

Oil palm-cattle integration: farmer perception of Ganoderma infection

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Abstract. Oil Palm- cattle integration is part of the government initiatives to supply the huge demand for beef in Indonesia. It also maximizes land usage to raise farmer productivity and profitability. The issue of cattle in oil palm could spread Ganoderma disease influencing the deployment of oil palm-cattle integration. The purpose of this study is to assess farmers' perception of cases of Ganoderma infection in oil palm plantations. The research was conducted in 6 districts of Bengkulu province (Bengkulu City, Seluma, Central Bengkulu, North Bengkulu, Muko-muko, and Kaur). The study's target group included male and female heads of rural agricultural households either practicing integrated oil palm-cattle systems (IOPCS) or not practicing IOPCS. In-person interviews were conducted with all respondents using a standardized questionnaire to collect data. The findings indicated that although farmers perceive several potential benefits from integrating cattle into oil palm plantations, they also confront challenges concerning security, finance, knowledge, feed availability, and disease in the cattle. In addition, many farmers were failing to recognize that their farms were contaminated with Ganoderma. Only a few respondents thought there was a link between Ganoderma infection and cattle integrated in oil palm. In this study, we will also discuss the relationship between farmer education level and their knowledge about Ganoderma infection and also compare the incidence of Ganoderma infection in IOPCS and non-IOPCS based on farmer perception.

1 Introduction

As the world's leading producer of palm oil, Indonesia continues to be one of the most advanced plantation crops [1]. This plant is frequently advocated as a means of promoting rural development and reducing poverty [1]. Palm oil production in Indonesia can meet food and non-food needs and contributes 59 percent to the world market share ([2]; Suryantini and Wulandari 2018). Oil palm land also has a very large contribution to the development of livestock, especially ruminants because plants growing beneath the canopy are a potential source of feed and also suitable for grazing [4][5]. The integrated system of cattle palm is not only beneficial for livestock because of the availability of feed, but the integrated system also

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has a considerable contribution to lower wedding expenses because cattle can be used as 'bio lawn mowers' and also improved soil quality due to manure return [6]. [7].

However, the program had two main concerns (1) whether it can boost oil palm output and farmer income, and (2) whether it poses a significant risk of destroying Indonesia's oil palm plantations because of the possibility of rapid livestock in the integrated system distribution of *Ganoderma* [8]. In other words, the implementation of the oil palm cattle integration system experienced another obstacle due to farmers' concerns about the alleged spread of basal stem rot disease (Basal Stem Rot)/BSR which is suspected to be spread from stepping on cow feet or cow feces. The incidence of *Ganoderma* infection due to the integration of cattle in oil palm plantations was also a hot topic at the FAO Inception Meeting TCP/RAS/3507 Building Policy Capacity Towards Sustainable Livestock Development Bangkok, Thailand in 2015 (Soedjana 2015). *G. boninense* has been identified as the fungus responsible for BSR on oil palm in Indonesia. In the provinces of North Sumatra, Riau, and Lampung, the BSR disease infestation has reached 20%–30%. Both the yield and the quantity of FFB were decreased by the illness. About 40% of the provinces' crop yield was lost to disease, particularly in places with more recent plantings or third-generation plantations. In the 25-year-old oil palm crops plantation, up to 85% of the oil palm population perished due to BSR illness.[8]. BSR disease caused by *Ganoderma boninense* has resulted in a decrease in the production of up to 50% and oil palm mortality [10]. Another investigation. Was also reported that the integration of oil palm cattle in oil palm plantations is suspected of spreading *Ganoderma* disease.

Thus far, there has been insufficient information released to determine whether there is a relationship between BSR and integrated oil palm-cattle systems and the occurrence of BSR. Therefore, farmers' perceptions of BSR are crucial since the farmer has the primary responsibility for guaranteeing the condition of oil palm. This study aims to assess farmers' perception of cases of *Ganoderma* infection (Basal Stem Rot) in smallholder oil palm plantations in Bengkulu. The constraints of oil palm farmers not implementing integrated oil palm-cattle systems (IOPCS) production in oil palm plantations will be highlighted.

