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Management of Cocoa Plant Pests & Diseases in East Luwu Regency

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ABSTRACT

East Luwu Regency is one of South Sulawesi's regencies with potential in the plantation sector, especially cocoa plants, with a production of 12,250 tons/year. Cocoa productivity has yet to be achieved optimally due to the lack of care and maintenance carried out by farmers, which increases the intensity of pest & disease attacks. This study evaluates farmers' knowledge, attitudes, and actions in managing cocoa plants and plant pathogens in East Luwu Regency. This study was conducted through direct interviews using a structured questionnaire sent to 50 farmers in Burau and Wotu Districts, East Luwu Regency. Respondents were selected purposively, considering that they were easy to find and the location of the plantation was easy to reach. Data are presented in tabular, graphical, and descriptive forms in Microsoft Excel to explain the relationship between farmers' knowledge, attitudes, and actions in managing cocoa VSD disease. The results showed that most of the respondent were active farmer groups. Pests & diseases are problems farmers face in cocoa cultivation. Most farmers used the MCC 02 clone, and the planting distance was 3×3 m. The diseases most commonly found in farmers' cocoa fields include VSD, fruit rot, upas fungus, and stem cancer. Pest & disease control was done through chemical pesticides and pruning (cultivation techniques). Cocoa farmers in Burau and Wotu Districts routinely carry out pruning to control disease in cocoa fields. Farmers prune cocoa plants to remove diseased branches and stimulate the growth of flowers and fruit.

Keywords: action, attitude, knowledge, questionnaire

INTRODUCTION

Cocoa (*Theobromae cacao* L.) is a plantation commodity that has an important role in the Indonesian economy. The production in Indonesia in 2020 was dominated by People's Plantations by 99.4% while Large Plantations by 0.6%. BPS (2022) noted that the area of cocoa plantations in Indonesia is 1.47 million hectares. Based on its region, Central Sulawesi is the province that has the largest cocoa plantation, with a land area of 273,085 ha. Southeast Sulawesi followed in second place with an area of about 240,106 ha. The area of cocoa plantations in South Sulawesi is 191,423 ha, producing 112,316 tons in 2022. However, this production fluctuated from the previous two years, namely in 2020 of 110,418 tons and in 2021 of 107,075 tons. This shows that the development of cocoa in South Sulawesi still plays an important role in the development of cocoa in Indonesia.

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Improvement of cocoa cultivation techniques will bring significant benefits to the development of cocoa plants. Efficient seedling techniques, efforts to obtain superior planting material, pruning methods, planting spacing, providing cocoa plant nutrition in the form of nutrients, as well as efforts to protect against pests and diseases are directed to obtain an efficient cocoa planting and maintenance period with maximum production (Nasution 2022). The main pests and diseases in cocoa plantations that are often found and interfere with crop metabolism to reduce their productivity are *Helopeltis* sp. (Hemiptera: Miridae), *Conopomorpha cramerella* (Lepidoptera: Gracillariidae), *Zeuzera* sp. (Lepidoptera: Cossidae), the fungus *Ceratobasidium theobromae* (syn *Oncobasidium theobromae*), and the fungus *Phytophthora* sp.

In 1989, VSD symptoms were first reported in Kolaka (Southeast Sulawesi), and in 2002, were found in the Polman and Pinrang areas (South Sulawesi). The disease has spread almost throughout Sulawesi (Rosmana 2005). This disease can occur both in the nursery phase, in young plants, and in mature plants (Syarif *et al*. 2016). Currently, cocoa plantations in Indonesia are almost entirely infected by VSD. Symptoms of VSD disease found in old plants, namely, the second and third leaf groups at the growth point, will fall off, so the branches appear empty (twigs). The typical

symptoms of VSD disease are three blackish-brown dots on the petiole of fallen leaves. This pathogen lives in the bundle of wood vessels (xylem), so it can interfere with and reduce the transport of water and nutrients to the leaves (Syatrawati 2017). C*. theobromae* fungus is an obligate parasite that attacks the vegetative parts of branches and leaves; further attacks cause tissue death that can spread to the main branches (Rosmana 2005).

