Pesticide Baseline Report

Sustainable Cocoa Production Program (SCPP)

September, 2017

Executive Summary

This pesticide report uses base-line data collected from 111,811 cocoa farmers in the Sustainable Cocoa Production Program (SCPP) in Indonesia, implemented by Swisscontact. It has been found that 79.8% of cocoa farmers use some kind of pesticide (herbicide, insecticide or fungicide). The number is disturbing when considering several findings of the study. Only 11.3% of the farmers apply all recommended agricultural practices (pruning, sanitation, frequent harvesting) that are needed before application of any chemicals, in order for the pesticide to be effective. Farmers are generally not aware of the active ingredients and safety level of the products they use. Only a small number (10%) of the farmers use protective clothes while spraying and they do not handle (90.6%) and store (81.2%) pesticides safely. Many farmers (33%) experienced health effects after spraying, mostly headaches and nausea.

To clear the soil from weeds competing with cacao trees for nutrients, herbicides are applied by 76.8**%** of all cocoa farmers. Most farmers that use herbicides use Glyphosate (66.6%) and Paraquat dichloride (43.0%), with some of them using both. The latter, classified by the World Health Organization (WHO) as moderately hazardous, is known under product names such as *Gramoxone, Noxone, Paratop, Supratox,* and others. The Indonesian Government has restricted use of paraquat products to large plantations only and it must be used by licensed sprayers.[1]

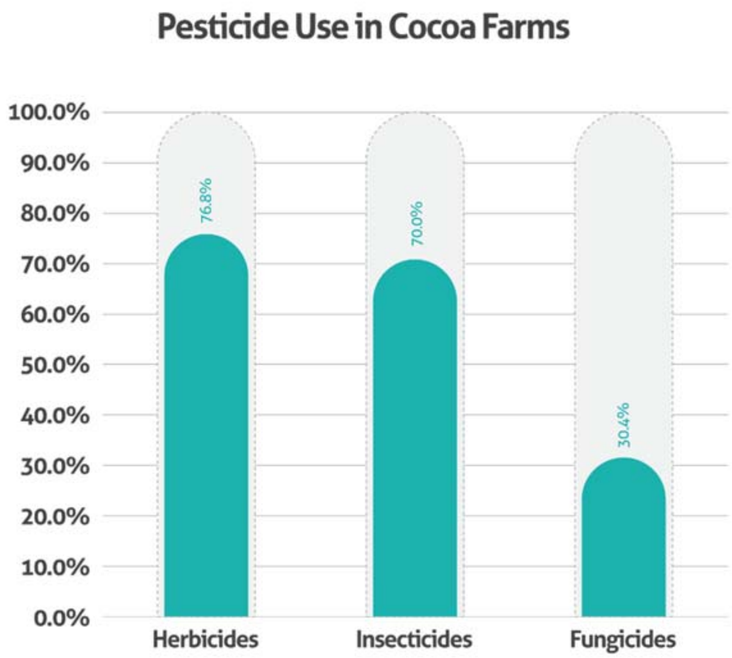


Figure 1: Pesticide Use in Cocoa Farms

Nonetheless, regulation compliance checks are limited and classified herbicides are available in small bottles, ready to use, in most agro-chemicals shops in rural areas. Moreover, the sellers or shop assistants

[1] Regulation: Ministry of Agriculture No. 7/1973 about Monitoring of Distribution, Storage and Use of Pesticide, Ministry of Agriculture No. 107/2014 about pesticide monitoring, Ministry of Agriculture No. 48/2006 about Good Agriculture Practices, Ministry of Agriculture No. 24/2011 about Registration of Pesticide

are generally not aware of what they sell and what regulations they fall under, and shopkeepers provide often no advice to farmers on how to safely apply the products.

Gramoxone is by far the most popular brand (69.7%) from all Paraquat products made available to smallholder farmers.

However, the use of herbicides does not seem to influence the yield at all. Farmers that just use herbicides yield 583 kg/ha/year on average, while farmers that use no pesticides at all produce 586 kg/ha/year. However, other chemicals used by farmers do have a significant positive impact on production. When fungicides and insecticides are used together, yields are reported to average 775 kg/ha/year, and 721 kg/ha/year, if fungicides, insecticides and herbicides are used.

To protect the farmer's family health, rural communities' safety, and the environment, Swisscontact trains cocoa farmers on good agricultural and environmental practices, focusing on integrated pest management and proper pesticide handling (i.e. right product, right timing, correct doses, understanding of pesticide labels, and effects on health and the environment). Moreover, Swisscontact raises awareness on pesticide issues among other stakeholders and shares the experience at various national and international networking platforms.

The data used in this report, disaggregated by sex, age, education, professionalism or the geographical area will show the situation as it is now, including behavioral changes over time, covered by baseline and post-line surveys.

We are aware that a report on pesticides touches a very sensitive topic. We are also aware that the results of this report will not be enjoyed by all readers, since it raises topics that are often swept under the rug, e.g. the use of banned pesticides, since it could damage the reputation of several stakeholders and the cocoa sector in general. Although we do not have the same detailed level of data from other agricultural sectors, there are strong indications that other sectors have similar issues.

This report shows practices in cocoa farming that should be, in our opinion, reduced for the sake of farming communities' health and the environment. Managing pesticides is important for producing food ingredients that are free of residues that might be harmful for the consumers. We are also aware that the scientific discussion is controversial and has often no final consensus and that highly political discussions are on-going in some of the federal states of the United States, the European Union and other regions. However, before the reader judges farmers and companies, it should also be noted that most of the farmers in Indonesia lack knowledge which an informed reader might have and struggle to generate sufficient income to allow them a decent living. The cocoa industry partners in SCPP are making enormous efforts to improve the livelihoods of the farmers, creating sustainable supply chains and ensuring that farmers have access to markets at fair prices. It is not a black and white issue; the grey areas are becoming increasingly blurred.

One of the most encouraging results to be shown is that the use of hazardous pesticides has been reduced significantly, after farmers received training on how to use them. The use of Paraquat products decreased by 72.8%. Safe pesticide handling before and after usage as well as disposal of empty pesticide containers shows that with increased awareness and knowledge, farmers do adopt better pesticide use practices.

Content List

List of Figures

List of Tables

About SCPP

The Sustainable Cocoa Production Program (SCPP) is a large public-private partnership in Indonesia between Swisscontact and the Swiss State Secretariat for Economic Affairs (SECO) and the Millennium Challenge Account Indonesia (MCA-Indonesia). On a national level, SCPP works with the Ministry of Home Affairs, while its multinational private sector partners include Barry Callebaut, Cargill, Ecom, JB Cocoa, Krakakoa, Mars, Mondelēz International and Nestlé.

The objective of SCPP is sector-level change. Change on every level of the value chain is needed – from improved farm inputs, modern and certified farming practices, state of the art post-harvest handling, to transparent cocoa trading such as traceable supply chains and enhanced service delivery models. SCPP activities target all these expected changes by working with its partners, the local Government and NGOs, communities, individual smallholder cocoa farmers, as well as cross sector networking platforms.

By implementing effective development strategies, SCPP enhances the economic, social and environmental sustainability of cocoa production. The current Program phase is designed to improve the well-being of 165,000 smallholder cocoa families by 2020, increase productivity, meet the demand and quality standards of the cocoa industry, reduce Greenhouse gas emissions, as well as increase income and support job creation in the cocoa sector. The Program operates in 57 districts across 11 provinces in Sumatra, Sulawesi, and Eastern Indonesia to deliver training on Good Agricultural Practices (GAP). Good Environmental Practices (GEP), Good Nutritional Practices (GNP), Good Financial Practices (GFP), among others. So far, more than 1.3 million training days have been delivered on the various topics.

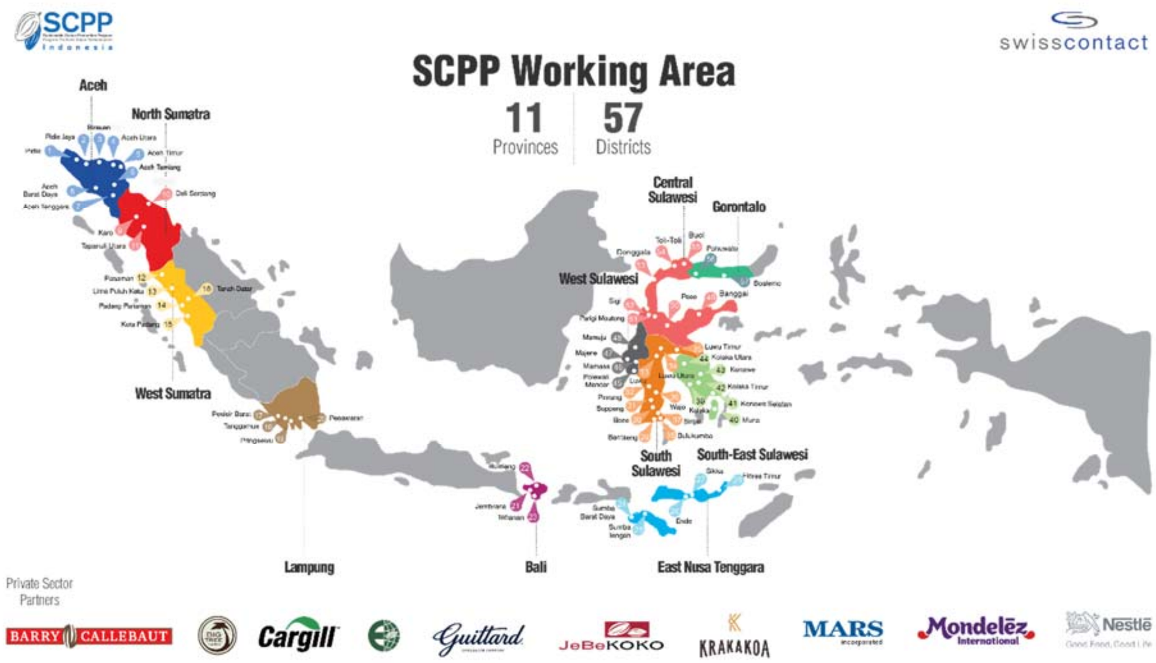


Figure 2: SCPP Working Area in Indonesia

The Program has introduced a holistic approach to foster improved competitiveness of the Indonesian cocoa sector, which involves:

(1) Good farming practices and technology transfer system;
(2) Nutrition and gender sensitivity integration;
(3) Farmer organizations, market access and certification;
(4) Integrated agribusiness financing;
(5) Stakeholder management and networking platforms.
(6) Environmental protection and reduction of greenhouse gas emissions

With the adoption of the Sustainable Development Goals (SDGs) in 2015, the impact of SCPP can be linked directly to 11 out of the 17 SDGs, contributing to improving the livelihood of smallholders, protecting the environment and reducing inequalities.

CocoaTrace- Program Management and Cocoa Value Chain Software

CocoaTrace is a cutting-edge application used to collect, evaluate, illustrate and report relevant data from every smallholder farmer household involved in SCPP. The application includes information such as farmer and household's demographic data, details of every cocoa farm, the number of cacao trees, productivity, prevailing pests and diseases, application of best practices, number of trainings and training days, maps containing farm locations, buying stations, financial institutions, and so on.

CocoaTrace can be used for internal control within the certification system. Farmers will benefit from the higher level of ownership in the data produced and can be offered premium prices for their cocoa – ultimately reimbursing their efforts in improving farm management, transparency and traceability of cocoa production. The application can be used for several other purposes such as creating more efficient business analyses when farmers apply for a loan, calculating efficient use of agricultural inputs and facilitating audits and program evaluations. When fully integrated with the farmer organizations and supply chain partners, CocoaTrace can help farmers to achieve sustainable production with a better pricing to improve their livelihood. The software is provided by the Indonesian agri-tech company, Koltiva.

Methodology

111,811 base-line and 30,164 post-line surveys were analyzed as per September 18, 2017 to evaluate the current situation of pesticide use on cocoa farms in Indonesia, identify constraints, and draw conclusions. Not all individual data sets were complete. To ensure the highest possible number of respondents, the most complete data sets per question was used. This can result in different sample sizes and thus minor differences (in absolute numbers usually less than 1%). Such differences are explained in the foot notes.