2 MATERIALS AND METHODS

The study was conducted in 6 districts of Bengkulu-Sumatera, those are 6 districts namely Kota Bengkulu, Bengkulu Tengah, Seluma, Bengkulu Selatan, Muko-muko, and Kaur. The study was conducted from 4 May- 10 June 2024. The criteria used to choose the respondents are farmers who practice IOPCS or do not practise IOPCS independently. Respondents were chosen from 128 randomly selected smallholders; 66 practising IOPCS, and 62 farmers not practising IOPCS. The interview was conducted using a pre-arranged list of open-ended and closed-ended questions covering general information on gender, age, education, occupation, and oil palm land ownership. Respondents then participants were then asked about their perception of the existence of *Ganoderma* sp in their oil palms, the number of infected oil palms, the symptoms of Basal Stem Rot (BSR), the role of cattle-transferred *Ganoderma* and the effect of disease on the oil palm. Meanwhile, secondary data was obtained from the literature or references related to this research. Data were

3 RESULTS AND DISCUSSION

Table 1 revealed that more than 50% of farmers practicing integrated oil palm-cattle systems IOPCS. Oil palm-cattle integration has been implemented in Bengkulu Indonesia since 2003. Initially, these systems are driven by policies that aim to improve food security and raise

farmer incomes. The percentage of females involved in practicing IOPCS is 37%, this result was quite high compared with the other finding

Table 1. Socio-demographic of respondents.

Variables	Practising IOPCS		Not- practicing IOPCS	
	Number	Percentage	Number	Percentage
Respondents	66	51.56	62	48.44
Gender				
Female	25.0	37.9	17.0	27.4
Male	41.0	62.1	45.0	72.6
Age (years)				
<25	4.0	6.1	3.0	4.8
25-40	11.0	16.7	19.0	30.6
41-50	22.0	33.3	17.0	27.4
51-60	15.0	22.7	15.0	24.2
> 61	14.0	21.2	8.0	12.9
Education level				
Basic	25.0	37.9	17.0	27.4
Secondary	8.0	12.1	6.0	9.7
High School	25.0	37.9	31.0	50.0
University	8.0	12.1	8.0	12.9

There are relatively few young people working in the agricultural sector. It could be because agriculture is still seen as a secondary sector compared to other businesses like manufacturing, trade, and government. The study's respondents' ages nearly fall into productive age categories since respondents' ages affect production [11] state than the productive-age population (those between the ages of 15 and 64). This indicates that the respondents can sustainably engage in farming. The majority of responders have completed high school, suggesting that the government's 12-year mandatory education program is effective [12]. The farmers with higher levels of education were more conscious of their issues and employed innovative methods to address them [13].

Table 2. Land ownership and oil palm age.

Variables	Practising IOPCS		Not- practicing IOPCS	
	Number	Percentage	Number	Percentage
Land ownership				
<1	27.0	40.9	30.0	48.4
1-2	19.0	28.8	16.0	25.8
3-4	10.0	15.2	6.0	9.7
4-5	4.0	6.1	6.0	9.7
5-6	4.0	6.1	1.0	1.6
>6	2.0	3.0	3.0	4.8
Oil palm age				
<14 year	48.0	72.7	40.0	64.5
>14 years	18.0	27.3	22.0	35.5

Table 2 More than forty percent of farmers occupy less than 1 hectare of oil palm plantation. [2] state that even though Indonesia is the largest oil palm-producing country, smallholder plots account for 40% of the total crop area and often as little as 1–2 hectares for food security and economic well-being. According to [14]. About 25% of Indonesia's oil palm farms are run by independent, small-scale, individual farmers who are not connected to any corporations.

Table 3. Farmer’s perception about Ganoderma infection.

Variables		Percentage			
		Yes	No	Not Sure	Don’t know
Have you ever seen the Ganoderma infection on the palm	IOPCS	36.36	7.58	56.06	0.00
	Non-IOPCS	41.94	6.45	50.00	1.61
Do you know any symptoms of the disease	IOPCS	10.61	31.82	10.61	46.97
	Non- IOPCS	8.06	22.58	19.35	50.00
Do you think BSR is a threatening disease in oil palm	IOPCS	24.24	15.15	12.12	48.48
	Non-OPCS	16.13	6.45	16.13	61.30
Do you think that the disease transferred from cattle to palm??	IOPCS	10.61	31.82	10.61	46.97
	Non-IOPCS	8.06	22.58	19.35	50.00

Based on farmer perception 36.36% (IOPCS) and 41.94% (Not-IOPCS) farmers believe that the oil palm was infected with Ganoderma, nevertheless, almost half were unsure. Based on Table 2, the percentage of oil palms infected with Ganoderma In North Sumatra, Riau, and Lampung provinces, the BSR disease infection has reached 20% to 30% [8]. The Basal Stem Rot disease caused by Ganoderma boninense can affect up to 50 % of oil palms and it causes both palm mortality and a sharp decline in production [15].