Some of the obstacles in the development of cocoa cultivation are low cocoa productivity, pests & diseases, and a lack of human resources. There are still many cocoa farmers who only know about farming from their parents. Therefore, this study aims to obtain information about farmers' knowledge, attitudes, and actions in cocoa crop management and disease management, especially VSD disease in East Luwu Regency, South Sulawesi.

METHODS

Location and Time of Study

This research was conducted in two districts, Burau and Wotu, in East Luwu Regency, from January to February 2022. Burau District consists of Asana, Batu Putih, Benteng, Jalajja, Lambara, Lambarese, Laro, and Lumbewe Villages. Wotu District consists of Cendana Hijau Village and West Pepuro. The two districts were selected based on the area of the People's Plantation in the district and the differences in the assisted farmer groups. Most cocoa plantations in the Wotu District were under the guidance of the Mars Cocoa Research Station.

Implementation

This study was conducted through direct interviews with up to 50 cocoa growers utilizing a structured questionnaire. Respondent were chosen purposefully based on the ease of discovery and the location of easily accessible cocoa fields. Respondent from each village were chosen based on the fact that they had planted cocoa during the last two years. Each community had between one and four farmers who were asked. The interview with farmers was designed to provide an overview of respondent's knowledge, attitudes, and control activities regarding plant and disease in cocoa plants. The data collected included respondent characteristics (age, education level, land ownership, farming experience and knowledge), cocoa cultivation characteristics (cultivated land area, plant age, planting distance, planting pattern, fertilization, fertilization interval, and fertilizer dose), plant and disease management in cocoa fields, knowledge, attitudes, and actions in managing the pests and diseases.

The data is given in Microsoft Excel as tabulations, graphs, and descriptive text to explain the relationship between farmers' knowledge, attitudes, and actions in the control of cocoa VSD disease.

RESULTS AND DISCUSSION

General Conditions of Cocoa Fields in East Luwu Regency

Geographically, East Luwu Regency is at 2°03'00''-3°03'25''S and 119°28'56''-121°47'27''E (Figure 1). Topographic conditions affect the aspect of land use in

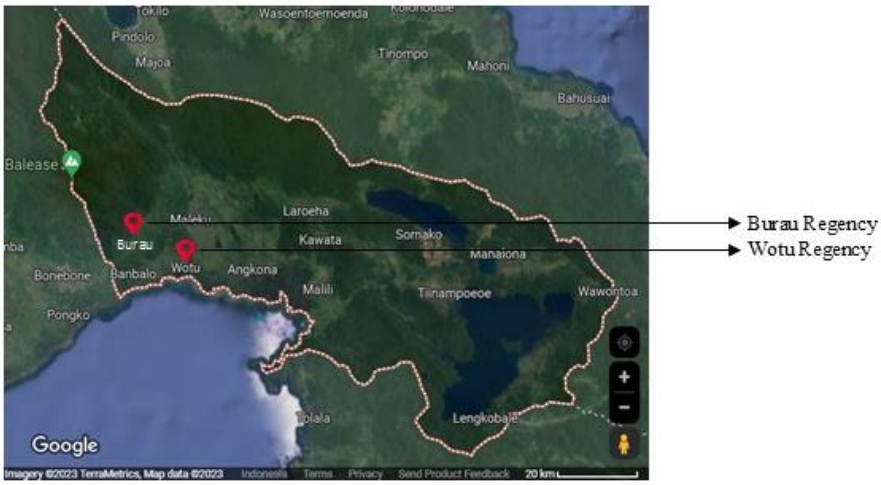

Figure 1 Satellite images of research locations in Burau and Wotu Districts, East Luwu Regency, South Sulawesi via *Google Earth.*

the regency. Most of the area is mountainous, and some places are lowland to swampy areas. Flat-to-sloping conditions have areas with the widest districts, Burau and Wotu. The region's cocoa land area is around 27,821.49 ha, producing 11,895.77 tons/year.