From Gorontalo (801), Lampung (1,027) and North Sumatra (961) the sample sizes are too small and were added just recently, therefore, those provinces will not be considered during the data analysis, although shown in the charts. The distribution can be found below:

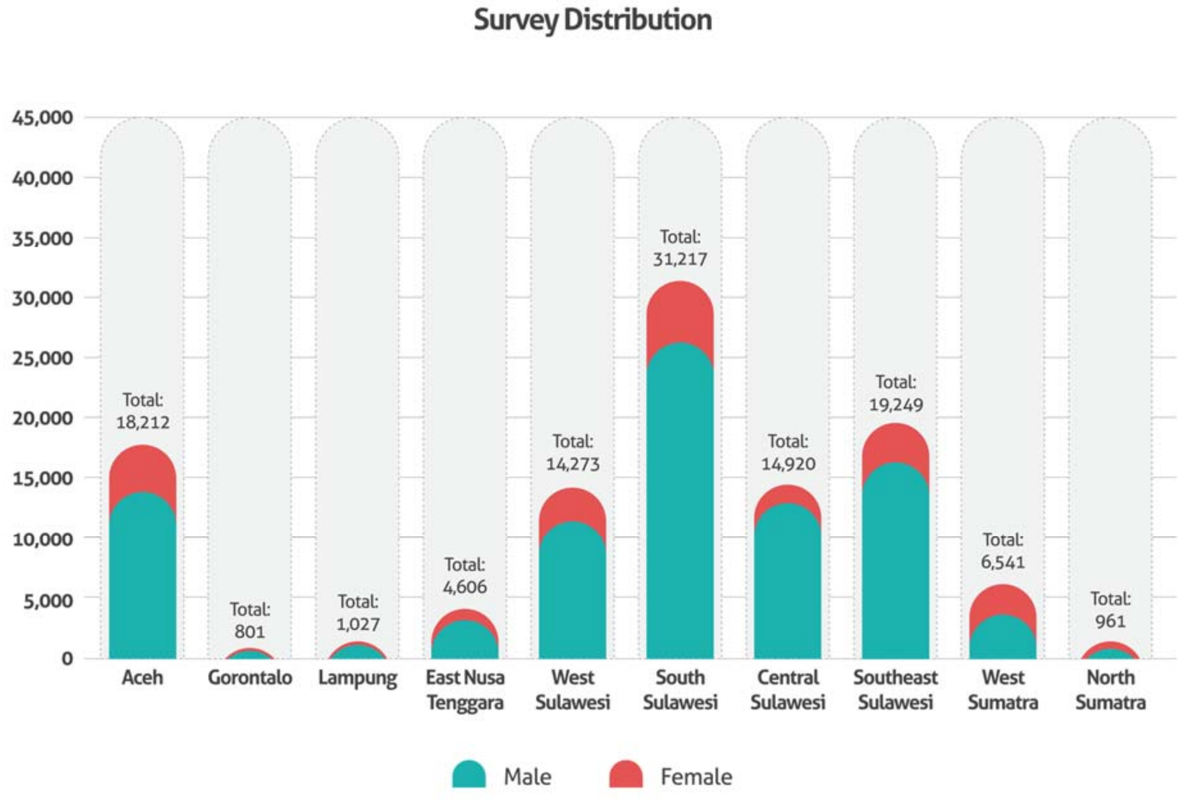


Figure 3: Provincial Distribution of Data Sample

Although cocoa farming is a family business, most of the registered farmers in SCPP are male (81.3%). In some regions, like West Sumatra with its matrilineal culture, female participation is significantly higher, while in other regions like Central Sulawesi male participation is above average.

	male	female
West Sumatra	60.8%	39.2%
Aceh	77.2%	22.8%
North Sumatra	77.3%	22.7%
East Nusa Tenggara	81.3%	18.7%
Total	81.3%	18.7%
West Sulawesi	81.9%	18.1%
Southeast Sulawesi	82.3%	17.7%
South Sulawesi	82.8%	17.2%
Central Sulawesi	89.3%	10.7%
Gorontalo	93.3%	6.7%
Lampung	94.5%	5.6%

Table 1: Gender Distribution per Province

Cocoa Farmer Demographics

The average age of cocoa farmers participating in SCPP is 44.7 years. The life expectancy in Indonesia is 69 years for men and 73 years for women.[2] 20.1% of the farmers are classified as young, as defined by the International Labor Organization (ILO), which classes those under the age of 35 as young.

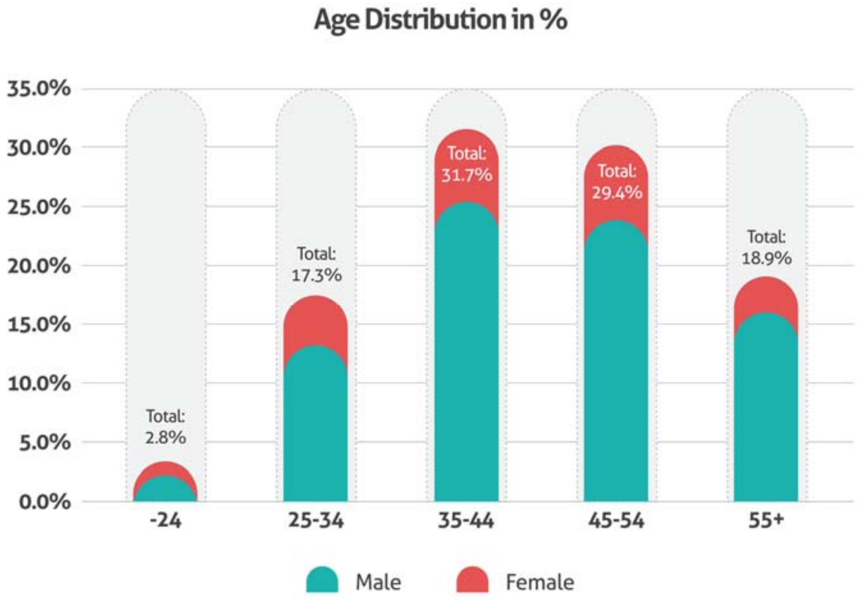


Figure 4: Age Distribution in %

The older participants in SCPP, the lower the share of females, decreasing from 22.5% at the age below 25 years to 17.4% for the age range 55 years and above. This is probably because younger household members are expected to take over farm work from older women.

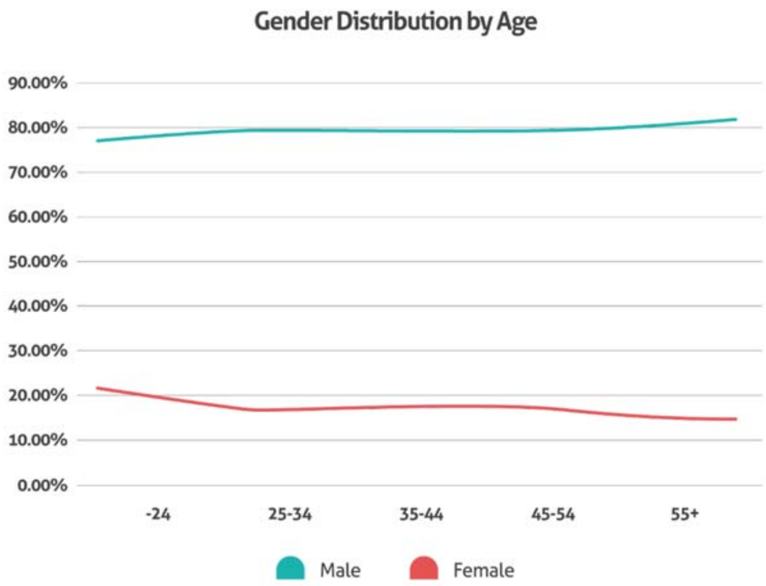


Figure 5: Gender Distribution by Age

[2] World Health Organization (WHO), 2012. Life expectancy at birth

43.4% of the farmers have completed elementary school (SD), while 2.7% of the farmers did not go to school. 3.3% of the farmers have a university degree.[3]

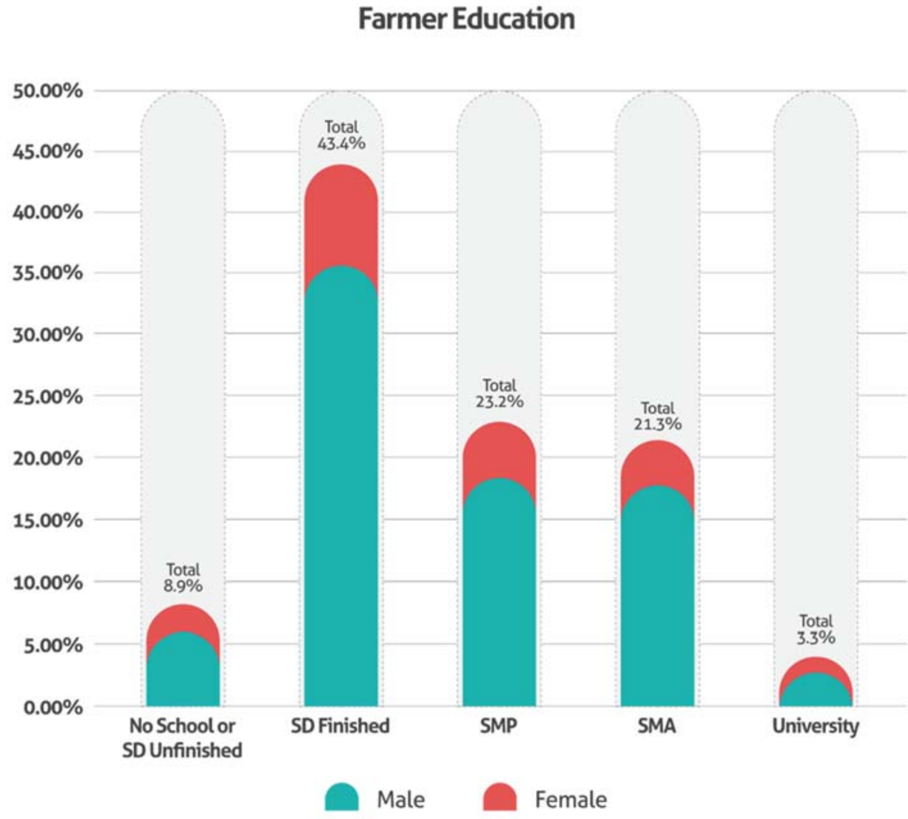


Figure 6: Farmer Education

50.6% of the farmer households live on less than 2.50 USD/day and the average farmer household has 3.7 members. The data below shows that in Aceh, for example, 7.0% of the cocoa farmers and their household members live on less than 1.25 USD/day. They are included in the 45% that live below 2.5 USD/day.