Only about 8.06-10.61 % of farmers recognize and know the symptoms of BSR, according to the farmers the symptoms of BSR are yellowing leaves, wilting leaves, and dead branches. The symptoms of BSR a "skirt-like" crown shape, a high percentage of unopened spear leaves, and severe drying of the lowest leaf portion are typical foliar signs of infected trees. Along with these other changes, the leaves become pale yellow, develop chlorotic and necrotic tips, and become shorter with wilting green fronds [16]. [17].

According to our analysis, 46.96–50% of farmers were unaware that BSR is now a serious illness that threatens oil palm production and results in significant financial losses. [8] said that the BSR has been reported to attack all stages of oil palm and is well-known as a silent killer. Furthermore, when it comes to the subject of how livestock transmits the BSR, 8– 10% of farmers are certain that cattle play a significant role in the illness's spread, 22.58% of cattle did not spread the disease, and 46.97–50% of farmers were unsure of how the disease spreads.

Table 4. The correlation between Ganoderma infection based on farmer perception of the age of oil palm and the implementation of IOPCS.

		Ganoderma	Age of oil palm	IOPCS-Not IOPCS
Ganoderma	Pearson Correlation	1.00	-0.06	0.02
	Sig. (2-tailed)		0.50	0.84
Age of oil palm	Pearson Correlation	-0.06	1.00	0.12
	Sig. (2-tailed)	0.50		0.19
IOPCS-Not IOPCS	Pearson Correlation	0.02	0.12	1.00
	Sig. (2-tailed)	0.84	0.19	

Our findings showed no correlation between the age of oil palm on the existence of Ganoderma. According to [8] Ganoderma attacks either the old crops or the young crops. Mature palms often take two to three years to die from infection, whereas young palms typically die six to twenty-four months after these symptoms first occur [17].

4 Conclusion

Based on farmer perception the percentage of the existence of Ganoderma is almost similar to either IOPCS or Not IOPCS. About 8-10% of farmers' perception sure that cattle can

transfer the *Ganoderma* to palm. Educating farmers influences the understanding of *Ganoderma* infection.

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References

1. Sulaiman, A.A., A. Amiruddin, A. H. Bahrin, K. Yuna, and M. Keela. 2024. New Challenges and Opportunities of Indonesian Crude Palm Oil in International Trade," *Caraka Tani J. Sustain. Agric.* 39 (1): 94, 2024, doi: 10.20961/carakatan.v39i1.81957.
2. Murphy, D. J., K. Goggin, and R. R. M. Paterson. 2021. Oil palm in the 2020s and beyond: challenges and solutions," *CABI Agriculture and Bioscience*, vol. 2, no. 1. *BioMed Central*, pp. 1–22, doi: 10.1186/s43170-021-00058-3.
3. Suryantini, R. and R. S. Wulandari. 2018. Diversity of *Ganoderma* pathogen in Pontianak, West Kalimantan: Characteristics, virulence, and ability to infect *Acacia mangium* seedlings," *Biodiversitas*. 19(2):465–471. doi: 10.13057/biodiv/d190213.
4. Henuk, Y.L., Hasnudi, Yunilas, N. Ginting, E. Mirwandhon, Hasanuddin, J. Ginting, D. Bakti, Rosmayati, E. Purba, H. Hafid, and M. M. J. Kapa. 2018. "The integrated farming systems between cattle and oil palm plantation in Indonesia," in 17th ADRI International Conference, September 2018.
5. Nobilly, F., S.N. Atikah, M. S. Yahya, S. Jusoh, G. S. Cun, A. R. Norhisham, K. A. Tohiran, R. Zulkifli and B. Azhar. 2022. Rotational cattle grazing improves understory vegetation biodiversity and structural complexity in oil palm plantations, 2022. *Weed Biol. Manag.*, vol. 22, no. 1, pp. 13–26, 2022, doi: 10.1111/wbm.12246.
6. Bremer, J.A., L. A. Lobry de Bruyn, R. G. B. Smith, W. Darsono, T. D. Soedjana, and F. C. Cowley. 2022. Prospects and problems: considerations for smallholder cattle grazing in oil palm plantations in South Kalimantan, Indonesia," *Agrofor. Syst.*, vol. 96, no. 7, pp. 1023–1037, 2022, doi: 10.1007/s10457-022-00759-2.
7. Grinnell, N. A., A. Van Der Linden, B. Azhar, and F. Nobilly. 2022. Cattle-oil palm integration – A viable strategy to increase Malaysian beef self-sufficiency and palm oil sustainability. *Livestock Science* 259:1-14.
8. Soetopo, D., D. Manohara, S. Wulandari, F. Djufry, and S. Syafaruddin, 2022. *Ganoderma* Diseases On Oil Palm, Factors And Vectors Dispersal And Its Control Strategy Development. *Perspektif*, vol. 21, no. 1, p. 1, 2022, doi: 10.21082/psp.v21n1.2022.1-17.
9. Soedjana, T. D. 2015. Policy Issue (1): Promoting Beef Cattle-Palm Oil Integration System Map of Indonesia," in *FAO Inception Meeting TCP/RAS/3507 Building Policy Capacity Towards Sustainable Livestock Development Bangkok, Thailand, 7-8 April 2015*, 2015, no. April, pp. 7–8.
10. Khoo Y. W. and K. P. Chong. 2023. *Ganoderma boninense*: general characteristics of pathogenicity and methods of control," *Front. Plant Sci.*, vol. 14, no. July, pp. 1–17, 2023, doi: 10.3389/fpls.2023.1156869.
11. Muhyiddin, M., S. A. Trisnantari, M. D. R. Amrizal, F. Fauwziyah, R. I. P. Harsiwie, and N. R. Ardhana. 2024. *Indonesia Employment in 2023: Labor Force Conditions and Policy*