Characteristics of Farmers

The characteristics of cocoa farmers in East Luwu Regency were observed in terms of age, education level, cocoa cultivated area, land ownership status, farming duration, and farming knowledge. Cocoa farmers in both districts were dominated by the age range of 40−60 years, with the percentages of those aged 52.17% and 40.17%, respectively. According to Heri and Maulana (2009), the older the individual, the more mature the level and strength of the individual will be in thinking and working. The education level of respondent in Burau and Wotu Districts was a senior high/vocational school. The level of education affects the absorption of the information obtained. The higher the education of farmers, the easier it is to absorb information related to innovation, technology and extension provided (Effendi 2020).

The cultivated area of cocoa farmers in Burau and Wotu Districts was diverse, ranging from 2,000 to 60,000 m^2. Most farmers cultivated cocoa plants on 7,000 to 10,000 m^2. The majority of farming experience in Burau District was 10−20 years, with a percentage of 43.48% of the total respondents. In comparison, farming experience in Wotu District was still less than 10 years, with a percentage of 37.04%. It shows that farmer regeneration takes place every year. According to Heri and Maulana (2009), the farming experience can be used to evaluate and consider in cultivation actions. Farmers' personal experiences are used to gain knowledge by repeating experiences that have occurred and solving the problems faced.

The level of participation of respondent in the combined farmer groups was almost the same in each district. Farmer participation in farmer group activities in Burau District was 69.57%, and Wotu District was 70.37%. Several farmers who joined the farmer group explained that cocoa cultivation knowledge was generally obtained from their own experience, field agricultural extension workers, and hereditary from parents. Farmer group activities have also not run as they should because socialization from agricultural extension workers has not been evenly distributed in each district, and these activities are only held at certain times. More information and knowledge about cultivation needs to be provided by some members of farmer groups (Table 1).

Table 1 Characteristics of cocoa farmers in Burau and Wotu Districts, South Sulawesi, Indonesia

Farmer identity	Burau		Wotu	
	Number of farmers	%	Number of farmers	%
Age of respondents				
20−40 yr	8	29.63	7	30.43
41−60 yr	11	40.74	12	52.17
>60 yr	8	29.63	4	17.39
Education level				
No schooling	2	7.41	6	26.09
Elementary school	8	29.63	4	17.39
Junior high school	4	14.81	4	17.39
Senior high/vocational school	8	29.63	6	26.09
University	5	18.52	3	13.04
Land area				
< 1/2 ha	7	25.93	8	34.78
1 ha	12	44.44	9	39.13
>1 ha	8	29.63	6	26.09
Farming experience				
2−9 yr	10	37.04	7	30.43
10−20 yr	9	33.33	10	43.48
30−50 yr	8	29.63	6	26.09
Farming knowledge				
Self-study	12	44.44	11	47.83
Parents	6	22.22	5	21.74
Extension workers	9	33.33	7	30.43
Group member				
Yes	19	70.37	16	69.57
No	8	29.63	7	30.43

Characteristics of Cocoa Cultivation

The farmers showed that the cocoa plants cultivated by farmers in the Burau and Wotu Districts consisted of several clones in one plantation land. Cultivated cocoa plants were generally 4–10 years old and enter the productive age (Table 2). Khaerati (2015) reported that the age of cocoa plants is not related to the intensity of VSD disease in the field; this occurs because VSD disease attacks all stages of cocoa plant growth from nursery to productive plants. The farmers cultivated local clones, MCC 01, MCC 02, Sulawesi 1, and Sulawesi 2. The selection of these varied clones was based on the production potential and the combination of compatible male and female flowers, considering that almost all cocoa clones in Indonesia are self-incompatible and resistant to cocoa pests and diseases. Based on the interviews, the potential cocoa bean yield by farmers in Burau and Wotu Districts averages around 1–2 kg of dry beans per year per cocoa plant. Yield loss in VSD-infected plants depends on the severity of the infection and the disease's handling. Cocoa plants infected with VSD can still produce fruit, although the quantity is unlike healthy cocoa plants. According to Ariningsih *et al.* (2021), several superior clones of lindak cocoa, such as Sulawesi 1, Sulawesi 2, MCC 01, and MCC 02 clones, have the potential to yield 1,800–3,670 kg per hectare per year. The resistance of cocoa clones planted by farmers, especially MCC 02, which was the most widely planted, can be said to be moderately susceptible to VSD because East Luwu Regency is an endemic area for VSD

