma cacao* L.) is a major plantation crop with high economic value, widely cultivated in tropical regions, including Indonesia. Its production, however, has experienced a steady decline due to various factors, particularly plant diseases. The primary diseases of cocoa plants include Vascular Strike Dieback (VSD), black pod rot, and Cocoa Swollen Shoot Virus (CSSV). All of which contribute significantly to yield losses and reduced bean quality.

Phytophthora palmivora is the most destructive pathogen, responsible for black pod rot and stem canker. These diseases can cause yield losses of up to 90% in poorly managed plantations (Sangadji et al., 2023). Black pod rot symptoms begin with black lesions on pods, which rapidly expand, while stem canker is characterized by necrotic lesions and exudates on stems (Matitaputty et al., 2014). Disease development is strongly influenced by high humidity, poor pruning, and lack of sanitation (Rohmando & Hartini, 2024).

Cocoa Swollen Shoot Virus Disease (CSSVD) is a disease caused by the Cocoa Swollen Shoot Virus (CSSV), which attacks cocoa plants in tropical regions. CSSVD is transmitted by 14 species of whiteflies, including *Planococcus citri* and *Planococcoides njalensis*, through nymphs and adult females. The virus does not replicate in the vector, is not transmitted to offspring, and does not spread through seeds or pollen. CSSV can infect cocoa at all stages of its growth. This disease is known to spread through propagation techniques such as side grafting and through seeds (Probowati et al., 2020).

Onchobasidium theobromae, the causal agent of Vascular Streak Dieback (VSD), poses a serious threat as it colonizes the xylem, leading to leaf chlorosis, defoliation, and eventual branch dieback. In severe cases, plant mortality can reach over 50% (Susilo, 2012). The disease is highly influenced by environmental conditions such as rainfall, temperature, and shade density (Harni et al., 2017).

Previous studies have shown that disease severity in cocoa is closely related to the intensity of management on plantations. Poorly managed fields with inadequate sanitation and irregular pruning exhibit higher incidence and severity of fungal diseases, while intensively managed plantations applying Good Agricultural Practices (GAP) demonstrate lower infection rates (Purba & Sari, 2021; Wahyuni & Ndewes, 2023).

RESEARCH METHOD

The study was conducted from June to August 2025 on cocoa plantations at Klewonah Village, Banjarharjo District, Kalibawang, Kulon Progo Regency. Two cocoa fields with different cultivation

practices were selected, one managed intensively (intensive) and the other poorly maintained (non-intensive). Field 1 has coordinates -7.676446, 110.245026, and field 2 has coordinates 7.676446, 110.245026. Symptomatic plant parts, including leaves, stems, roots, and pods, were collected using scissors or cutters.

Disease severity was assessed using a 0–4 visual scale. According to the Directorate of Food Crop Protection and the Directorate of Plantation Crop Protection, the value of the crop damage score scale/certain parts of the crop is as follows: a score of 0 indicates no diseased or damaged plant parts; a score of 1 indicates that 1–25% of the plant parts are diseased or damaged; a score of 2 indicates 25–50% diseased or damaged plant parts; a score of 3 indicates 50–75% diseased or damaged plant parts; and a score of 4 indicates more than 75% diseased or damaged plant parts. Disease intensity was calculated following the formula provided by the Directorate of Crop Protection. To calculate non-absolute damage, you can use the following formula:

$$IS = \{(\sum n \times v) \div (Z \times N)\} \times 100\%$$

IS = Attack Intensity (%)

n = Number of plants or plant parts on the v-scale

v = Scale value of crop damage

N = number of observed sample plants or plant parts

Z = highest damage scale value.

The criteria or categories of pest damage are determined as follows: no attack/damage if the IS value 0%; light attack/damage if the IS value < 25%; moderate attack/damage if the IS value ranges from 25–50%; heavy attack/damage if the IS value ranges from 50–85%; and very heavy attack/damage (puso) if the IS value > 85%.

