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Cocoa Farming in Indonesia: Present Challenges

Cocoa is an engine of national growth in Indonesia, which is poised to become the world's largest producer of cocoa beans.

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Chocolate or cocoa is becoming an engine of national economic growth in many parts of the world, particularly in Indonesia. By 2012, although a number of countries in the target export areas had been affected by economic crisis, it was obvious that the world demand for chocolate had increased significantly. In fact, a more than twofold rise in demand was reported, compared to previous years, and it is predicted to continue to increase. The demand for cocoa beans has grown as well (Guest, 2013).

As one of Indonesia's most popular export commodities, cocoa enables people to gain profit, provides employment and brings well-being to communities. Currently, the number of cocoa factories established in Indonesia, including those processing cocoa into cocoa powder, cocoa butter and industrial chocolates, is about 18 companies, predicted to grow to 20 cocoa bean processors by 2015. The cocoa industries require large numbers of employees (up to 6,000) as well as cocoa beans from the farmers. Furthermore, it has been reported that Cargill Company, one of the cocoa grinders, is eager to invest seriously in Indonesia. As the president of Cargill Company, de Loor, claims, over US\$100 million will be invested in Indonesia for a production capacity of about 70 thousand mt, starting in 2014 (Aldhin, 2013). Other cocoa grinders are General Food Industry (Singa-

pore), Bumi Tangerang, Effem Indonesia and Davomas Abadi Tbk. A company from Malaysia, Guan Chong Berhad, has established a cocoa factory projected to produce about 150,000 mt per year in Batam Island, Sumatra. Another cocoa grinder from the United States, Barry Callebaut, is investing about US\$150 million in this sector in Indonesia.

Interestingly, cocoa is not a native crop in most of the main production areas in the world. However, cocoa growing has transformed communities in many areas. As Samuels et al. (2012) state, cocoa is native to the higher zones of Amazonia, but it is now grown in almost all tropical countries. Cocoa has become an economic essential wherever it is grown. It is believed that over 15 percent of the total world cocoa production comes from Indonesia (Natawidjaja, 2009). Certainly, cocoa farmers play a vital role in this sector, with approximately 1.6 million hectares (ha) of cocoa plantation.

The total area devoted to cocoa plantations in Indonesia in 2008 was about 1.5 million ha before rising by about 10 percent in recent years. National cocoa plantations totaled over 1.67 million ha, of which about 94 percent was held by the cocoa farmers' community, and 4 percent, or over 57,000 ha, belonged to the government of Indonesia (Indonesia Investment Coordinating Board, ►



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Cocoa Farming in Indonesia

National cocoa bean production is likely to peak at 1.5 million metric tons. Once this production target is achieved, Indonesia will most likely overtake the biggest world producers of cocoa beans.

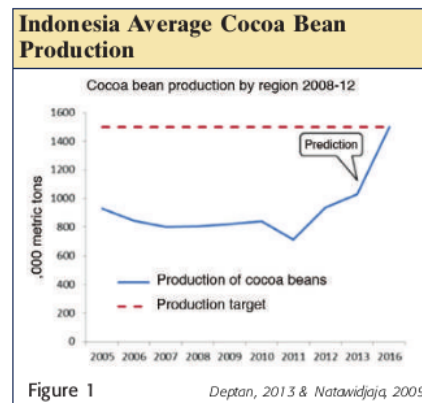
2013). Other private sector entities managed only about 51,000 ha or 2 percent of the total area. The majority of the cocoa beans come from smallholders with over 90 percent of the total production, while the government contributed over 36,000 mt of cocoa beans, or about 4.5 percent, and private plantations produced less than 36,000 mt (Natawidjaja 2009 cited in Junaid, et al., 2009).

The average cocoa bean production of Indonesia is 857,000 mt annually. Cocoa bean production overall has shown an upward trend during the last decade, standing at 928,000 mt in 2005, falling slightly to 712,000 in 2011–12, before reaching a peak at over 1 million mt by 2013 (Directorate General of Estate Crop of Indonesia) (Figure 1). Cocoa bean production is predicted to grow to approximately 1.5 million mt by 2016. In Jawapos (2013), a Minister of Agriculture of Indonesia, Suswono, pointed out that potential national cocoa bean production is likely to peak at 1.5 million mt. Once this production target is achieved, Indonesia will most likely overtake the biggest world producers of cocoa beans in forthcoming years. This is mainly due to cocoa revitalization schemes which have been promulgated for five years.