Table 2 Characteristics of cultivation in Burau and Wotu Districts, South Sulawesi, Indonesia

Cultivation	Burau		Wotu	
	Number	%	Number	%
Cocoa clone				
Local	4	9.76	2	4.44
MCC 01	2	4.88	2	4.44
MCC 02	23	56.10	26	57.78
Sulawesi 1	1	2.44	3	6.67
Sulawesi 2	11	26.83	12	26.67
Plant lifespan				
<4 yr	7	25.93	6	26.09
4-5 yr	6	22.22	11	47.83
6-10 yr	9	33.33	3	13.04
>10 yr	5	18.52	3	13.04
Planting pattern				
Monoculture	2	7.41	1	4.35
Polyculture	25	92.59	22	95.65
Planting distance				
2,5×2,5 m	1	3.70	0	0.00
3×3 m	15	55.56	7	30.43
3,5×3,5 m	8	29.63	6	26.09
4×4 m	3	11.11	9	39.13
6×6 m	0	0.00	1	4.35
Fertilization				
Organic fertilizers	14	51.85	15	65.22
Inorganic fertilizer	24	88.89	22	95.65
Liquid fertilizer	4	14.81	5	21.74
Fertilization interval				
1 time/year	5	18.52	1	4.35
2 times/year	17	62.96	13	56.52
3 times/year	2	7.41	6	26.09
4 times/year	3	11.11	3	13.04
Fertilizer dosage				
< 100 kg	2	7.41	4	17.39
100–200 kg	6	22.22	5	21.74
210–300 kg	8	29.63	5	21.74
310–400 kg	3	11.11	1	4.35
410–500 kg	4	14.81	3	13.04
> 500 kg	4	14.81	5	21.74

disease. In addition to various plant clones, cocoa seedlings transplanted to the field were generally planted with a planting distance of 2.5×2.5 m to 6×6 m. The recommended planting distance recommended by farmer groups, as the majority of farmers use, was 3×3 m and 3.5×3.5 m. The selection of planting distance is closely related to the nature of plant growth, the source of planting material, and soil fertility (Syakir 2010).

Some farmers in Burau and Wotu Districts applied organic fertilization (compost, manure, and lime) as essential fertilizers. The majority of farmers also applied further fertilization with inorganic fertilizers (NPK, Phonska, Urea, TSP, and KCl) and liquid fertilizers (liquid NPK, Neo Kristalon, Kristalin, Seprint, Sempurna, and Ecofarming). The fertilization intensity applied by most farmers was 2 times/year at the beginning and end of the rainy season. In comparison, organic fertilizer is applied as a basic fertilizer when cocoa plants are six months to 1 year old (Table 2). Farmers generally fertilize at intervals, and doses are adjusted to the age of the plant. This was done by the farmers based on each farmer's experience and availability of capital without considering the reference to the standard application of fertilization in cocoa cultivation. de-Almeida and Alle (2007) explain that cocoa plants not balanced with fertilization will become more susceptible to pests and diseases. Nevertheless, the problem of fertilization is the main problem for farmers who are not members of the farmer group because of the high demand for fertilizer. However, it needs to be balanced with the availability of adequate fertilizer. According to respondents who did not belong to farmer groups, fertilizer distribution was sometimes prioritized to farmer groups. Farmers who were not members of farmer groups buy it at a fairly high price.