FINDINGS AND DISCUSSION

The Disease on The Cocoa Plantation

Environmental conditions and cultivation practices strongly influence disease development in cacao plantations. Differences in field management intensity, particularly between intensive and non-intensive systems, often result in contrasting levels of disease severity. Based on observations conducted on two cocoa plantations at Klewonah Village, Banjarharjo District, Kalibawang, Kulon Progo Regency, disease severity in cacao plants showed distinct differences between intensively and non-intensively managed fields across two periods. Figure 1 shows the disease severity during two observation periods, under intensive and non-intensive conditions. In the first observation period (15–30 June 2025), disease severity in the intensive field increased gradually from about 10% to nearly 28%.

In contrast, the non-intensive field showed higher severity, starting at around 55% and increasing to about 65% by the end of the period. During the second observation period (August 14–September 3, 2025), the pattern was different. Disease severity under intensive management increased steadily from 6% to about 24%, whereas the non-intensive field showed a decline, from nearly 40% at the beginning to around 30% by early September. These observations indicate that non-intensive cultivation is associated with higher initial disease severity, while intensive management tends to suppress disease progression more effectively over time.

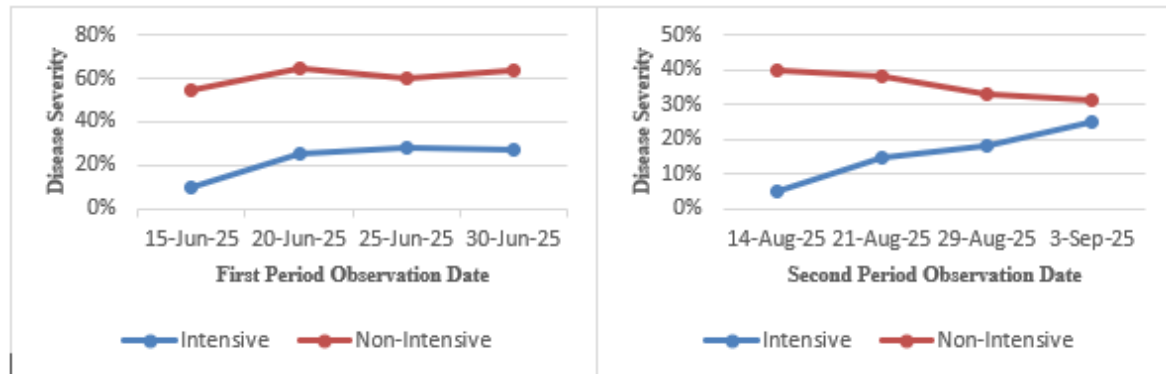


Figure 1. Disease severity at the first and second observation period on intensive and non-intensive

The difference in disease severity between the two plots and observation periods is closely related to the presence of several major cocoa diseases found at the research site. These diseases include Vascular Strike Dieback (VSD), black pod rot, and Cacao Swollen Shoot Virus (CMMV), each of which contributes to the level of damage on both intensive and non-intensive plots.

1. Vascular Strike Dieback (VSD)

Symptom

Vascular Streak Dieback (VSD) is caused by the fungus *Oncobasidium theobromae*. Environmental conditions greatly influence the development of VSD disease. Vascular Streak Dieback (VSD) is spread by wind, and if the spores land on a dry surface, they quickly lose their viability. The disease could potentially reduce yield by approximately 30% to 50% and even cause the death of cacao trees within 2 to 3 years of infection (Ameyaw et al., 2023). Symptoms of VSD infection appear on the second or third leaves from the shoot tip. This fungus is an obligate parasite that infects the vegetative parts of the cocoa plant, specifically its branches and leaves. In more severe infections, it causes tissue death that can spread to the branches. There are 2 or 3 black spots at the base of the leaf (Figure 2D) (Hamdi & Lakani, 2021). Symptoms of the disease include yellowing up to the tip of the branch, with three brown spots visible at the leaf scar (Figure 2A). On branches or twigs, when cut transversely, brownish lines are found in the xylem tissue (Figure 2C), due to the death of the vascular tissue. Lenticels on infected trees typically enlarge, causing the bark to become rough and scaly. Sometimes numerous shoots develop but fail to grow (Harni et al., 2017). Advanced symptoms include leaf drop, bare branches, and dead tips (Trisno et al., 2016).