In contrast to national cocoa bean production, the export volume of cocoa beans has fallen. Meanwhile, it has been claimed

that the cocoa bean supply in Asia is relying on Indonesian exports (Kompas, 2013). Tempo (2013) reports that the export volume was about 210,000 mt in 2011, then fell by 29 percent in 2012 and is forecasted to continue to fall. The depletion of cocoa bean exports is commonly believed to be due to the imposition of a 15 percent tax, which has burdened the raw material exporters since 2010. Although this imposition tends to have drawbacks for certain international cocoa exporters, generally speaking it seems to have enormous benefits for other members of the cocoa community such as the farmers, and for the grinders and chocolate companies which might potentially settle in Indonesia, stimulating the growth of chocolate factories downstream. In fact, farmers can sell the cocoa beans directly to local factories and exporters as well. Also, investors can profit from their investments in farmers' communities due to the low costs in the supply chains. According to the Minister of Trade, Wirjawan, there was a significant increase in the number of chocolate factories in recent years, from only six factories to about 20 currently, dominated by several international companies. Because of the impact of regulation, local chocolate factories tend to import enormous quantities of cocoa beans from Africa for ingredient and taste purposes. The number of chocolate factories investing in Indonesia has increased and also national chocolate companies have imported more cocoa beans from Africa, growing from 31,000 mt in 2012 to approximately 100,000 mt by 2013.

During the last four years there was a noticeable increase in cocoa grinding, from 130,000 mt in 2009/10 to 265,000 mt in 2011/12 (Abdoellah, 2013). Meanwhile, there was a negative correlation between cocoa bean exports and semifinished products exported. There were approximately 400,000 mt of cocoa bean exports in 2010, ➤



Cocoa Farming in Indonesia

200,000 mt in 2011, then falling to about 130,000 mt in 2012. Semifinished products grew from about 100,000 mt to 200,000 mt in 2012 (Deptan, 2013) (Figure 2). The Vice Minister of Trade, Heriawan (n.d), points out that the largest quantity of Indonesian cocoa beans is exported to Malaysia (47 percent), and the second largest is to the United States (21 percent). Other countries such as Singapore, Brazil and China are 12 percent, 7 percent and 4 percent of the total respectively (Kemenperin, 2012). Regarding the volume of factory capacity, in 2012 it was about 350,000 mt of cocoa beans and was projected to increase to 600,000 mt during 2013 (Tempo, 2012). In East Java, cocoa production reached 26,000 mt in 2012 and was predicted to rise to 32,000 mt in 2013. East Java exports cocoa beans mainly to Europe (75% of total) and the rest is sold on the domestic market (Deliknews, 2013).

Looking at Indonesian domestic cocoa bean production by regions (Figure 3), it is clear that the vast majority of national cocoa production is from the island of Sulawesi, which produces about 67 percent of total national cocoa production. The second-largest amount is from the island of Sumatra, which contributes about 22 percent. Meanwhile, Papua and Maluku and Java combined contribute 4 percent of cocoa productivity. Although their contribution is small, Papua and Maluku and Java are potential areas in which to develop cocoa plantations. At the same time, other areas such as Borneo and Bali, East Nusa Tenggara and West Nusa Tenggara contributed about 3 percent each. It can be seen that Sulawesi plays an essential role in national cocoa production. Overall, there is an upward trend in total cocoa bean production, from about 803,000 mt to over 936,000 mt in 2012 (Natawidjaja, 2009). However, it is believed that globally many cocoa-producing countries are facing a reduction

in cocoa productivity. Taking Nigeria and Côte d'Ivoire as examples, the largest cocoa producers in the world are experiencing a decline in cocoa yield. Similarly, Indonesia has cocoa challenges, namely aging trees, poor farmer skills and knowledge, pest and disease management, soil and postharvest management. These obstacles may have a significant detrimental effect on production in the future.

CHALLENGES FACING COCOA

Cocoa, both on farm and off farm, is facing four main threats. First of all, cocoa plantations suffer from low productivity. Many cocoa plantations are getting older, reaching over 25 years of cultivation. Second, cocoa plantations have been hit by serious pests and diseases, in particular cocoa pests such as cocoa pod borer and fruit suckers (*Helopelthis* sp.), and cocoa diseases like black pod disease and vascular streak dieback, known as vSD. Third, smallholder

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Exports: Cocoa Beans and Semifinished Goods

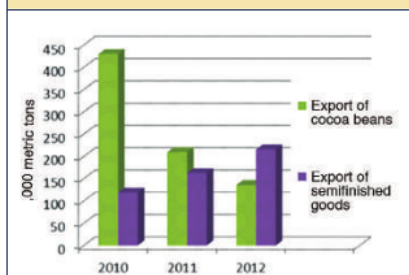


Figure 2

Deptan, 2013

Domestic Cocoa Bean Production

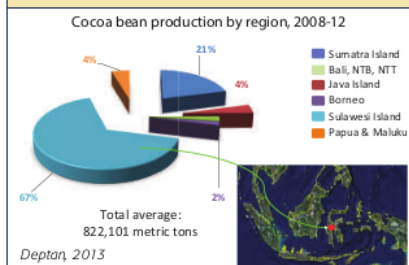


Figure 3

Cocoa Farming in Indonesia

There is a strong positive correlation between fully fermented cocoa beans and maintaining the quality of the beans. However, many cocoa growers still have not fully embraced fermentation.