Pest and Disease Management

Pests and diseases found in the Burau District were also found in the Wotu District. These pests and diseases were almost the same as respondents said during the interview. The pest that damages cocoa fields the most was the cocoa fruit borer (*Conopomorpha cramerella* Snellen), which in almost all cocoa fields were found and damaged the fruit. According to Hayata (2017), the PBK pest results in incomplete seed filling, so the seeds are very difficult to separate from the fruit skin and cannot be processed.

Plant diseases suspected to be present in cocoa fields owned by farmers include fruit rot (*Phytophthora palmivora* Butl), upas fungus (*Corticium salmonicolor*), stem cancer (*Phytophthora palmivora*), and VSD (*Ceratobasidium theobromae*). The most destructive disease in farmers' land is VSD 53.57% in the Burau District and 45.45% in the Wotu District (Table 3). VSD disease attacks the leaves and twigs of plants with varying symptoms, including necrosis on the edges and tips of the leaves and twig symptoms with leaf chlorosis accompanied by small green patches. The yellowed leaves finally fall off, and the symptoms of twigs appear (Harni 2019).

Weed management in cocoa plantations of farmers was carried out in two ways: mechanical and chemical. Mechanical control was carried out using a lawn mower or sickle. Weed was chemically managed by spraying weeds with herbicides. Most farmers used herbicides with active ingredients isopropyl amine glyphosate, dimethylamine, paraquat dichloride, and IPA glyphosate + dimethylamine. Khaerati (2015) reported that the high application of herbicides in cocoa fields is suspected to cause plants to become weak and more susceptible to disease attacks on cocoa plants. Puslitkoka (2010) stated that one of the natural ways to solve the problem of weeds on cocoa fields owned by farmers is to place the remaining pruning of cocoa branches on the periphery of cocoa plants.

Maintenance activities play a vital role in increasing cocoa production. One important form of cocoa plant maintenance is pruning, which aims to remove unproductive branches such as water shoots, dry branches, fan branches, and branches that are affected by diseases, especially VSD disease so that the plant's crown can capture sunlight for photosynthesis. The types of pruning carried out in Burau and Wotu Districts are light and heavy. Light pruning was done once a month or every two months, while heavy pruning was usually done at the end of the year. The majority of farmers did light pruning more often than heavy pruning. According to farmers, pruning and sanitation that was performed regularly is a way to control VSD and aims to eliminate diseased twigs or branches by cutting 30 cm below leaf branches with chlorosis symptoms (Puslitkoka 2010). Pruning cocoa plants consists of pruning the shape to maintain the plant skeleton, maintaining pruning to maintain the skeleton and removing diseased branches or branches. Pruning aims to spur the growth of flowers and fruits (Karmawati *et al.* 2010). Then, field sanitation was done by collecting leaf branches that have been pruned to reduce moisture in the field.

Pest & disease was still chemically and mechanically controlled. Farmers' knowledge about the effective use of pesticides was low, and the target still needs to be higher. Most farmers applied pesticides without distinguishing in spraying for pests or diseases on cocoa. Farmers did this to save time, effort, and pest & disease control costs. The intensity of spraying by farmers varies greatly depending on the pest & disease attack. According to the interview, farmers' understanding of pesticides in eradicating pests & diseases was quite different from farmers' tendency to apply pesticides on their land. Farmers carried out spraying 2 times in 1 month. The types and active

Table 3 Pest and disease management on cocoa land by farmers in Burau and Wotu Districts, South Sulawesi, Indonesia