Control

Infected plants will wither and eventually die slowly. Proper spacing of shade trees or protective plants is crucial in reducing the spread of VSD and maintaining healthy cocoa plant growth. For existing cocoa plants in the field, protective plants should be pruned at the beginning of the rainy season. For new cocoa plants to be planted in open areas, protective plants should be planted one year before cocoa is planted (Harni et al., 2017).

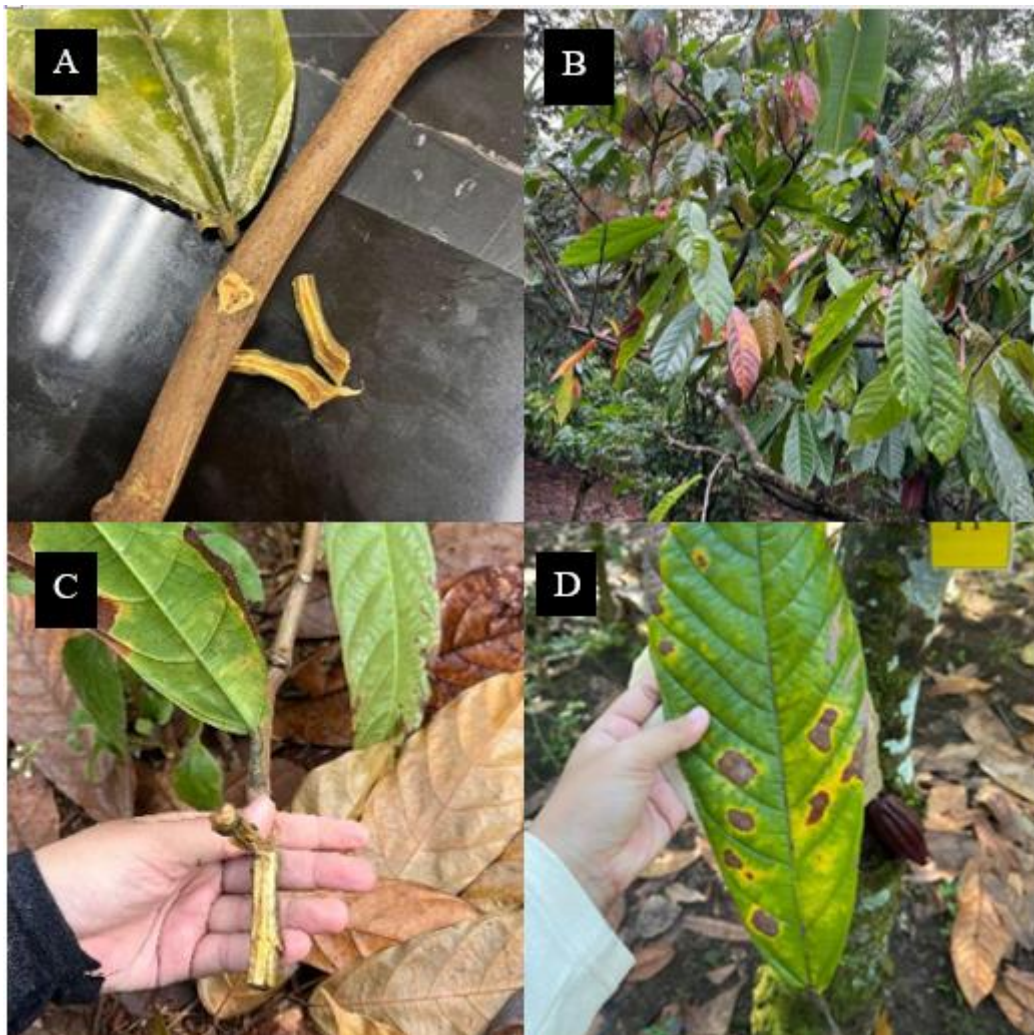


Figure 2. Symptoms of Vascular Strike Dieback in cocoa field.