cocoa farmers tend to lack skills and knowledge of good agricultural practices. Last but not least, the amount of nutrients in the soil on the cocoa farms is decreasing and there is a lack of postharvest handling. The combination of these factors poses a serious threat to cocoa production. These issues might lead cocoa to a lower bargaining position than other crops such as palm oil, which is booming, and maize.

Aging Trees

A serious problem facing cocoa sustainability is aging trees. This applies not only to Indonesian cocoa but to all cocoa producers around the world. According to Natawidjaja (2009), the average age of cocoa trees is about 20 years. By 2013 the average cocoa plantation was about 25 years old. Because of this, although many efforts have been made to increase cocoa pods, such as fertilizers, and to control cocoa pests and diseases, farmers are still left with low production compared to previous years. Therefore, cocoa revitalization has been put forward to renew cocoa plantations.

Poor Skill and Knowledge Levels Among Farmers

The number of Indonesian cocoa farmers increased between 2000 and 2011 by over 50 percent, from about 170,000 smallholders to nearly 400,000 smallholders (Wahyudi et al., 2013). Similarly, as Natwidjaja (2009) states, the number of people, including farmers themselves, who rely on this sector was nearly 1.5 million people and it is expected to increase in the near future. Over 1.3 million ha of cocoa-producing land is possessed by smallholders while other private sector entities manage only 2 percent of the total and the government has 4 percent. From this it can be calculated that every farmer can manage more or less one hectare of cocoa plantation.

However, in fact, production has tended to fall from year to year. In this case, lack of skill and knowledge of good agriculture practices has become a serious problem. For instance, to manage cocoa pests and diseases, farmers have relied on synthetic pesticides and thus they were vulnerable to exposure to chemical contaminants. Another problem is a lack of consistency in cocoa farm management. Poor sanitation and inappropriate fertilizers were often seen in many cocoa areas. The vulnerability to pests and disease infestation is mostly caused by poor tree and farm sanitation as well as inappropriate soil fertilizers. A further crucial issue related to farmers' knowledge is poor harvest-handling management such as treatment for bean fermentation. It is believed that fermenting the beans immediately after harvesting the fruits from the trees will significantly increase the quality of the cocoa beans. It is undeniable that there is a strong positive correlation between fully fermented cocoa beans and maintaining the quality of the beans. However, many cocoa growers still have not fully embraced fermentation.

Cocoa Pests and Disease Infestation

The invasion of cocoa pests and diseases is one of the most serious problems on cocoa farms (Figure 4). As Lass (1999) states, total losses of cocoa production due to pests and diseases were substantial. Similarly, Cramer (1967), cited in Lass (1999), argues that the potential loss from disease can reach 39 percent of the total annual cocoa production, or about 588,000 mt out of a total of 1,528,000 mt of world cocoa production by 2008.

One of the main cocoa diseases is vascular streak dieback (VSD). It has been estimated that VSD can cause losses of about 30 mt where it occurs, and Indonesia is badly affected. Guest & Keane (2007) point out ►

that VSD caused heavy losses of mature trees and seedlings in Sulawesi. VSD is caused by *Basidiomycete Oncobasidium theobromae*, also known as *Thanatephorus theobromae* (Guest and Keane 2007 and Samuels et al., 2012) and Junaid et al. (2009) found the pathogen of VSD, *T. theobromae*, in Luwu regency. This disease is predicted to be more dangerous than other cocoa diseases. Samuels, et al. (2012), argue that VSD has a severe long-term effect. The disease can potentially kill all growth stages of cocoa on the plantation, from seedlings to branches to even entire trees, not just destroy a year's crop (Purwantara et al, 2009).

Another cocoa pest, cocoa pod borer, is one of the major constraints to production not only in Indonesia but also in all countries producing cocoa in South and Southeast Asia and Melanesia. The cocoa pod borer is caused by the insect *Conopomorpha cramerella* (Snellen). Damage to beans or pods is a characteristic destruction of this pest.

Another disease is pod rot phytophthora or black pod disease, which can lead to heavy losses (Natawidjaja, 2009). It is caused by several species of phytophthora (Bowers et al., 2001, cited in Junaid 2009). Overall, most areas in Sulawesi are infected with VSD and black pod disease as well as other main cocoa pests.