[3] SD = Elementary School (till grade 6), SMP = Junior High School (till grade 9), SMA = Senior High School / Vocational School (till grade 12), University = Bachelor and above

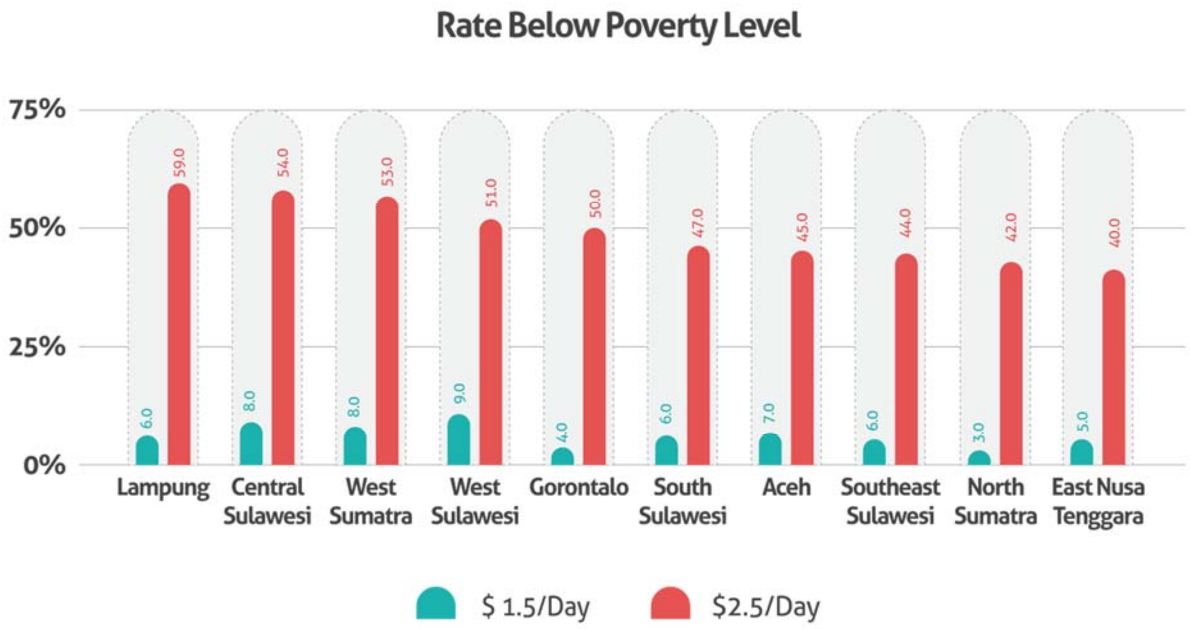


Figure 7: Poverty Level

Cocoa Farm Specifics

9.2% of the cocoa farms are large with two hectares or more, 49.0% of the farmers have a medium sized farm between one and two hectares, while 43.8% of the farmers have farms that are smaller than one hectare. The average farm size is 0.94 hectares per cocoa farmer household. In Central Sulawesi, the share of large farms is 17.7% almost twice the average. In West Sumatra, 81.6% of the farms are below one hectare and only 2.9% are two hectares or more.

The chart below shows the distribution of small, medium and large farms per province. It is safe to assume that households with larger farms can harvest more cocoa, which would contribute to their income. In regard to land ownership, 22.6% of the farmers have a formal land title, while the rest have either no land titles or semi-formal ones, such as a letter from the village head.

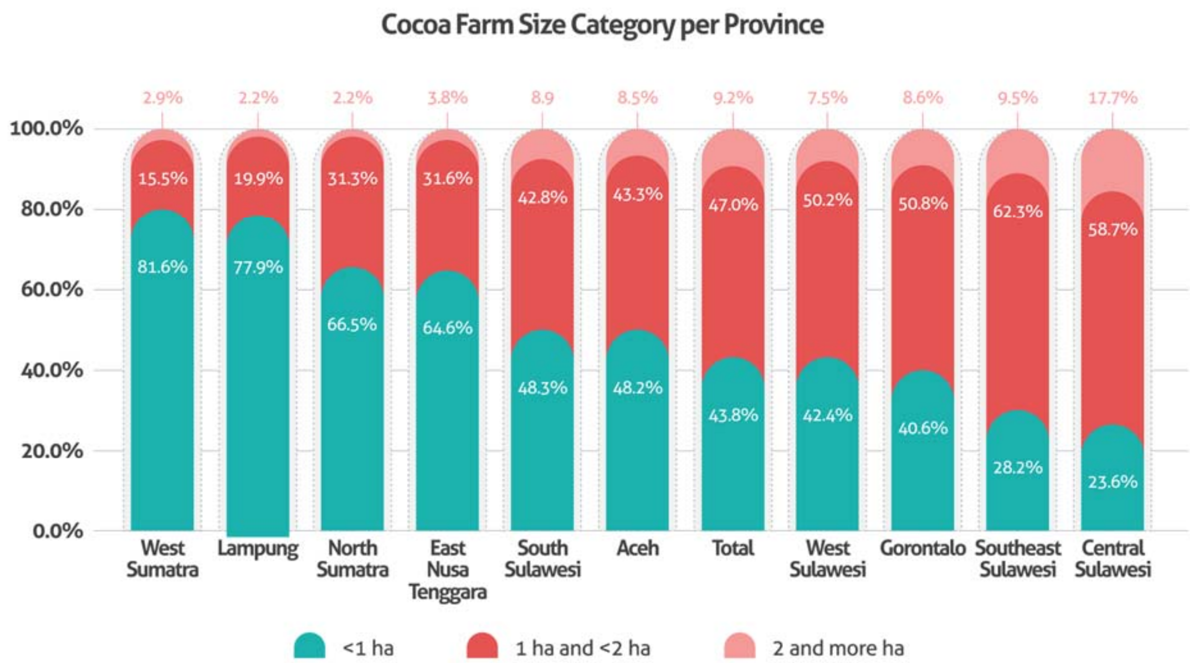


Figure 8: Cocoa Farm Size Category per Province

The average composition of a cocoa farm shows that,74.3% of trees are productive, while 9.6% are listed as unproductive old trees that have passed their economic productive life.

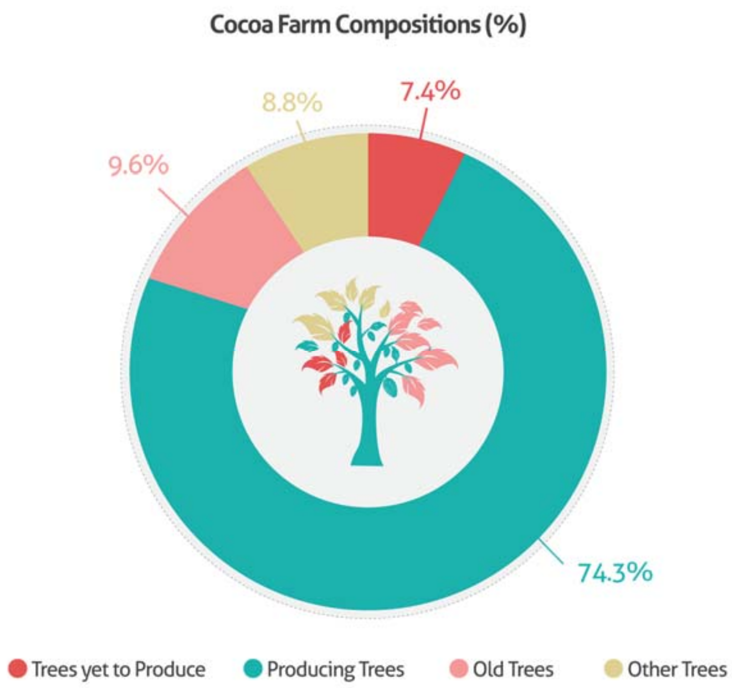


Figure 9: Farm Composition

This study categorizes farmers based on professionalism. **Professional farmers** are defined as those that can produce 1,000 kg or more of dried cocoa beans per hectare per year, and constitute 8.8% of the farmers in SCPP. Progressing farmers are those that can produce between 500 and 1,000 kg/ha/year, 43.9% of farmers are categorized as progressing. However, almost half of the farmers (47.3%) are considered to be unprofessional, producing less than 500 kg/ha/year. Amongst the provinces there are few outliers. Only 17.6% of the farmers in Aceh, where SCPP has worked the longest, produce less than 500kg/ha/year, whereas in NTT (79.7%) and West Sumatra (70.8%) most farmers are considered to be unprofessional.

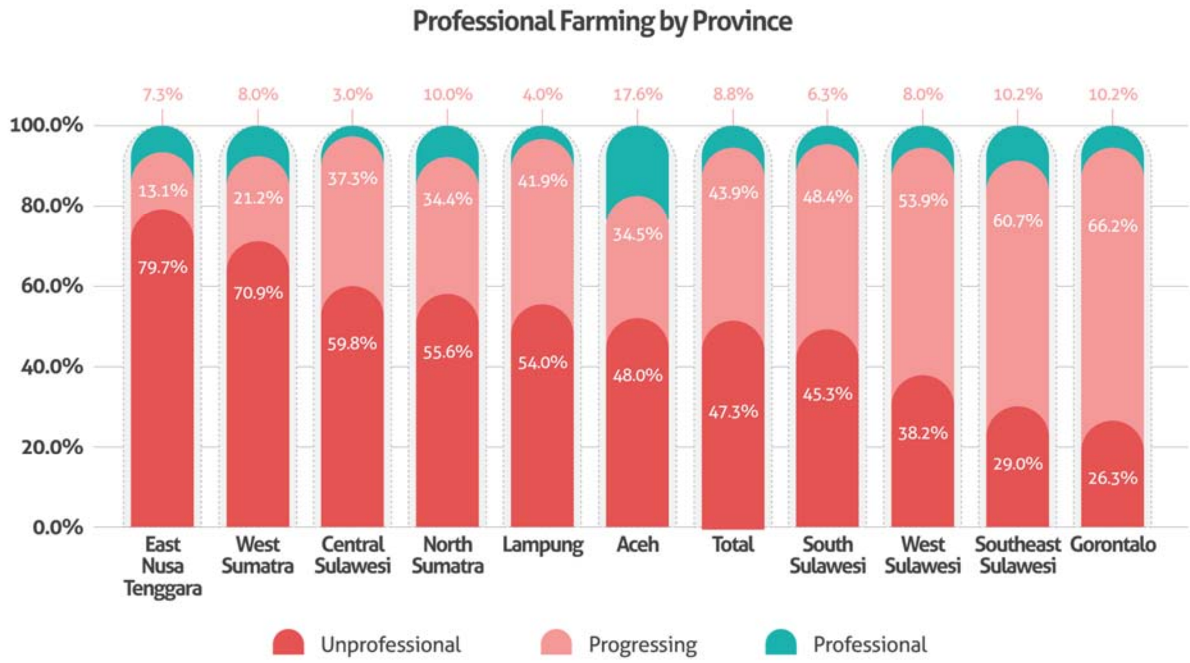
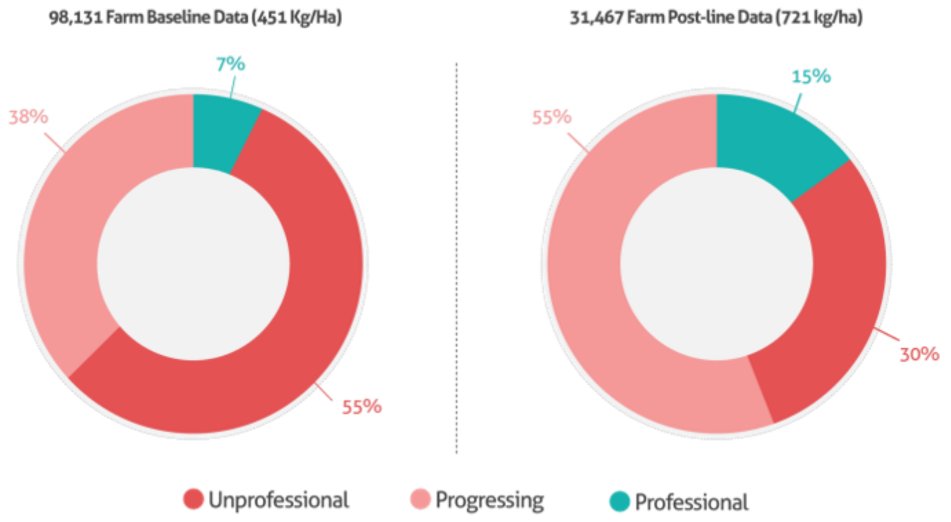


Figure 10: Categorization of Farmers by Professionalism

One objective of SCPP is to increase farmers; income through increased productivity. Better knowledge through trainings in Good Agricultural Practices (GAP) has been proven to be effective in bringing unprofessional and progressing farmers to a more productive level. The comparison between baseline and post-line surveys shows that this change happens. Post-line surveys are taken at the earliest twelve months after the GAP training. During the GAP trainings, farmers learn skills like pruning, top-grafting, side-grafting, sanitation, pest and disease handling as well as an appropriate application of fertilizer.



	Unprofessional	Progressing	Professional
Yields (Kg/Ha)	<500	500-1,000	>1,000
Baseline Share	55.2%	37.7%	7.1%
Post-line Share	30.5%	54.5%	15.0%

Figure 11: Production Improvement after GAP trainings

Professional farmers have nearly 20% more trees per hectare than unprofessional farmers, and four times higher production per tree. There is substantial room for improvement on most family cocoa farms.