- Developments in the Early Stages of the Demographic Bonus,” *J. Ketenagakerjaan*, vol. 19, no. 1, pp. 1–16. doi: 10.47198/jnaker.v19i1.339.
12. Kemendikbud RI. 2020. Kementerian Pendidikan dan Kebudayaan » Republik Indonesia. [Online]. Available: <https://www.kemdikbud.go.id/main/blog/2020/11/pemerintah-daerah-diberikan-kewenangan-penuh-tentukan-izin-pembelajaran-tatap-muka>.
 13. Farooq, M., A. Ashraf, S. Ullah, M. Israr, Neelum, S.W. Khattak, and I. Ghaffoor. 2021. The role of formal education in farm productivity and farmer’s socio-economic development in district SWAT,” *Multicult. Educ.*, vol. 7, no. 9, pp. 52–57, 2021, doi: 10.5281/zenodo.5368413.
 14. Abubakar, A and M. Y. Ishak. 2023. An Overview of the Role of Smallholders in Oil Palm Production Systems An Overview of the Role of Smallholders in Oil Palm Production Systems in Changing Climate,doi: 10.46488/NEPT.2022.v21i05.004.
 15. Mercière, M., R. Boulord, C. Carasco-Lacombe, C. Klopp Yang-Ping Lee, Joon-Sheong Tan , S. S.R. Syed Alwe, A. Zaremski, H. De Franqueville , F. Breton, L. amus-Kulandaivelu. 2017. About *Ganoderma boninense* in oil palm plantations of Sumatra and peninsular Malaysia: Ancient population expansion, extensive gene flow and large scale dispersion ability,” *Fungal Biology*, vol. 121, no. 6–7. pp. 529–540, 2017, doi: 10.1016/j.funbio.2017.01.001
 16. Azuan, N. H., S. Khairunniza-Bejo, A. F. Abdullah, M. S. M. Kassim, and D. Ahmad. 2019. Analysis of Changes in Oil Palm Canopy Architecture from Basal Stem Rot Using Terrestrial Laser Scanner,” *Plant Dis.*, vol. 103, no. 12, pp. 3218–3225. doi: 10.1094/PDIS-10-18-1721-RE.
 17. Naher, L., U. K. Yusuf, A. Ismail, S. G. Tan, and M. M. A. Mondal. 2013. Ecological status of *Ganoderma* and basal stem rot disease of oil palm s (*Elaeis guineensis* Jacq.),” *Aust. J. Crop Sci.*, vol. 7, no. 11, pp. 1723–1727, 2013.