Figure 5 shows effects of the main cocoa

diseases, namely VSD and black pod disease. The VSD fungus has characteristics and symptoms that can be identified properly in the field. In particular cases of VSD, the tree can be devastated and the pathogen can be difficult to eradicate with chemical usage. The fungus exists within the xylem vessel and in a short time can destroy the host when there is high humidity and low temperature. However, while black pod disease can damage cocoa production due to pod mummification and reduce the quality of beans due to enzyme and mycotoxin activities within the pod layers, it does not very often kill the trees themselves.

Cocoa pod borer occurred for the first time in Indonesia many years ago. At that time there was not much information about the life cycle, pod symptoms, natural enemies and alternative hosts, nor were there extension specialists and local farmers with skill and knowledge. Nowadays, although these pests still exist in the cocoa ecosystem, the lost production due to their infestation is not significant. Outbreaks and the number of affected trees can be controlled by various techniques.

Poor Soil Nutrients and Postharvest Handling

A main problem of growing plantation cocoa is that the soil quality tends to deteriorate over time. Many farmers just har-

Rejuvenation, rehabilitation and identification methods have been put forward by the government to solve low cocoa productivity and the problem of pests and disease.

Estimated Loss Due to Pests/Diseases

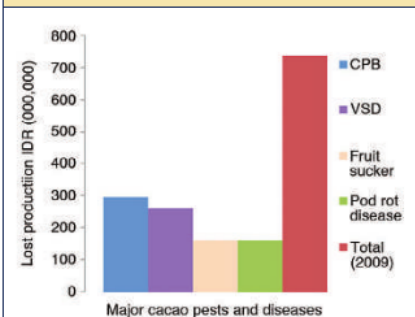


Figure 4

source: Natawidjaja, 2009

Effects of Black Pod Disease and VSD Disease in Indonesia



Figure 5

Cocoa Farming in Indonesia

According to cocoa practitioners, the cocoa farmers seem to be reluctant to practice bean fermentation because they do not get an incentive price from the buyer.

vest cocoa pods without making a serious effort to maintain the quality of their soil. As Sari & Baon (2013) argue, because the soil fertility has decreased, cocoa productivity has also fallen over the last decade. Cocoa plantations require macro- and micronutrients.

A further issue related to postharvest handling is the poor quality of the cocoa beans. It is commonly believed that the lack of bean treatment after the fruits have been harvested from the trees is a key problem. Marseno (n.d) points out that a serious issue of bean quality in Indonesia is tied to poor postharvest handling (Zakiya & Pramesti, 2012). Consequently, poor fermentation treatment of beans can seriously deplete chocolate flavor when producing chocolate products. According to cocoa practitioners, the cocoa farmers seem to be reluctant to practice bean fermentation because they do not get an incentive price from the buyer. Nonfermented and fermented pods are not significantly different in price, but treating the pods requires farmers to spend a great deal of time, cost and attention on their pods. Another reason is that they do not see the difference in quality between non-fermented and fermented treatments.

DEALING WITH COCOA PROBLEMS

Rejuvenation, rehabilitation and identification methods have been put forward by the government to solve low cocoa productivity and the problem of pests and disease. First of all, rejuvenation aims to renew cocoa trees with high-yield clones propagated by somatic embryogenesis methods. Next, rehabilitation is aimed at eradicating aging cocoa trees, also with high-yield clones. With this technique, the top part of the cocoa tree is cut down after new flesh comes out. Lastly, poor agricultural management is to be improved through regular and intensive application

of cocoa pruning, farm sanitation, regular harvesting time and fertilizer management, as well as use of chemical manipulation. If this program succeeds, it is forecasted that Indonesia will soon attain the status of largest cocoa producer in the world.

Renewing Cocoa Plantations and Development of Promising Clones

The success of the cocoa renewal program certainly depends on well-prepared seedlings. Sutariati & Khaeruni, (2013) studied good seed preparation and found that overall there was a significant difference in performance between seeds with and without bio-invigoration. With rhizobacteria and invigoration techniques, seedlings performed better in terms of viability and vigor. Cocoa somatic embryogenesis propagation, known as SE, is used to support the national cocoa revitalization program (Figure 6). SE has been developed solely by the Indonesian Coffee and Cocoa Research Institute (ICCRI).

The program originally aimed to escalate cocoa production and quality in order to increase farmer well-being. However, some critics, such as the Indonesian Cocoa Association, contend that the SE technique is somewhat doubtful. The performance of this seedling propagation method had not been tested at the field level. Although SE was successful in the lab (conducted by

Somatic Embryogenesis Propagation



Figure 6 source: Wahyudi et al, 2013

Cocoa Farming in Indonesia

ICCRI's breeders), trials at the cocoa farm level might not succeed.