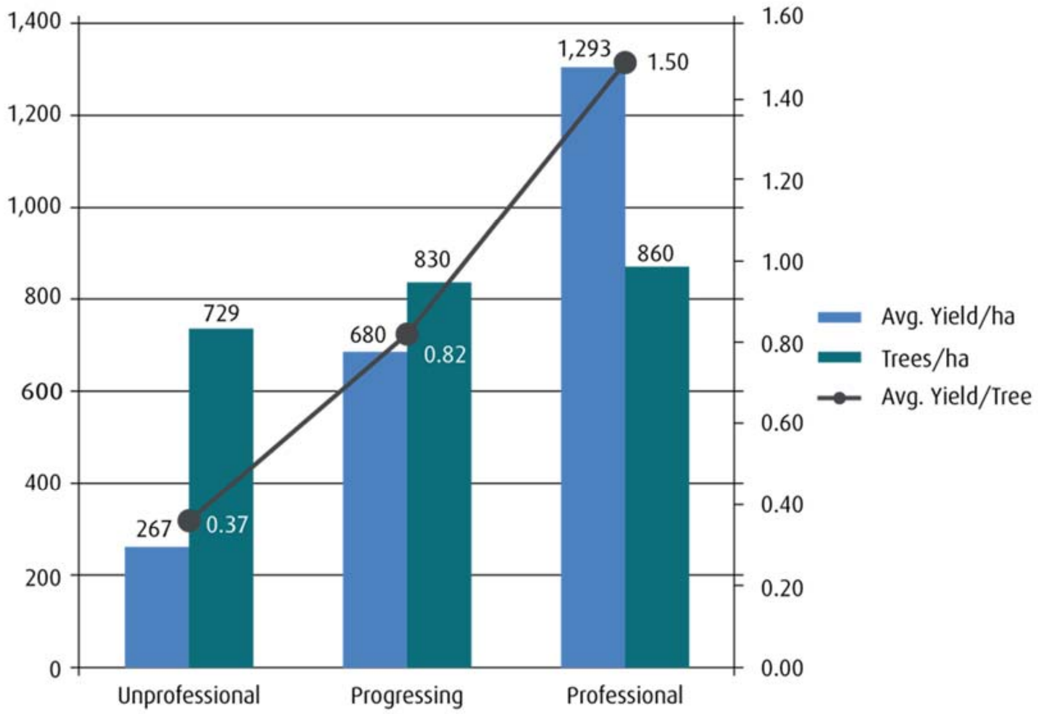


Figure 12: Yields level per hectare and tree of different Farmer Categories

Pesticides in General

Pesticides are substances meant for attracting, seducing, destroying, or mitigating targeted pest infestations. In general, a pesticide is a chemical or biological agent (such as a virus, bacterium, antimicrobial, or disinfectant) that deters, incapacitates, kills, or otherwise discourages pests. Target pests can include insects, plant pathogens, weeds, mollusks, birds, mammals, fish, nematodes (roundworms), disease vectors, and microbes that destroy property, cause nuisance, or spread disease. Of the farmers in SCPP, 76.8% of them use herbicides, 70.0% use insecticides and 30.4% use fungicides. Some farmers (28.1%) use all three (herbicides, insecticides and fungicides), while 32.4% apply herbicides and insecticides, but no fungicide. The SCPP data does show how much the farmers use and whether this is sufficient or even too much.

Herbicides are pesticides used to kill unwanted plants. An insecticide is a substance used to kill insects. They include ovicides and larvicides used against insect eggs and larvae, respectively. Fungicides are biocidal chemical compounds or biological organisms used to kill or inhibit fungi or fungal spores. Fungi can cause serious damage in agriculture, resulting in critical losses of yield, quality, and profit.

Farmers who use (any) pesticides produce on average 644 kg/ha/year, while farmers who don't use pesticides at all, produce 586 kg/ha/year. The table below shows an interesting correlation: Farmers who use fungicides as part of any observed crop protection regime, produce in general more than farmers that use herbicides. The combination of at least fungicides and insecticides results in a higher production of on average minimum 120 kg more compared to farmers that use using herbicides and insecticides, only insecticides or only herbicides. The table below also shows that herbicides seem to have no effect on yield, though may reduce labor costs.[4]

% of farmers	Herbicide	Insecticide	Fungicide	kg/ha
1.59%		✓	✓	775
29.73%	✓	✓	✓	721
0.07%			✓	698
33.92%	✓	✓		601
4.60%		✓		588
0.25%	✓		✓	586
16.94%				586
12.89%	✓			583
	76.79%	69.84%	31.64%	

Table 2: Use of Pesticides and Yield

[4] There are slight differences between the table and previously stated used of herbicides (76.75% vs. 76.79%), insecticides (70.04% vs. 69.84%) and fungicides (30.37% vs. 31.64%) because different sample sizes (completeness of pesticide data and yield). The same applies for the 28.1% of the farmers that use herbicides, insecticides and fungicides (compared to the 29.73% in the table) and the 32.4% of the farmers that apply herbicides and insecticides, but no fungicides (compared to 33.92% in the table).

The average production for the 29.7% of the farmers who use fungicides, insecticides and herbicides is 721 kg/ha/year. Of those farmers, those that use paraquat products (41.7% out of the 29.7%) produce on average 662 kg/ha/year, while the farmers who don't use paraquat products (58.3% of the 29.7%) produce on average 762 kg/ha/year. One reason could be that only less professional farmers use Paraquat products, while more professional ones prefer alternatives. More qualitative research is needed to analyze the impact of paraquat products in cocoa production.

Pesticides can have a negative impact on health and the environment. Sometimes they are applied excessively, which is uneconomic and unnecessary. They can reduce the populations of insects, spiders and birds that naturally control pests either through direct effects (e.g. affecting insect larvae) or indirect effects (such as lower number of flowering weeds visited by insects).

In interviews, male farmers reported using pesticides slightly more than female farmers.

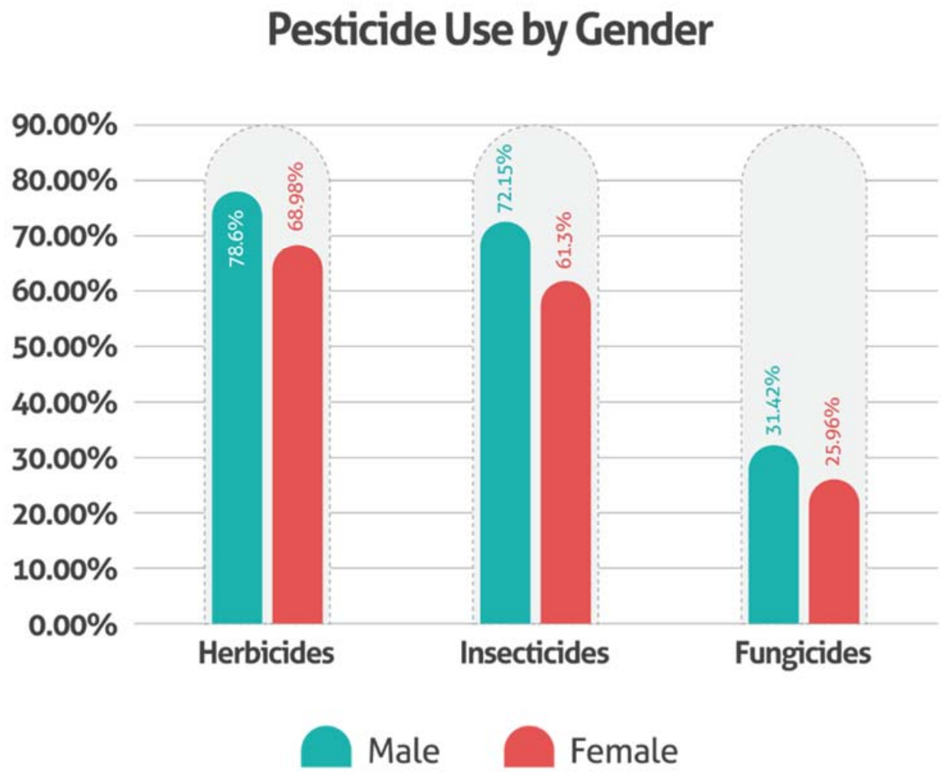


Figure 13: Use of Pesticides by Gender

There are downsides towards the use of pesticides. These are safety aspects, including real and potential risks to growers and consumers and cost-effectiveness which is perhaps of greatest interest to many farmers. Technical problems in the pesticide application include the development of resistances (resulting in loss of effectiveness), which may cause farmers to increase dosages and thus add to the risk of high residue and resurgence. Insecticides can make minor pest problems worse or increase general impact on the environment, the soil and non-target organisms. Pesticides cause costs to society in terms of health and environmental costs. These external costs are not yet reflected in the market price of pesticides.[5]

[5] Eyhorn/Roner/Specking (2015)

Opportunities related to Pesticides

The table below shows weaknesses, strengths and opportunities for farmers, retailers and pesticide producers:

	Weaknesses	Strengths	Opportunities
Farmers	• Lack of knowledge about pesticides • Farmers want to see results in a short period of time • Farmers think that the most powerful pesticides are the best	• Farmers are very open to increase knowledge which is related to agriculture and farms • Farmers have basic technical skills	• Refresh theory and provide more information about pesticides, active ingredients, health and environment effects. • Some could specialize in pesticide application and offer the service
Retailers	• Lack of knowledge/ awareness on active ingredients, watchlist and banned pesticides • Lack of infrastructure and trained personnel for safe pesticide handling	• Close presence to and strong network/link with farmers	• Could play a bigger role in educating farmers on the use of pesticides and how to handle pests and diseases • Could be the gate-keeper, what is sold to the farmers • Could offer protective clothing for spraying
Pesticide Producer	• Lack of transparency when informing farmers about their products • Lack of infrastructure and trained personnel for safe pesticide handling	• Understand the farmer needs • Effective Marketing • High visibility • Offer a visible effective product • Strong network/link to the farmers	• Cooperate with all stakeholders in the pesticide value chain and enhance transparency on banned or watchlist pesticides • Store pesticides safely • Keep farmers health and environment effects in mind • Offer safe products and have them always in stock • Educating farmer on the safe use of pesticides; having printed explanations available in the store • Traceability system to monitor buyers
SCPP	• No power to force desired behavior	• Basic information about (organic) pesticides • Access to farmers trained • Field staff on the ground	• Train farmers on best pesticide application practices including health and environment effects, protective closes, active ingredients, etc. • Advise on not spraying in sensitive areas, such as wildlife corridors or food/fodder areas • Increase farmer knowledge on fungicides • Recycle container, using lower toxic pesticides, using PPE, and reduce dose
Field conditions	• Many companies/ formulators promote their product	• Support from government law regulations	• Has alignment with government, other institutions and companies to promote products which do no harm people and the environment

Table 3: Weaknesses, Strengths and Opportunities related to Pesticides

Pesticide Use in Cocoa Farming

Pests in Cocoa

Sixty-three percent of SCPP farmers said that they had Cocoa Pod Borers (CPB) on their farm within twelve months before the baseline survey was taken. It has been demonstrated that implementing a variety of proper farming practices can control infestation. These practices include correctly timing the harvest, planting less susceptible cultivars, proper sanitation and pruning, managing shade trees, weeding, removal of water shoots, removing infested crop residues, using biological controls (black ants, parasitic wasps, etc.) and chemical pesticides (insecticides, herbicides and fungicides). It has been shown that 61% of SCPP farmers only apply chemical practices and apply fungicide or insecticide at baseline, instead of proper cultural practices. Thirty-five percent of the farmers apply neither cultural practices nor chemical practices.