A = 3 black spots at the base of the leaf. B = infected plant. C = brownish lines in the xylem tissue. D = black spots of the leaf

2. Black Pods Rot

Symptom

Black pod rot disease is caused by the fungus *Phytophthora palmivora* Butl. The pathogen *P. palmivora* in cocoa plants can result in production losses ranging from 10% to 90% (Sangadji et al., 2023). Symptoms of black pod rot include the appearance of black spots on the outer skin of the fruit (Figure 3A). These black spots will spread to cover the entire fruit skin if not controlled. Symptoms appear on fruits of various ages, from small fruits to those nearing maturity. The fruit color changes to dark brown, starting from the tip or near the fruit stem. The fruit eventually turns black and is often covered with white secondary fungi (Defitri, 2017).

Control

Fruit rot disease can attack all stages of fruit development, from the bud stage to the ripening stage. Fruit affected by fruit rot disease will appear charcoal black and feel wet and rotten when touched. If the affected fruit is young, the cocoa fruit will not develop or rot. However, if the affected

fruit is mature or nearly ripe, the fruit can still be harvested, but the seed quality will be poor. This disease can spread from one infected fruit to others through various means, such as direct contact between fruits, water splashes, animals (ants or squirrels), or even wind. The spread of fruit rot will be faster if the plantation is too humid, as the *P. palmivora* fungus can thrive in humid areas (Defitri, 2017).



Figure 3. Symptoms of Black pods rot in cocoa field.

A = Symptoms on cocoa pod. B = Symptoms of Cocoa Pod Rot on the Lower Trunk of the Cocoa Tree

3. Cocoa Swollen Shoot Virus

Symptom

Cacao swollen shoot virus is transmitted semi-persistently by several species of mealybugs (*Pseudococcidae*, *Hemiptera*) on cacao. In infected plants, the pod surface appears wrinkled and shows necrosis. When the pod is split open, the seeds are blackened and often adhere to each other. The presence of swelling on the cacao stem can also identify cacao plants infected with the virus. Symptoms on the leaves include a mosaic pattern, characterized by circular grooves that resemble chicken feathers (Probawati et al., 2020).

Control

This mosaic disease is known to spread through propagation techniques such as side grafting as well as through seeds (Probawati et al., 2020). The prevention and control of CSSVD can be achieved through field sanitation, which involves removing infected trees along with their surrounding plants and cutting down or destroying infected plants. Management of CSSV can also involve removing two adjacent rows of plants to prevent further spreading. Additionally, strict quarantine and sanitation practices are crucial for minimizing the risk of CSSV infection (Suwanto, 2014).



Figure 4. Symptoms of Cocoa Swollen Shoot Virus in cocoa field

Cocoa Control Management

In Kalibawang District, Kulon Progo Regency, most cocoa plants are more than 20 years old and are becoming increasingly susceptible to pests and diseases, which is followed by a decline in soil fertility that impacts land productivity. Therefore, a revitalization program for cocoa development is needed, accompanied by effective pest and disease management. Revitalization can be carried out through two approaches, including intensification and extensification. Intensification focuses on optimizing existing land by implementing cocoa farm sanitation, pruning, fertilization, and controlling pests and diseases. Meanwhile, extensification is achieved by expanding cocoa cultivation to previously unused potential land (Halim et al., 2024).

To support cocoa plant revitalization, integrated pest and disease management is required. Several methods can be applied, including pruning of infected plant parts to improve sunlight penetration and increase the microclimate temperature around the plants. Sanitation, which involves removing plant debris and infected fruits from the field, and physical control, which involves applying smoke treatment at the plant base to reduce pest and disease development. In addition, fruit bagging or wrapping young fruits prevents pest and disease attacks. Chemical control may also be employed through the careful and wise application of insecticides to prevent pest resurgence and resistance (Halim et al., 2024).