Looking first at the SE plantation in the center of the cocoa-growing area in Sulawesi, the SE seedlings that showed growth had dwarf and dead trees in a number of new cocoa areas. The adaptation at field level was a major problem. Halim (cited in Metronews.com, 2013) asserts that the program was unproductive. It was difficult to clone the plant with the best resistance to pests and disease while achieving higher yield. Similarly, the cocoa experts at University of Hasanuddin (UNHAS) claim that it was difficult to prepare and maintain healthy twigs for maternal side and shoot grafting. Meanwhile, a huge number of cocoa plantations suffered from severe disease and the SE propagation effectively distributed the disease. It seems that the distribution of SE to other areas in Indonesia spread out VSD disease but the SE breeders had to provide as many healthy twigs as possible for seedling propagation. Consequently, in Bantaeng Regency, 100 km from Makassar, based on a UNHAS survey in 2010 (prior to the cocoa revitalization program), plenty of native cocoa trees were not attacked by new cocoa VSD disease.

Another potential issue in relation to cocoa revitalization is lenient surveillance of old-cocoa eradication, which might be highly vulnerable to corruption. It is believed that initial data collection of farmer groups, which has become fundamental to decision-making by the government, tends to be manipulated in order to obtain a greater proportion of subsidy than other regions. Also, the government keeps subsidizing the farmers for agricultural inputs, such as fertilizers, seedlings and pesticides, with weak assessment and evaluation. In several regencies in Sulawesi, those guilty of subsidy corruption have been put in jail. Consequently, the farmers have

become serious victims of the program. It has been strongly suggested that the government should focus on establishing chocolate processing and developing cocoa machinery in households, Halim added.

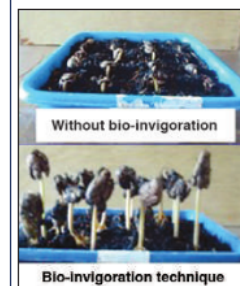
Regardless of the main constraints, preparing good seedlings has become a serious task in order to reach the national seedling target. As the ICCRI reported, during the last five years, preparing cocoa seedlings with the SE method has produced over 90 million seedlings which may help counteract the lack of good seedlings (Figure 7). At the least, this simple technique for seed development can accelerate the production of appropriate seedlings to achieve the program target. The technique has several benefits. It can improve seed viability and vigor, plant growth and plant resistance to pathogen infection, and it can increase the availability of plant nutrients through nitrogen fixation and phosphorus solubilization.

Furthermore, rejuvenation using shoot grafting can probably be considered. Cocoa experts at the Faculty of Agriculture, UNHAS, in South Sulawesi, Indonesia, developed this technique to meet the demand for good cocoa seedlings in the field. Shoot grafting is the most popular technique to provide healthy seedlings because it needs neither a high skill level nor a special location. Commonly, farmers can produce their own seedlings with this technique using simple grafting tools. The tip of the young seedling is cut down and replaced with twigs that have resistance against the main pests and diseases. Utilizing this way to grow cocoa seedlings rapidly in the field, farmers do not need to plant seeds.

Figure 8 shows the pattern of intercropping between corn under the rejuvenation method and cocoa immaturity after cutting down the twigs and top branches of trees. With the intercropping tactic, once the old cocoa is eradicated and/or the new

With the intercropping tactic, once the old cocoa is eradicated and/or the new cocoa is rejuvenated, farmers can obtain alternative income through intercropping between cocoa and corn.

Seed Treatment with Bio-invigoration (SE)



source: Sutariati et al, 2013

Figure 7

Cocoa Farming in Indonesia

During the last five years, cocoa experts have focused on the development of disease-resistant cocoa that also has a high yield. Some clones have been tested in the field and one has shown tremendous promise.

cocoa is rejuvenated, farmers can obtain alternative income from another crop through intercropping between cocoa and corn. It is believed that throughout the period of rejuvenation, which lasts a few years before a yield can be obtained, cocoa farmers will be able to gain profit from growing and producing corn.

Another technique aims to replace old cocoa trees that have a low yield with potential clones. The technique has been disseminated to some areas in Indonesia to boost farmers' income. Figure 9 shows an example of a combination between a low-yield maternal stem and a high-yield twig being transplanted to accelerate cocoa growth and production. Soon after the twig starts growing and producing pods, the maternal stem above the twig can be removed.

During the last five years, cocoa experts have focused on the development of disease-resistant cocoa that also has a high yield. Some clones have been tested in the field and one of them has shown tremendous promise. The ICCRI's cocoa breeder, Susilo & Sari, identified a potential clone in 2013 (Figure 10). This clone has become a maternal crop to side grafting or shoot grafting. These combinations can be adopted to increase yield. The promising clone is expected to sustain cocoa production and to have tremendous yields. This technique can be adopted by farmers and at a low cost. Selection for CPB- and VSD-resistant clones in Sulawesi has been conducted and a promising clone has been identified.