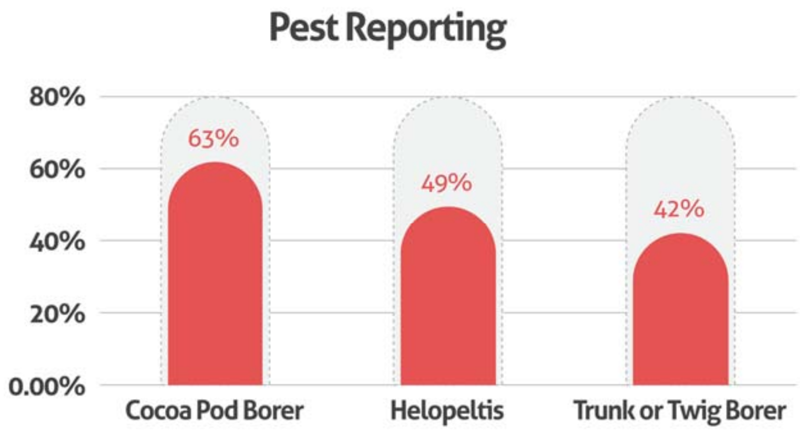


Figure 14: Pests in Cocoa Farms

Diseases in Cocoa

Sixty-two percent of the farms of SCPP farmers suffer from the disease Black Pod, where pods turn black and often results in total loss of that pod. It is caused by a fungus (*Phytophtora palmivora*) that proliferates and infects cacao trees in areas with high relative humidity.[6] After that, Stem Canker is most common with 44% of the farms affected. Cankers can form under the bark of infected stems and branches. The canker can continue to expand until it kills the branch. “Severe losses due to stem canker were reported in Fiji and Papua New Guinea, where a number of trees died.”[7] Site selection, quarantine, plant resistance, removal, spacing and pruning, and fungicide are options to manage stem canker. VSD (Vascular Streak Dieback) effects 41% of the farms. It causes losses among cacao seedlings and kills branches in mature cacao trees. The characteristics symptoms include a green-spotted chlorosis and falling leaves. Eventually complete defoliation occurs, and if the fungus spreads to the trunk, the tree will die. Pod diseases like black pod have the capacity to reduce yield by more than 80%.[8] Diseases can be fought similarly to pests

[6] Mahon et al., 2010
[7] Firman and Vernon 1970; Prior 1981 and Adegbola 1981, quoted from: Surujdeo-Maharaj, S. et al (2016): Black Pod and Other Phytophthora Induced Diseases of Cacao: History, Biology, and Control
[8] Bateman, 2015

through cultural practices such as frequent harvesting, pruning, sanitation, or *pod sleeving* (although with a questionable ecologic footprint), or it can be managed with natural predators or chemical insecticides.

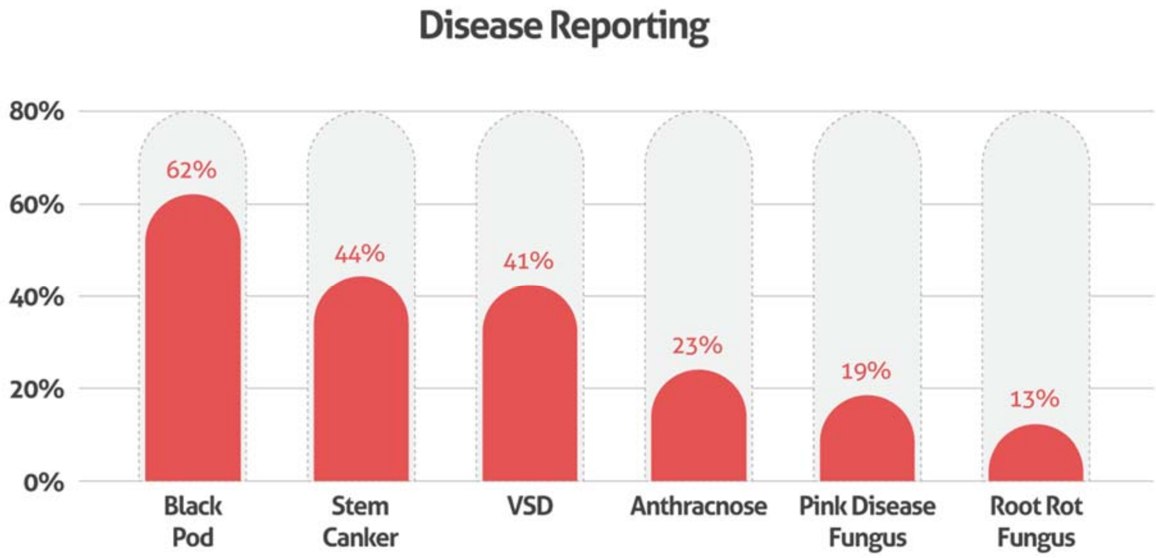


Figure 15: Diseases in Cocoa Farms

Pesticide Application

Pesticide application is considered to be a male task. In 90% of the cases, men are the ones applying pesticide, regardless of the gender of the farm owner. Pesticides can harm the environment if they are not applied correctly. Inappropriate pesticide application can lead to contamination of the soil and waterways, wildlife corridors and exposure to humans. Therefore, farmers need to take important considerations and follow good practices of several aspects such as target, type, timing, dosage and systematic application of pesticides to achieve effective pest and disease management with minimal environmental degradation on cocoa farms.

Recommended pesticide application practices include:[9]

1. Knowing the right target
   Identification of the types of organisms (specific plants, pest and diseases) to be controlled. Examination, how to treat the target including pesticide application in pods/trunks/shoot/entire tree. If the pest is wrongly identified, farmers will not be able to choose the right type of pesticide.

2. Selecting the right type
   After the assessment of the targeted plants and pests, determination of suitable types of pesticides to be used and check if the pesticide is recommended for controlling the problem. Farmers need to understand the important information including the hazard exposure signs on the pesticide labels. Selection of a pesticide that is effective against the targeted pest or diseases and has a minimum risk to human health and environment.

[9] See amongst other DuPonts SIX-T; SCPP

3. Timing
   Determination of the most appropriate control time by identifying:
   a. Vulnerable stages of pests that attack the cacao tree.
      - Knowing and being able to identify the life cycle of the pest helps to find the right time, when the pest is most vulnerable and becomes a threat for the cacao tree. Thus, the quantity of pesticide applied will be optimal.
   b. Population density
      - Checking the population density of a pest that affects the cacao tree helps to choose a quantity that has lowest possible effects on human health and environment
   c. Environmental condition
      - The effectiveness of application depends on weather conditions such as wind. Strong wind can decrease the applied quantity to the area to be treated. Pesticides can run-off through the soil to the ground water and waterways, which can contaminate habitats and human health. The best time to use a pesticide is when the soil is moderately dry and no or only a little rain is expected.
   d. Repeat
      - If repeat is required, repeat, but check minimum required number of days between application and harvest to avoid harmful residues in the product.

4. Dosage
   Application of the appropriate concentration/dose as recommended, including the correct mixture of the solution to control the target. Use of only the minimum rate on the pesticide label that is recommended.

5. Application
   Application of the pesticide that is consistent with formulations and recommended suggestions. Pesticides are the least option, applied only after mechanical and biological control. Personal Protective Equipment (PPE) is required when handling and apply pesticides.

UTZ Recommended pesticide handling practices include:

1. Pregnant and breastfeeding women and children under 18 are not allowed to handle pesticides.
2. Pesticides should be stored in special places away from children, animals, and other natural resources.
3. Empty pesticide containers should be rinsed three times, chopped and buried into the ground.
4. Use of appropriate PPE and protective clothing, as prescribed, based on the kind of pesticide and method of application.
5. Preparation of and access to first-aid boxes.
6. Handling of empty pesticide containers and obsolete pesticides by a collection, return, and/or disposal system (organized by government or supplier). Containers are stored, labeled, and handled adequately and securely until they are collected.
7. In case there is no integrated waste management in the area, empty pesticide containers are disposed in a manner that minimizes exposure to humans, the environment, and food products.

In a case study in Tanggamus, West Lampung, and South Ogan Komering Ulu, South Sumatra, about the pesticide monitoring system in Indonesia it is shown that 47% of the farmers receive information about pesticides through retailers and 14% receive information through agricultural extensions. Yet, in this study 39% of their farmers also receive information from other farmers. A survey done in October 2015 in

Mamuju, West Sulawesi, showed a different situation. When buying pesticides, 70% of the farmers reported not receiving any information about how to use the purchased pesticide even though all retailers surveyed claimed that they provided information on the use to the farmers, mainly verbal instructions though.

Pesticide Storage

When farmers receive training, and are aware of the topic, behavior changes. After receiving training, the bad practice to store pesticides in the house was reduced from 30.8% to 6.2%, while the good practice of storing pesticides in special places increased significantly from 18.8% to 60.3%.

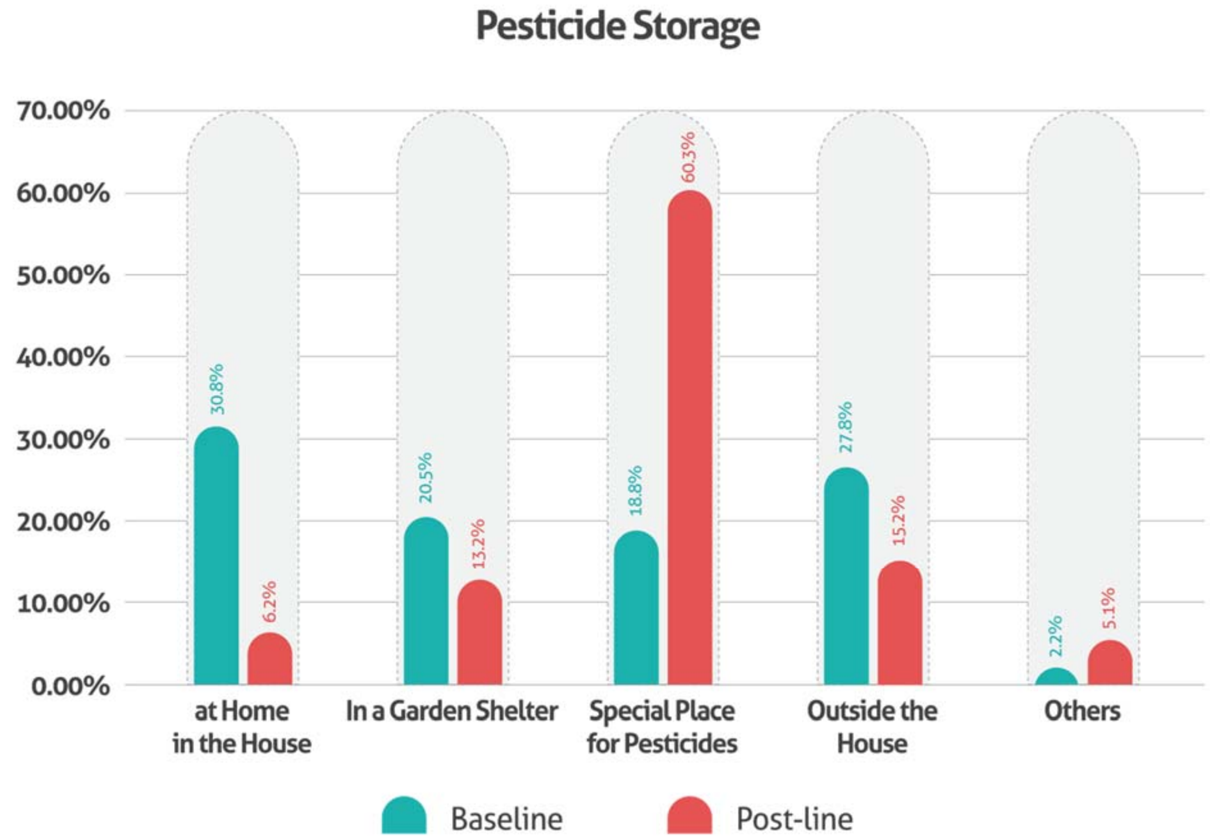


Figure 16: Pesticide Storage: Baseline / Post-line Comparison

The bad practice of disposing empty pesticide containers carelessly decreased from 72.1% of the farmers doing it to 13.6%. The good disposal practice of rinsing, chopping, and burying the empty containers, increased significantly from 9.4% to 61.9% after cocoa farmers have received training that raises awareness and increases knowledge.