Pest and disease management	Burau		Wotu	
	Number	%	Number	%
Pests on cocoa				
None	2	7.41	1	8.70
PBK	25	92.59	22	95.65
Diseases of cocoa				
Low attack	6	18.18	6	21.43
Fruit rot	4	12.12	3	10.71
Upas mushroom	5	15.15	1	3.57
Stem cancer	3	9.09	3	10.71
VSD	15	45.45	15	53.57
Use of pesticides				
Pest	9	33.33	8	34.78
Disease	3	11.11	5	21.74
Not differentiating	18	66.67	15	65.22
Spraying intervals				
1×1 month	8	29.63	9	39.13
2×1 month	11	40.74	9	39.13
1×2 month	0	0.00	1	4.35
1×3 month	3	11.11	2	8.70
1×6 month	5	18.52	2	8.70
Pesticide mixing				
Yes	7	25.93	7	30.43
No	20	74.07	16	69.57
Weed management				
Herbicide	22	81.48	18	78.26
Mechanical	5	18.52	5	21.7
Prunning				
Light	17	62.96	17	73.91
Heavy	5	18.52	4	17.39
Light and heavy	5	18.52	2	8.70

ingredients farmers used in the two districts were quite diverse. In general, most farmers used insecticides rather than fungicides. There were eight types of active insecticide ingredients and three fungicide active ingredients. The active insecticide ingredients widely used in both districts are Thiametoxam and Lambda Cyhalotrin. In contrast, the active fungicide ingredients used by farmers are Mankozeb, Propineb, and Copper Oxide (Figure 2). According to the Directorate General of Agricultural Infrastructure and Facilities (2016), the types of insecticides allowed and registered in cocoa commodities are 94 trademarks with various active ingredients.

Farmers applied insecticides to suppress relatively high PBK attacks on the land. Generally, farmers start applying insecticides when the fruit has appeared. The chemicals were sprayed on the branches and twigs that have fruit. In addition to spraying, farmers also applied insecticides by smearing on fruits. In addition to the application of insecticides, farmers also applied fungicides. However, the application was still low compared to insecticides on the land. This was because using fungicides is ineffective in controlling diseases caused by fungi, especially VSD in cocoa plants. The *C. theobromae* fungus is an obligate parasitic pathogen that attacks the protected part of the plant, namely the xylem.

Knowledge, Attitudes, and Actions of Farmers towards Pest & Disease

Pests & diseases are some of the obstacles in cocoa cultivation. Many farmers in Burau District still could not distinguish between the terms pests and diseases. It is common to find farmers who consider pests and diseases to be the same terms, only different in their pronunciation. Most farmers also lack knowledge in recognizing VSD disease and explaining its symptoms and causes. In contrast to other control techniques besides pesticides, many farmers had been taught in farmer group counselling on using biological agents such as *Trichoderma*. However, the realization in the field itself was still lacking because farmers still depend on chemical control (Table 4).

Farmers' attitudes were measured through their opinions on the importance of pest & disease control, prioritizing non-chemical control, monitoring, efforts to reduce chemical control and the assumption that the