A further technique that is more environmentally friendly is the development of natural products and fungal antagonism. Natural products consist of the manipulation of semichemicals from weeds or plants that can attract or repel insect pests. This is one of several tactics in integrated pest management. This chemical manipulation

of insects can play an important role in controlling cocoa pests like CPB. First, the development of a sex pheromone aims to

Intercropping with Corn



Figure 8

Stem with High-yield Twig



Figure 9

Clone Developed by Susilo and Sari



Figure 10

Cocoa Farming in Indonesia

attract the male adult insects and to trap them. In the laboratory of the Faculty of Agriculture, UNHAS, a chemical manipulation pest-control technique has been developed. Cocoa experts in UNHAS are still focusing on developing an attractant compound, namely kairomone, that has prospective control for insect pests in the field. The natural product technique has potential for success in the agro-ecosystem. It can also be combined with color traps and odorless glue to increase the effectiveness of pest control. Furthermore, natural enemies have been developed, too. Use of the fungi of trichoderma and *Beauveria bassiana* has become popular among plant protectors around the world. These agents can control pests naturally in many ways. For instance, an emulsion of trichoderma can simply be spread out by using sprayers which most farmers are familiar with. These fungi can also be easy to maintain. They can be grown in a small water tank near the cocoa field, mixed with sugar, water and organic matter. After a couple of weeks they can be harvested to spray on the tree. As microbiologists of plant protection in UNHAS state, using microorganisms combined with some sugar and organic matter could accelerate the growth of microorganisms and increase microbial virulence

in the fermenter. This indigenous technique has been found acceptable to farmers.

Another technique is covering the pods. A type of plastic bag is crinkled over the fruits in order to protect them from pest infestations such as CPB and fruit sucker (Figure 11). Implementing this technique poses some constraints. This tactic is vulnerable to black pod phytophthora disease, particularly during the rainy season. Also, the environmental issue must be considered. The possibility of waste plastic bags after harvesting has become a heated issue. But, since the development of degradable plastic, this issue can be alleviated. Another issue is that this technique requires tremendous labor.

Use of the fungi of trichoderma and Beauveria bassiana has become popular among plant protectors around the world. These agents can control pests naturally in many ways.

Farmer Training in Implementing Pest and Disease Management Methods

By 2008, the Indonesian government had trained more than 1,070 farmers and farmer groups in many regions (Figure 12) including Sulawesi, Borneo, Java, Sumatra and East Nusa Tenggara. By 2012, in Bantaeng, South Sulawesi, the Cocoa Research Group (CRG) under the Faculty of Agriculture, UNHAS, had updated local farmers' skills and knowledge of rejuvenation techniques, good agricultural practices and integrated pest management. The target of the project was about 500 people in this regency.

Pod Condomization Technique



Figure 11

source: Natawidjaja, 2009

Integrated Pest and Disease Management Training



Figure 12

source: Natawidjaja, 2009

Cocoa Farming in Indonesia

It is argued that the best way to deal with the shortage of soil fertilizer is to tackle land degradation and to conserve farmland by implementing environmentally friendly agriculture.

This farmer field training program aims to emphasize good agricultural practices and to solve the problem of harmful pests and diseases on cocoa plantations.

Soil Management

Over a long period of cocoa farming, soil nutrients may become undermined because of the high level of nutrients that are required. Unfortunately, not many inputs are introduced to restore the loss of fertilizer from the soil. Recently, the Indonesia Coffee and Cocoa Research Institute, located in Jember, East Java, conducted a study of soil fertilizers in Sulawesi and found that the main cocoa plantations in this region seem to lack principal soil fertilizer components, namely carbon, nitrogen and phosphorus. This research recommended that certain crop nutrient requirements should be implemented. It also suggested introducing efficient and effective fertilizer.

The management of shade trees may also conserve soil fertilizer (Figure 13). It is believed that this technique can increase cocoa productivity, as well. The usual function of shade trees is to protect the cocoa plantation from sunlight exposure. However, as many studies have shown, the

shade tree technique not only provides a good microclimate for cocoa but also acts as a source of macro natural fertilizers in order to develop the cocoa trees. According to Pujiyanto (1994, in Sari et al., 2013), lamtoro (*Leucaena leucocephala*), a kind of shade tree, can provide huge amounts of soil fertilizer in the form of macronutrients, producing 44kg NH₃/ton wet leaves, 5kg TSP/ton and 10kg KCl/ton. *L. leucocephala* may even produce higher levels of macronutrients in dry leaves: 118kg NH₃/ton dry leaves, 13kg TSP/ton and 27kg KCl/ton. Furthermore, using temporary and permanent shade trees such as banana, coconut, durian, mango and others protects cocoa trees from exposure to UV light. In many cases, twigs on cocoa trees can suffer from dieback because of UV exposure. Burying pod husks after harvesting can also reduce pests and disease because the life cycle is cut before growing.