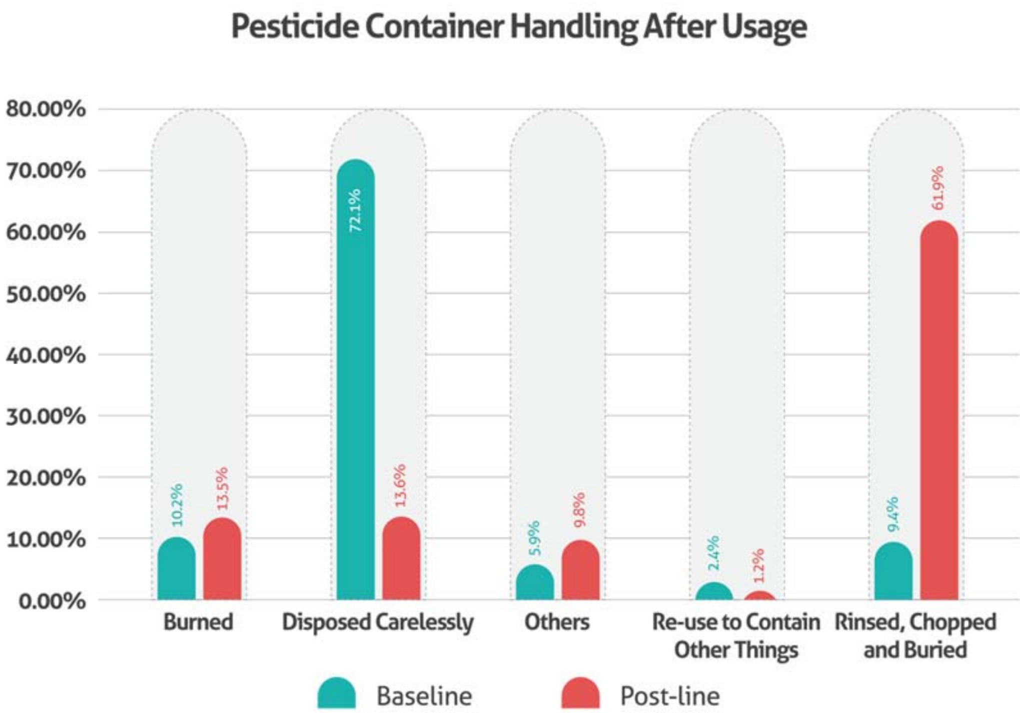


Figure 17: Empty Pesticide Container Handling: Baseline / Post-line Comparison

Farmers' behavior towards pesticide use is influenced by several factors. Firstly, there are government programs. From 2009 to 2013 the government launched GERNAS, a program to increase cocoa production and quality. The program provided training to farmers, agri-inputs for cocoa intensification, as well as equipment to ferment and dry cocoa beans. The provision of agri-inputs included pesticides, fertilizers and seedlings. Since then, the number of extension officers in the field was reduced, hence knowledge transfer on proper use of pesticides was obstructed.

Secondly, cost efficiency plays a role. Farmers save a lot of time, energy and resources eliminating weeds in their cocoa farms by using herbicides. By using herbicides, the farmers do not need to pay additional workers for manual weeding, what would cost significantly more than buying and applying herbicides.

Marketing by pesticide brands is another factor to be considered, when looking at farmers' behavior of pesticide use. Intensive marketing can be found in almost all regions. For instance, the pesticide producers establish instantaneous demo-plots, where the effectiveness of pesticides is shown.

Usually, Indonesian farmers need to see results first, before implementing an agriculture practice, therefore, some pesticide producers have established permanent demonstration plots. In those plots, highly visible from the road, they use pesticides and show high-yielding cacao trees. The producers also use small pieces of land besides the roads, about 10m, where they spray herbicides, demonstrating its effectiveness. A sign board with the name of the herbicide is placed. These intensive efforts have been carried out over many years and formed the belief among farmers, that using pesticides is required for highly productive cocoa farms, although technically other agricultural practices come first. Marketing for herbicides, stating to be the "choice of the intelligent farmer" are common.

There are indications that pesticide retailers do not know what effect pesticides have on health or environment, therefore they sell (sometimes banned) pesticides which are recommended by the pesticide producers. Health and environmental risks are not being considered when retailers were selling pesticides to their clients. Retailers often do not have a list of banned pesticides or active ingredients, and do not know that it exists. However, some farmers obtained list of pesticides and their active ingredients from trainings that they joined.

49.1% of the farmers in the baseline survey and 82.4% of the farmers in a post-line survey claim that they use some kind of protective equipment, usually gloves, masks, coat and/or boots to protect themselves from chemical compounds in pesticides when it is sprayed. However, in SCPP's Mamuju study it was found that 65.6% of the farmers used just a simple scarf, while 34.4% used a plastic mask. Use of full protection is probably way less, considering the warm climate and availability of protective clothes. 13.3% of the farmers re-entered the farm after one day, 46.7% after two to three days. Recommended practice is to re-enter earliest after 48 hours after the farm was sprayed.

Herbicides

Use of Herbicides

General Overview

Herbicides, also commonly known as weed killers, are pesticides used to kill unwanted plants. The aim of weed control is to reduce moisture to inhibit pest and disease development and reduce the level of competition between weeds and plants in nutrients, and other growth factor such as light and water. Consequently, weed control is an activity that must be routinely done in cocoa plantation and other plantation crops. Weeds often become a perfect hideout for dangerous animals that can disrupt the safety of the farmer. In addition, using herbicides is cheaper than non-chemical control, because farmers only hire one day labor to spray, while non-chemical control can last several days. Certification bodies such as UTZ suggest giving priority to non-chemical weed control strategies, e.g. sanitation, mulching or planting cover crops.

76.8% of the farmers in SCPP use herbicides.[10] 16.0% use more than one of the three active ingredients (Glyphosate, 2,4D or Paraquat). The table below shows that e.g. 29.6% of the farmers use only Paraquat, while another 13.4% use Paraquat in combination with products in one or both of the other categories.

[10] Herbicides containing Isopropylamine Glyphosate, Monoammonium Glyphosate and/or Monoammonium Glufosinate are referred to as Glyphosate or Glyphosate products in this study. Herbicides containing Paraquat dichloride, are called Paraquat, and herbicides containing 2,4 Dimethylamine are called 2,4D. Some herbicides such as Bimastar contain more than one active ingredient. Those are classified under the more hazardous category, as classified by the World Health Organization (WHO), in this case the hazardous category of 2,4D.

% of farmers	Glyphosate	2,4D	Paraquat
0.52%	✓	✓	✓
11.96%	✓		✓
2.01%	✓	✓	
0.96%		✓	✓
52.12%	✓		
2.84%		✓	
29.58%			✓
	66.62%	6.33%	43.02%

Table 4: Use of Herbicides

Of the farmers who use herbicides, in Aceh, 92.7% prefer Glyphosate products, while in Sulawesi Paraquat products are used frequently. Because of double or triple use of different categories of herbicides products (Paraquat, Glyphosate and/or 2,4D products), the total sum per province shows herbicide use beyond 100%.

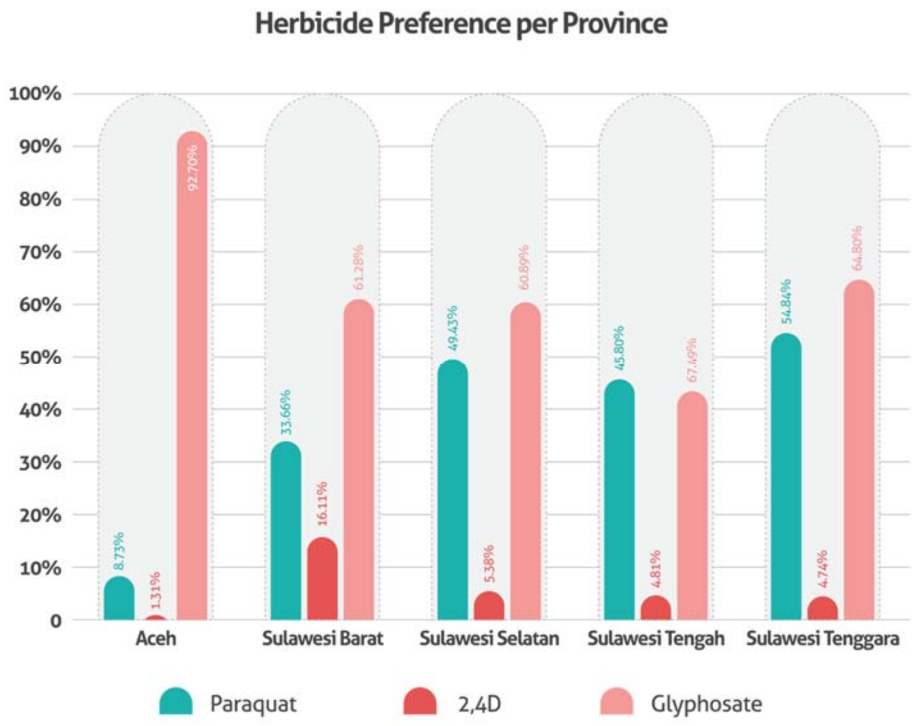


Figure 18: Herbicide Preference per Province

On the farms surveyed by SCPP, farmers use herbicides that the WHO classification scale lists as moderately hazardous. These are Paraquat and 2,4D products. 69.7% of the farmers who use Paraquat products use *Gramoxone* and 20.7% use *Noxone*. Both are banned by UTZ.

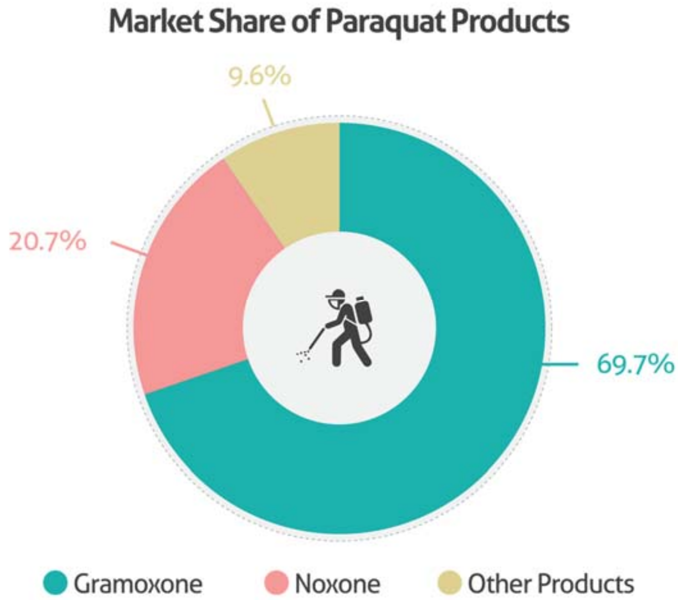


Figure 19: Market Share of Paraquat Products

From the 2,4D products, 32.7% of the farmers use *Bimastar* and 19.5% *Rumat*. 2,4D products are also classified as moderately hazardous. Overall use is however little. 4.9% of men and 4.5% of the women who use herbicides, use 2,4D products.

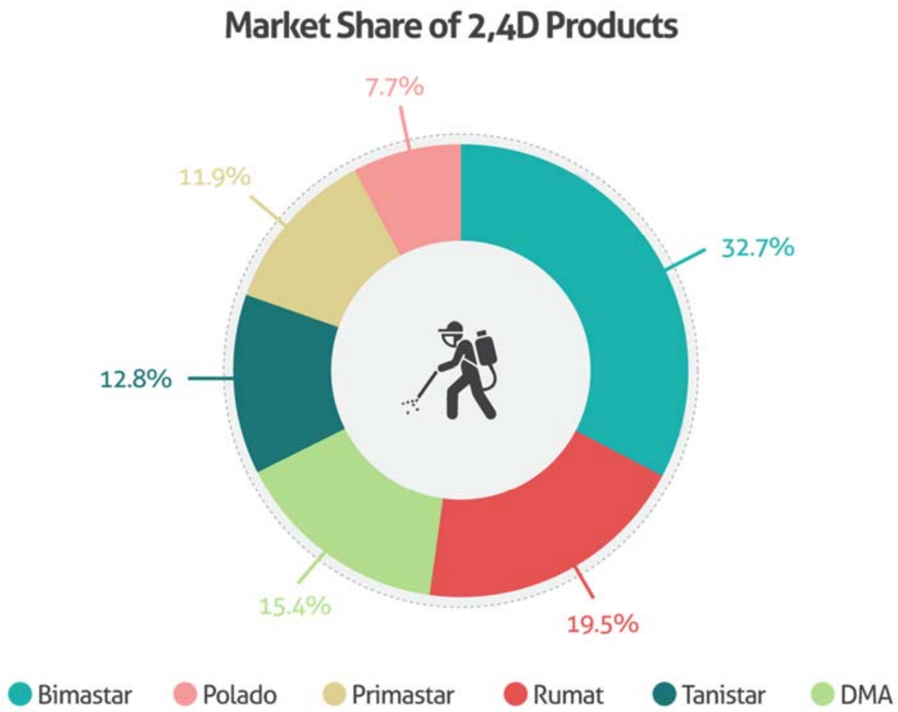


Figure 20: Market Share of 2,4D Products

Glyphosate products are indicated as slightly hazardous on the WHO classification scale.[11] 40.6% of the Glyphosate products used is *Supremo*. The next three products have an equal share of about 12% each.