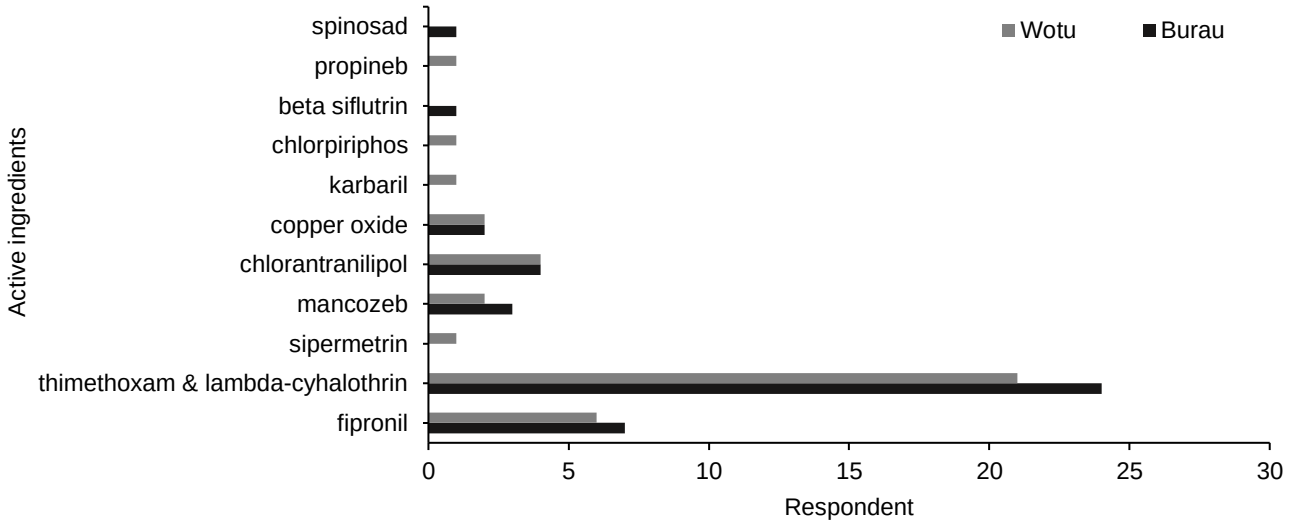

Figure 2 Active ingredients of pesticides used by farmers in Burau and Wotu Districts, South Sulawesi, Indonesia.

Table 4 Proportion of VSD farmers' knowledge in Burau and Wotu Districts

Criteria for farmer knowledge	Burau		Wotu	
	Number of farmers	%	Number of farmers	%
Ability to distinguish pests and diseases				
Yes	15	55.56	10	43.48
No	12	44.44	13	56.52
Know VSD disease/twigs				
Yes	12	44.44	9	39.13
No	15	55.56	14	60.87
Know the symptoms and causes of VSD				
Yes	11	40.74	9	39.13
No	16	59.26	14	60.87
Know other control techniques such as using biological agents				
Yes	17	62.96	11	47.83
No	10	37.04	12	52.17

continuous use of chemical pesticides for an extended period can be detrimental to the sustainability of agricultural practices. The response given by farmers shows that there are many farmers in Burau District who think that pest & disease control was carried out at a particular time only. This is due to the limited time and the size of the land, which is an obstacle. Most farmers in the two districts were not optimal in monitoring the symptoms of pest & disease that arise because, according to farmers, their main job in the field was fertilizing, harvesting, and spraying weeds to eradicate pests & diseases. Some farmers also complained that the field distance from the house was too far, making it difficult to make regular observations. Farmers were also well aware that the continuous use of chemical pesticides on land can harm agricultural businesses. However, most farmers refused to reduce chemical control. Farmers think their pesticide use was influenced by other farmers who have successfully controlled pests & diseases that attack crops.

The main problem in cocoa farming in Burau and Wotu Districts was the existence of pest & disease, which requires farmers to act to solve the problem. Nevertheless, farmers tended to choose practical and fast ways to control it. In plants that show heavy attacks, farmers tended to replant. Sanitation activities carried out by farmers are fruit peel, weed, and pruning residue sanitations (Table 5). The majority of farmers in Burau and Wotu Districts routinely pruned their crops. The rest was done at a particular time because the field is too far, or pruning was carried out during fruit picking.

Pest & disease control using chemicals was carried out by farmers because, according to them, it was more practical and effective. However, farmers ignored the

effect of chemical pesticides that can cause disease-causing pathogens to become resistant. Resistance occurs due to the development of a new generation that is more resistant or resistant to these pathogens. Halimah and Sukamto (2007) stated that chemical actions can negatively impact the environment and fruit quality, so they are less in demand by the market.

Pruning VSD diseased branches promotes the production of new shoots and improves the health of cocoa trees. Guest and Keane (2007) mentioned that the basidiospores *O. theobromae* can survive for up to a week on infected cocoa parts if left unpruned. The practice of pruning for VSD disease is to prevent further spreading to other parts of the tree, as has been widely practised by countries such as Indonesia (Susilo and Sari 2014), Malaysia (Kamil *et al.* 2016), and Papua New Guinea (Marfu *et al.* 2016).

Some farmers' land conditions are attacked by VSD, with symptoms such as chlorosis on the leaves, necrosis, and severe attack, which can cause twig crops (Figure 3). According to the interviews, some farmers thought this symptom was due to the lack of element N in plants. Therefore, farmers only let alone their crops and did not control them. Most plants that suffer from VSD could still produce fruit. Plant disease control techniques, especially VSD in cocoa among farmers, still need to be improved due to a lack of motivation and knowledge of control techniques and consideration of financing expenditure (Table 6).