The last activity to deal with challenges to Indonesian cocoa is organic farming. It is argued that the best way to deal with the shortage of soil fertilizer is to tackle land degradation and to conserve farmland by implementing environmentally friendly agriculture. It is believed that organic cocoa has the potential to be a long-term solution to the main problems of productivity. It has been shown that an increase in the amount of carbon in the soil occurred, which could promote nutrient health and provide abundant food for soil organisms. A group of soil experts from ICCRI surveyed potential cocoa farmland in Indonesia, and showed that 2 million sq km of land suitable for developing cocoa plantations was still potentially available (Prastowo and Baon, 2013).

Postharvest Management and Added Value

It is believed that bean quality is often ➤

Management of Shade Trees



Figure 13

source: Sari and Baon, 2013

Cocoa Farming in Indonesia

determined by postharvest handling. Poor quality of cocoa beans tends to be due to poor postharvest management and lack of fermentation. Poor-quality beans mixed with good-quality beans can affect overall bean quality, so that fermentation of cocoa beans is becoming crucial in managing cocoa beans. As Djagel points out, poor bean quality is caused by not fermenting beans. Fermentation of beans is a serious issue in regard to the quality of beans. The best solution is to give a premium price for fermented beans. This leads the farmers to focus more on bean treatment. Another solution is to provide a management instrument for fermentation. The farmers can develop equipment themselves in which they can modify simple technology to overcome quality issues at the off-farm stage.

Turning to the off-farm stage, postharvest handling is a part of cocoa management. It allows farmers to gain extra income and reduce the cost of cocoa production by supplying compost or biogases and food for their livestock. In Figure 14, we can see how the waste of cocoa pods is recycled and reused to be more useful through postharvest management. As the ICCRI expert in composting, Widyatomo (2013), states, profitable cocoa waste can be implemented during high harvesting time. First, useless husks are chopped into small pieces. From this, small materials are fer-

mented by using a beneficial fungus, *Aspergillus niger*. In the next stage, the small materials are dried for a couple of days. Soon after being dried under sunlight, these are ground in simple machinery to produce powder. In order to make nutritious food, the powder is mixed with some ingredients and the livestock are allowed to feed. Cocoa husks, another product of cocoa waste, are recycled to produce beneficial compost. The cocoa husks are separated from the beans and shredded into small pieces and composted. Next, all materials are dried and then they are sorted. Powdering and packaging are the last steps in this process.

Interestingly, producing biogas from the useless cocoa husks and livestock waste has also become popular in recent years. Such integration between animal breeding and cocoa farming is an alternative tactic to achieve not merely the main products (meat or cocoa pods), but also to reuse and recycle cocoa waste into a new source of energy like compost and gas for stoves. This natural technology is acceptable for farm communities because the procedure is quite simple. Cocoa husks are neutralized in a water tank that is buried 2m deep in the ground which holds water mixed with manure from livestock. In the next stage, the substrate is diluted and homogenized. Afterwards, the result of substrate immersion passes into a minireactor producing biogas, which can be used for liquid fertilizer and/or biogas on a small household scale.

The best solution is to give a premium price for fermented beans. This leads the farmers to focus more on bean treatment.



Organic Cocoa and Certification

Organic products are becoming more and more popular nowadays on cocoa plantations. It is believed that organic methods can produce profits for farmers, attract consumers and preserve the environment. ➤

Cocoa Farming in Indonesia

Organic farming can also be a good solution for poor farmer skills and knowledge. The more farmers that become organic cocoa trainees, the better the quality of life will be in the cocoa-farming community.

It is also believed that by using organic methods, cocoa farm degradation can be prevented. In addition, organic methods produce sources of natural compost for cocoa production and provide income for cocoa farm communities.

The demand for organic agriculture and land certification is increasing among cocoa companies around the world. As Guest (2013) argues, many chocolate producers have a tendency to require more and more certified farmland. This can encourage cocoa producers to increase production through organic methods. It seems that the issue of organic cocoa is becoming vital and consumers are becoming more and more interested in the organic provenance of the chocolate they buy. According to Tanos & Rivay (2013), demand for certified cocoa plantations and cocoa farmers has increased significantly over the last five years. In 2008, over 40,700 ha and nearly 8,000 cocoa farmers were certified. Both of those numbers have since risen sharply, to over 641,000 fields and 198,000 cocoa farmers in 2012. This indicates that the demand for organic cocoa and skilled cocoa workers in the world is increasing.