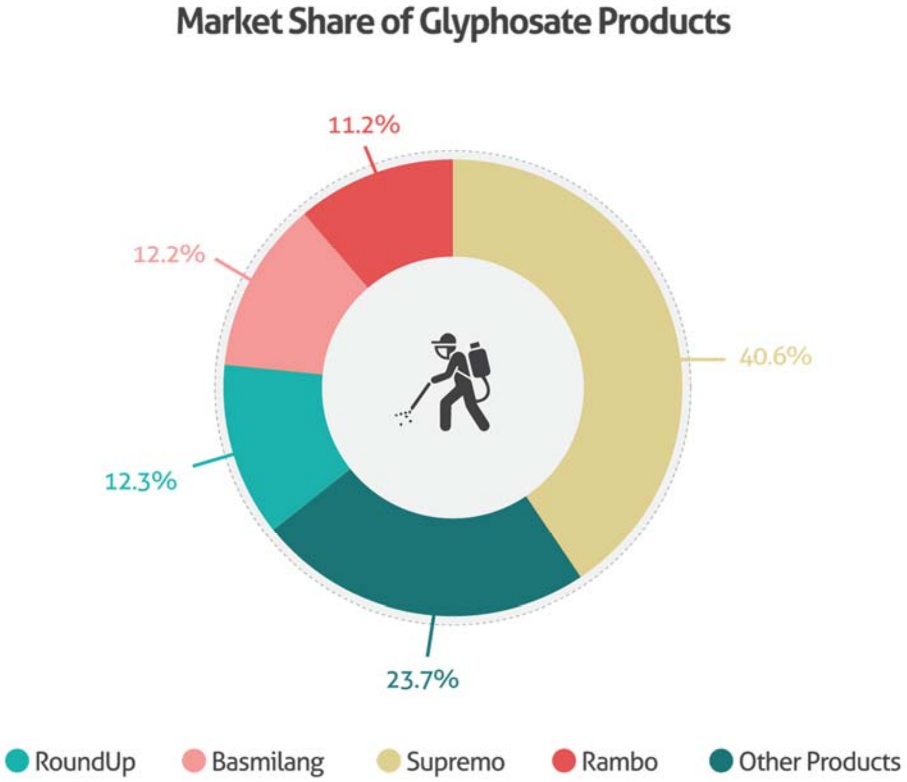


Figure 21: Market Share of Glyphosate Products

Who are the Herbicide Users?

78.6% of male and 69.0% of the female farmers use herbicides. Professional, and especially progressing farmers use herbicides, as well as farmers on medium and large farms. In both cases, farmers have higher absolute cash flows, thus might be able to afford herbicides and appropriate equipment to protect themselves and apply the herbicide. Education and age doesn't seem to be correlated to pesticide application.

[11] Correct application should have no health effect. However, evidence from the field shows that farmers do not apply pesticides always as recommended. Other research points out the fact, that Glyphosate products are usually mixed with other ingredients that might solely or in combination cause negative health or environmental effects. This means, that research on 100% Glyphosate can show a certain result (e.g. non-carcinogenic), while in combination with other ingredients the result could be different (e.g. probably carcinogenic).

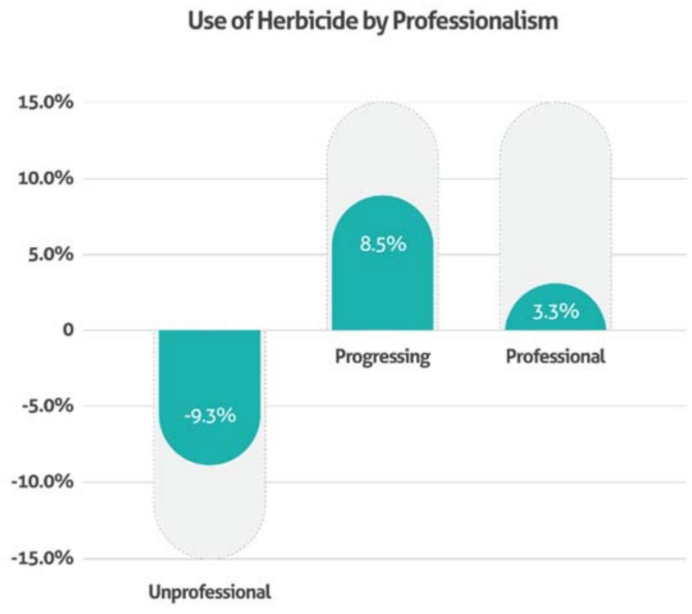


Figure 22: Herbicide Use by Professionalism
Note: Zero refers to the average rate of use

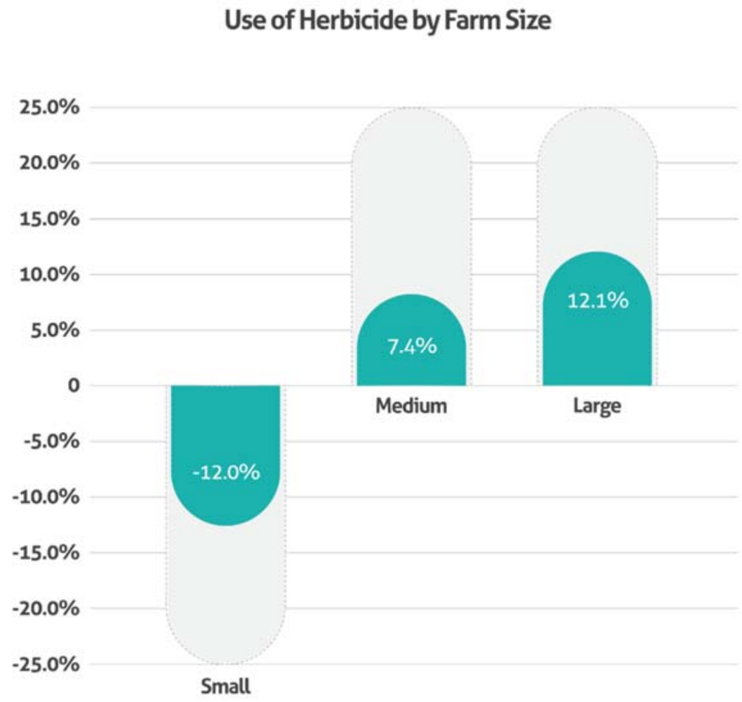


Figure 23: Herbicide Use by Farm Size

Manual weed control (not using herbicides) doesn't show a different yield compared to the use of herbicides. Herbicides could reduce the population of natural predators or agents directly or indirectly. Moreover, herbicides can have negative effects on soil biological and biota. Pesticides kill all microorganism without selection and can cause contamination of the soil with its chemical substances and thus, reduce soil fertility.[12] This could cause negative effects, equaling the positive effects of a fast removal of unwanted plants that compete with the cacao trees for nutrients. In addition, possible overuse of chemicals can lead to resistance, resulting in greater pest problems, as recommended pesticide application doesn't show effects anymore. Farmers below 45 years of age use Paraquat products more often than their older peers. This is especially the case in West Sumatra. As more professional the farmers are, as less they use Paraquat. This might be because Paraquat is banned by UTZ and farmers who want to be certified, cannot use it. Instead, those farmers use more often Glyphosate.

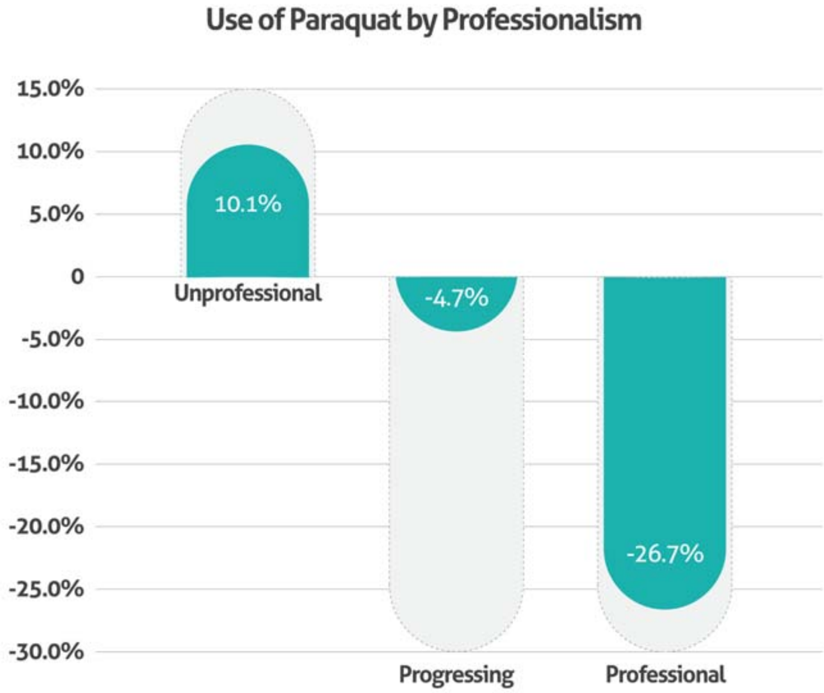


Figure 24: Use of Paraquat by Professionalism

Paraquat use was reduced from 38.2% of the farmers to 10.4%[13], a decrease of 72.8%. Although 31.4% of the farmers have stopped using Paraquat completely, 3.6% have started using it after the training, while 6.7% are continuously using it.

---

[12] This includes physiological and biochemical mechanisms, as well as behavioral resistance of the insects, leaving the area where pesticides are/were applied. (see Gonzales, R. et. Al (2017): The behavioral resistance in insects: Its potential use as bio indicator of organic agriculture). Research has shown, that some predators are less active, when exposed to pesticides. (see Miko, Z. et al (2017): Effects of a glyphosate-based herbicide and predation threat on the behavior of agile frog tadpoles. De Freitas et al. (2017; Pesticide selectivity to natural enemies: challenges and constraints for research and field recommendation) found in their review that pesticides can be harmful to eggs and larvae of certain predators, but not on adults, while in some cases of other predators the pesticides affected the adult population. Afolabi, O./Muoghalu, J. (2016) found that the decomposition of pesticide treated cacao leaf litter is slower than for untreated leaves. (Effect of pesticides on microorganisms involved in litter decomposition in cacao plantation in Ile-Ife, Nigeria). Forbes, S./Northfield, T. (2016) state, that "broad spectrum pesticide use often lead reductions in the provision of pollination services and crop production." (Increased pollinator habitat enhances cacao fruit set and predator conservation)

[13] The 38.2% differ from the 43.02% of Paraquat users stated in Table 2, as for the table latest data from 63,727 farmers where used, while for the baseline/post-line comparison the sample size with not only baseline, but also completed post-line surveys was 29,106 farmers.