Table 5 Proportion of farmers' attitudes in controlling pest & disease in Burau and Wotu Districts

Criteria for farmers' attitudes in pest & disease control	Burau		Wotu	
	Number of faermer	%	Number of farmers	%
Frequently/have been rejuvenated on plants				
Yes	17	62.96	16	69.57
No	10	37.04	7	30.43
Field sanitation				
Yes	27	100.00	23	100.00
No	0	0.00	0	0.00
Monitoring of emerging pest & disease symptoms				
Yes	9	33.33	11	47.83
No	18	66.67	12	52.17
Reduced control chemically				
Agree	9	33.33	8	34.78
Disagree	18	66.67	15	65.22
The continuous use of chemical pesticides can be detrimental to farming				
Agree	27	100.00	23	100.00
Disagree	0	0.00	0	0.00

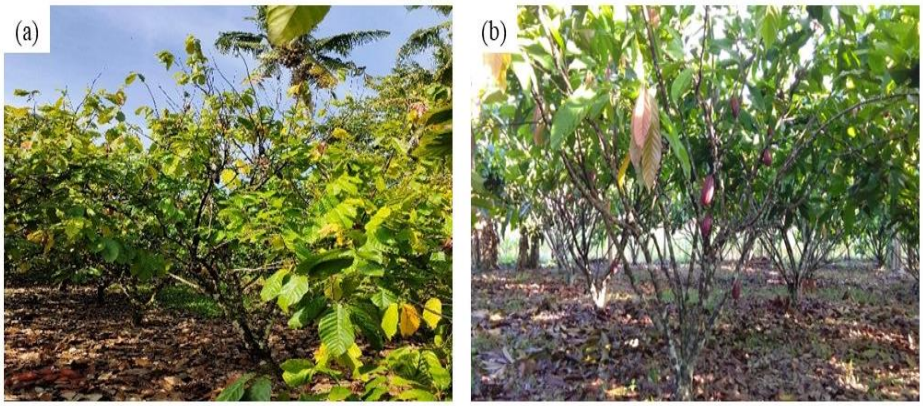

Figure 3 Land conditions of cocoa farmers in East Luwu Regency; (a) plants affected by VSD, (b) land with regular pruning.

Table 6 Proportion of farmers' actions in cocoa cultivation in Burau and Wotu Districts

Criteria for farmers' actions in cocoa cultivation	Burau		Wotu	
	Number of farmers	%	Number of farmers	%
Action against pest and disease problems				
Controlled	27	100.00	23	100.00
Not controlled	0	0.00	0	0.00
The importance of pest & disease control				
Essential	15	55.56	9	39.13
At certain times	12	44.44	14	60.87
Pest & disease control				
Chemically	27	100.00	23	100.00
Non-chemicals	0	0.00	0	0.00
Pruning plants				
Routinely	17	73.91	17	73.91
At certain times	6	26.09	6	26.09

CONCLUSION

The main problem in cocoa cultivation in Burau and Wotu Districts is the existence of pest & disease in cocoa fields. PBK pests and VSD diseases attack most cocoa farmers' land in the two districts. The knowledge of farmers about pest & disease, especially VSD disease, still needs to be improved. Farmers still rely on chemical pesticides to manage cocoa plants; pests & diseases cause both symptoms. The impact of the low farmers' knowledge of VSD disease and the absence of VSD disease control efforts has caused the intensity of VSD-diseased cocoa plants in East Luwu Regency to increase. Therefore, the management strategy of cocoa plant pests and diseases must be adjusted to minimize the possibility of losses caused. It is necessary to conduct counselling and disseminate information on cocoa cultivation and the management of appropriate plant pest organisms equally by relevant agencies, especially for cocoa farmers in East Luwu Regency.

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