CONCLUSIONS

Major diseases affecting cocoa plantations in Kulon Progo Regency include Vascular Streak Dieback (VSD), black pod rot, and Cacao Swollen Shoot Virus (CSSV). The intensity of cultivation practices strongly influenced the severity and progression of these diseases. Fields managed with intensive practices, such as regular pruning, sanitation, and fertilization, demonstrated lower levels of disease severity compared to non-intensive fields. These findings underscore the importance of implementing Good Agricultural Practices (GAPs) to reduce the incidence of pathogenic infections and promote sustainable cocoa production.

LIMITATIONS & FURTHER RESEARCH

Further research is recommended to evaluate integrated disease management strategies that

combine cultural, biological, and chemical approaches, as well as to explore the genetic resistance of local cocoa varieties. Such studies will strengthen long-term solutions for improving both productivity and resilience of cocoa farming systems in Kulon Progo and other cocoa-producing regions.

REFERENCES

- Ameyaw, G. A., Domfeh, O., & Gyamera, E. (2023). Epidemiology and Diagnostics of Cacao Swollen Shoot Disease in Ghana: Past Research Achievements and Knowledge Gaps to Guide Future Research. *Viruses*, 16(1), 43. <https://doi.org/10.3390/v16010043>
- Ariningsih, E., Purba, H. J., Sinuraya, J. F., Septanti, K. S., & Suharyono, S. (2021). Permasalahan dan Strategi Peningkatan Produksi dan Mutu Kakao Indonesia. *Analisis Kebijakan Pertanian*, 19(1), 89–108. <https://doi.org/10.21082/akp.v19n1.2021.89-108>
- Badan Pusat Statistik. (2023). *Statistik Kakao Indonesia 2023*. <https://www.bps.go.id/publication/2024/11/29/ed255af0c9059f288fb7e1de/statistik-kakao-indonesia-2023.html>
- Defitri, Y. (2017). Intensitas Beberapa Penyakit Utama Pada Tanaman Kakao (*Theobroma cacao* L.) di Desa Betung Kecamatan Kumpeh Ilir. *Jurnal Media Pertanian*, 4(2), 81–87. <http://dx.doi.org/10.33087/jagro.v4i2.86>
- Halim, R., Satrah, V. N., & Amiruddin, T. (2024). Penyuluhan Pengendalian Hama Penyakit Tanaman Kakao Pada Kelompok Tani Desa Totallang Kabupaten Kolaka Utara. *Jurnal Pengabdian Masyarakat Indonesia (JPMI)*, 4(3), 445–449. <https://doi.org/10.52436/1.jpmi.2466>
- Hamdi, I., & Lakani, I. (2021). Tingkat Keparahan Penyakit Vascular Streak Dieback (*Ceratobasidium Theobromae*) pada Tanaman Kakao (*Theobroma Cacao* L.) Setelah Pemberian Perlakuan Infus Akar. *Agrotekbis: Jurnal Ilmu Pertanian (E-Journal)*, 9(1), 188–196. <https://doi.org/10.47387/agrotekbis.v9i1.423>
- Harni, R., Amaria, W., Syafaruddin, S., & Mahsunah, A. H. (2017). Potential of *Trichoderma* spp. Secondary Metabolite in Controlling Vascular Streak Dieback (VSD) on Cacao Seedlings. *Journal of Industrial and Beverage Crops*, 4(2), 57–66. <https://doi.org/10.21082/jtidp.v4n2.2017.p57-66>
- International Cocoa Organization. (2019). *ICCO Quarterly Bulletin of Cocoa Statistics*, 45(3), Cocoa year 2018/2019. Abidjan, Côte d'Ivoire: International Cocoa Organization. <https://www.icco.org/app/statistics/>
- Matitaputty, A., Amanupunyo, H. R. D., & Rumahlewang, W. (2014). Kerusakan Tanaman Kakao (*Theobroma Cacao* L.) Akibat Penyakit Penting di Kecamatan Taniwel Kabupaten Seram Bagian Barat. *Jurnal Budidaya Pertanian*, 10(1), 6–9. <https://doi.org/10.30598/jbp.2014.10.1.6>
- Ndamung, E. P., Pekuwali, A. A., & Abineno, R. T. (2023). Optimasi Segmentasi Citra Daun Padi dengan Metode Thresholding Dalam Identifikasi Penyakit. *Jurnal Inovatif*, 2(3), 197–209. <https://doi.org/10.58300/inovatif-wira-wacana.v2i3.700>
- Probowati, W., Firyalunfah, P. R., & Wulansari, W. (2020). Formulasi Pupuk Cair *Pseudomonas Fluorescens* Sebagai Agensi Pengendali Hayati Penyakit Mosaik Tanaman Kakao. *Jurnal Ilmu Pertanian Tropika dan Subtropika*, 5(2), 56–60. <https://doi.org/10.35941/jipts.v5i2.212>
- Purba, L. S., & Sari, W. K. (2021). Karakteristik Budidaya Kakao (*Theobroma Cacao* L.) Pada Perkebunan Rakyat di Kecamatan Timpeh Kabupaten Dharma Raya. *Jurnal Riset Perkebunan*, 2(1), 40–54. <https://doi.org/10.25077/jrp.2.1.40-54.2021>
- Rohmando, A., & Hartini, H. (2024). Pengaruh Intensitas Serangan Penyakit Busuk Buah Kakao (*Phytophthora Palmivora* Bult) Terhadap Kehilangan Hasil Kakao di Kecamatan Palolo Sulawesi Tengah. *Prosiding Seminar Nasional Pembangunan dan Pendidikan Vokasi Pertanian*, 5(1), 1255–1261. <https://doi.org/10.47687/snppvp.v5i1.1197>