Looking at certification of cocoa areas in Indonesia from 2012 to 2013, the land and farmer certification rate has risen, from nearly 27,000 ha to over 46,000 ha of total certified areas. In terms of organic cocoa trainees, the number of farmers reached about 38,000 in June 2013. However, of the countries that have certified organic cocoa, Indonesia has just 6 percent of certified cocoa plantations. The vast majority of organic cocoa certification is in Côte d'Ivoire with over 60 percent of land certification. The second largest is Ghana and Dominican Republic with 17 percent and 9 percent of cocoa plantations respectively. Meanwhile, some countries, such as Ecuador, Nigeria, Philippines, Colombia, Peru, Tanzania, Togo and Papua New

Guinea, are about 7 percent of total. Therefore, a serious effort is needed to accelerate the number of organic cocoa trainees and cocoa farming in Indonesia.

Organic farming can also be a good solution for poor farmer skills and knowledge. The more farmers that become organic cocoa trainees, the better the quality of life will be in the cocoa-farming community.

The implementation of organic cocoa farming in Sulawesi has achieved some success. A good example of this is in Bantaeng regency. Recently, a Cocoa Alliance project that focused on Sulawesi cocoa (with collaboration among a wide range of stakeholders including ICCRI and Cocoa Research Group [CRG] of UNHAS supported by Mars, Inc., the Ford Foundation, IFC, GEF and others under the Rainforest Alliance) implemented organic cocoa farming in Sulawesi. The program focused on farmer training, such as composting, biopesticides, good agricultural practice and mapping biodiversity. Recently, under the organic cocoa certification program, an electronic organic cocoa-training practice was launched on a website, www.sustainableagriculturetraining.org, in six languages.

Regardless of successful training achievement, there are serious problems facing the successful implementation of organic cocoa. The main problem is the commitment to incentive price, which requires time, thought and manpower. Another challenge is the strict procedure for organic farmers and farmland certification. It is argued that the procedure seems to be rather difficult to follow. This is because it takes plenty of time and needs complex efforts.

National Cocoa Day and Benefits of Regulations

Recently, the government has launched the Hari Kakao Nasional program, the National Cocoa Day program, which is generally cel- ➤

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celebrated every September 16. This event aims to stimulate cocoa growers to improve the quality and quantity of cocoa beans and to sustain cocoa productivity. The program also promotes consumption of chocolate for society so that it may drive the supply and demand of chocolate cocoa beans. In this way, cocoa farmers can gain enormous benefits from the program.

A further solution for cocoa sustainability was imposition of a 15 percent tax on cocoa bean exports in 2010. This regulation has greatly stimulated downstream cocoa industries in Indonesia. Cocoa growers might gain enormous benefits from this new regulation because they can sell their cocoa beans directly to downstream cocoa factories in Indonesia, not just to exporters. According to the Minister of Trade, Wirjawan, the government offers an incentive (a provision of tax allowance) for investors to build up their business, especially in the eastern part of Indonesia. Consequently, the investment trend is for factories to grow from year to year, from six factories in the last three years to 17 factories in 2013, and it is predicted to grow to 20 factories in the near future. This is because a successful government policy (imposition of a 15% tax on cocoa bean exports) stimulated investment in downstream industries in Indonesia (Energitoday, 2013). Unfortunately, it has been claimed that the rate of cocoa bean exports has dropped, but the number of cocoa players putting up factories in the centers of cocoa production such as Makassar, Sumatra and Java has grown. Indonesia is also producing good chocolate, despite producing raw material only.

Another solution is imposition of cocoa certification to attract consumers. Jawapos (2013) reports that production capacity of international exporters absorbing cocoa beans from farmers accounted for near 150,000 mt, growing to about 330,000 mt at the end of the period. Meanwhile,

exports of semiproducts of chocolate made up 50,000 mt in 2009 but have increased noticeably to 200,000 mt of semiproducts. It has been reported that in 2015 the government will target 20 factories with 950,000 mt of production capacity per year. Also, the government gives incentives such as a tax allowance for investors who will invest in the eastern part of Indonesia. Although the export of cocoa beans has decreased from 430,000 mt in 2010, to 210,000 mt in 2011, then to 163,000 mt in 2012, chocolate semiproducts have thrived, growing from 119,214 mt in 2010 to 215,791 mt in 2012 (Jawapos, 2013). Furthermore, in 2012 and 2013, national cocoa bean production reached 310,000 and 400,000 mt respectively. And it is predicted to increase about 800,000 mt in 2014. Another solution, a concept of a rural cocoa industry which aims to modernize cocoa villages, should be taken into consideration, too. □

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