- Sangadji, N., Lihawa, M., Husain, I., & Iswati, R. (2023). Efektivitas Arang Tempurung Untuk Mengendalikan Penyakit Kanker Batang Kakao (*Phytophthora palmivora*). *Jurnal Agroteknotropika*, 12(1), 34–42. <https://ejurnal.ung.ac.id/index.php/JATT/article/view/21853>
- Sari, P., Utari, E., Praptiningsih, Y., & Maryanto. (2015). Karakteristik Kimia-Sensori dan Stabilitas Polifenol Minuman Cokelat-Rempah. *Jurnal Agroteknologi*, 9(1), 54–66. <https://doi.org/10.21107/agroteknologi.v9i1.2184>
- Siregar, T. H. S., Riyadi, S., & Nuraeni, L. (2021). *Panduan Praktis Budidaya Kakao*. Jakarta: Penebar Swadaya.
- Susilo, A. W. (2012). ICCRI 06H, Hibrida Unggul Kakao Tahan Penyakit Pembuluh Kayu (Vascular Streak Dieback). *Warta Pusat Penelitian Kopi dan Kakao Indonesia*, 24, 1–4. <https://doi.org/10.22302/iccri.wartappki.v24i1.13>
- Suwarto. (2014). *Top 15 tanaman perkebunan*. Jakarta: Penebar Swadaya.
- Trisno, J., Reflin, R., & Martinius, M. (2016). Vascular streak dieback: Penyakit Baru Tanaman Kakao di Sumatera Barat. *Jurnal Fitopatologi Indonesia*, 12(4), 142–142. <https://doi.org/10.14692/jfi.12.4.142>
- Wahyuni, S., & Ndewes, M. E. (2023). Peningkatan Kapasitas Petani Untuk Menghasilkan Biji Kakao Premium Melalui Teknologi Good Agricultural Practice. *JMM (Jurnal Masyarakat Mandiri)*, 7(1), 306–316. <https://doi.org/10.31764/jmm.v7i1.13245>