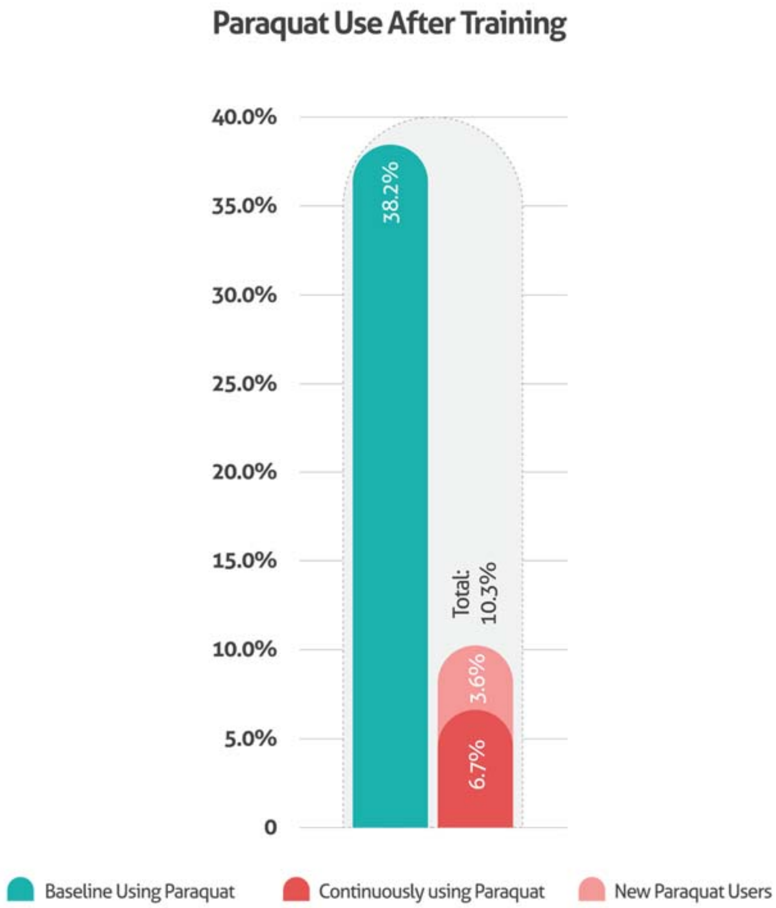


Figure 25: Paraquat Reduction: Baseline / Postline Comparison

Background on Paraquat

Paraquat dichloride was first banned in 1983 by Sweden, since then it has been forbidden in more than 30 countries, including Switzerland. Its use is restricted in many more countries, including Indonesia since 1990: **"Severely restricted, use only for certain estate crops by professional applicators possessing special permit. May induce symptoms in affected humans too late to cure."** Since 2009 it has been on PAN (Pesticide Action Network) Highly Hazardous Pesticides (2009) lists for global phase-out. World Bank funded projects and most of the large certification labels (UTZ, Rainforest Alliance, Fair Trade and FSC) do not allow its use. Because of its toxicity and immediate health effects, there are growing requirements for setting up of permissible levels and control of paraquat dichloride residues in cocoa beans, currently being already checked in Japan, EU and the US.

Effects on health and environment

- ✓ Highly acutely toxic to humans, with irreversible effects
- ✓ Extreme toxicity to animals (including aquatic fauna), fungi and algae
- ✓ High residues in plants
- ✓ Very long persistence in soils
- ✓ Toxic to water resources

52.3% of the male and 46.2% of the female cocoa farmers use Glyphosate. There are big variances with almost no use in NTT and about 60% of the farmers in South-East Sulawesi (60% men; 65% women) using it. Education and age are not a major distinguisher, although on average farmers below 25 and above 55 years use comparably less Glyphosate than their peers. As mentioned before, professional farmers use comparably more often Glyphosate products.

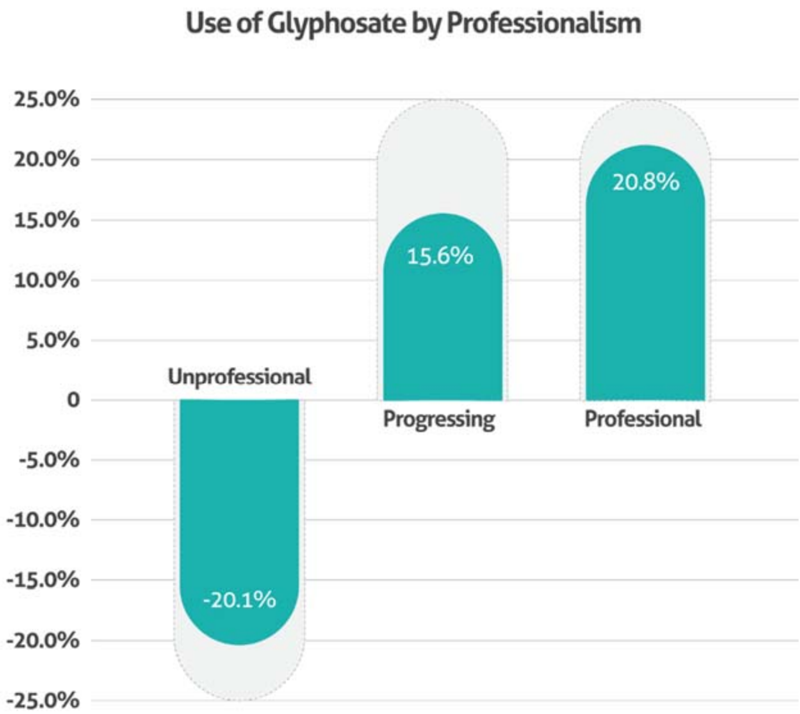


Figure 26: Use of Glyphosate by Professionalism

Application and Information

In relation to the impact on the environment and the safety to growers and consumers, voluntary certification bodies such as UTZ, Fairtrade and Rainforest Alliance publish lists of Banned Pesticides and Pesticide on Watchlists. Every certification body has its own list, yet the differences are not huge. To get certified, which usually comes with premiums paid by following the certification standards, farmers must use the pesticides which do not consist of the banned active ingredients. For the UTZ certificate, these lists only apply to active ingredients used during production, thus these lists do not apply to active ingredients used during post-harvest activities.

Farmers and pesticide applicators are particularly prone to adverse effects due to their direct exposure to pesticides at work. In addition, in agricultural areas where pesticides are heavily used, the population nearby is also at risk. Pesticides drift in the air, pollute soil and water resources and can thus contaminate large areas. The widest exposure to pesticides, however, is through residues in food. Exposure is presented as multiple mixtures of chemicals, the toxic effect of which are unknown, particularly over longer time scales.[14]

Insecticides

An insecticide is a substance used to kill insects. They include ovicides and larvicides used against insect eggs and larvae, respectively. 70.0% of the farmers use insecticides: 72.2% of the male and 61.3% female farmers. The use in Aceh is low, while in Sulawesi the use is much higher.

[14] Eyhorn, Roner and Specking, 2015

	male	female
East Nusa Tenggara	8.8%	22.2%
Aceh	30.9%	23.0%
Lampung	66.7%	25.0%
North Sumatera	67.3%	61.4%
Central Sulawesi	70.8%	70.2%
Total	72.2%	61.3%
West Sulawesi	78.8%	77.4%
South Sulawesi	87.3%	83.6%
Southeast Sulawesi	90.9%	92.1%
Gorontalo	92.9%	86.3%

Table 5: Use of Insecticides per Province

Similar to the use of herbicides, professional and progressing farmers, as well medium and large farms are using insecticides.

On SCPP farms, banned and Watchlist insecticide are being used by 89.2% of the farmers who use insecticides. 85.8% use watchlist insecticides only, while 2.0% use both banned and watchlist insecticides. 2.5% of the farmers use organic insecticides.

% of farmers	Banned	Watchlist
2.04%		
1.39%		
85.78%		
	3.44%	87.83%

Table 6: Use of Banned and Watchlist Insecticides

While the share of farmers who apply banned insecticides decreased by 94.2% after training, the share of farmers who previously did not apply them, increased from 0.7% to 4.4%.

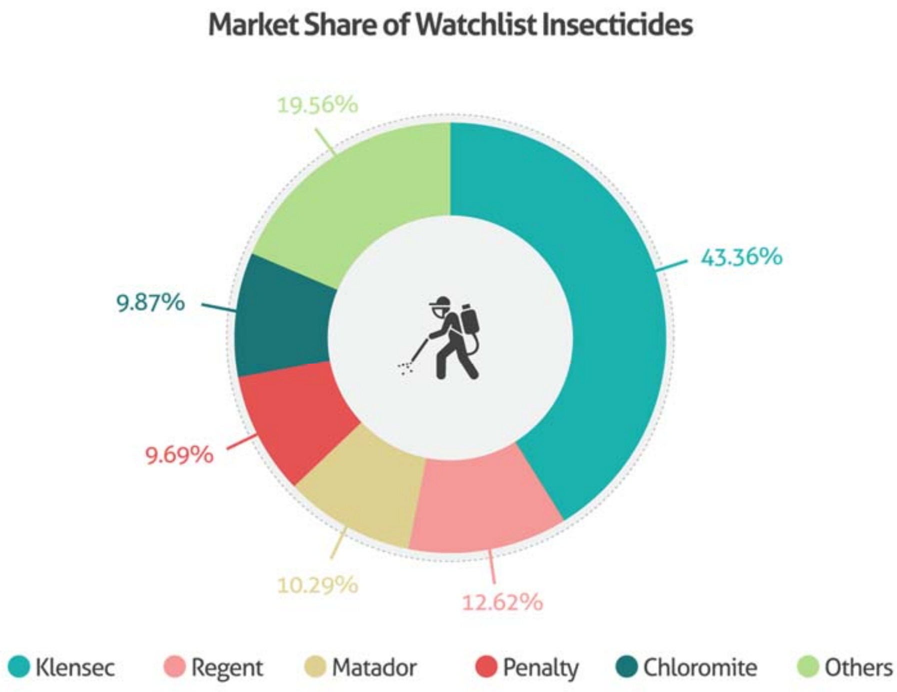


Figure 27: Market Share of Watchlist Insecticides

The market share of those banned products is as follows:

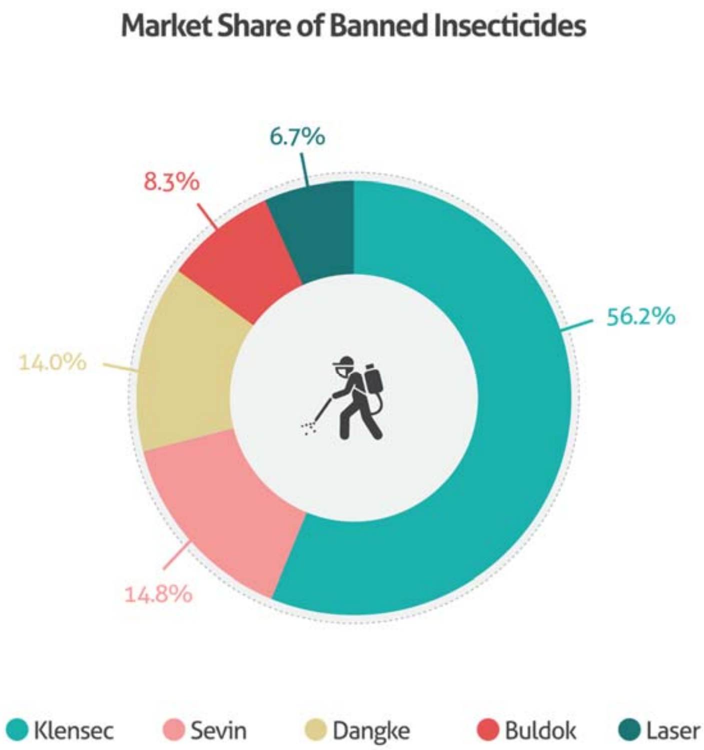


Figure 28: Market Share of Banned Insecticides

Dangke and *Buldok* (combined market share of 22.3%) are classified by the WHO as 1b, highly hazardous, while the others are classified as moderately hazardous. The typical banned pesticide user is a progressing farmer below the age of 45 with a medium sized farm. 91.5% of the instances of banned insecticides occurred in Sulawesi.

Fungicides

Fungicides are biocidal chemical compounds or biological organisms used to kill or inhibit fungi or fungal spores. Fungi can cause serious damage in agriculture, resulting in critical losses of yield, quality, and profit.

The overall picture for fungicide use looks similar to herbicide and insecticide use, except that the difference between professional and unprofessional farmers is significantly larger than in herbicides and insecticides. There are at least two possible explanations: (1) Farmer knowledge is low and through application of an herbicide or insecticide unprofessional farmers might think they have successfully handled the issue, or (2) absolute cash flows do not allow the farmer to purchase herbicides and insecticides, as well as fungicides. There is, as with the other pesticides before, a more likely application, if the farm size is one hectare and above.

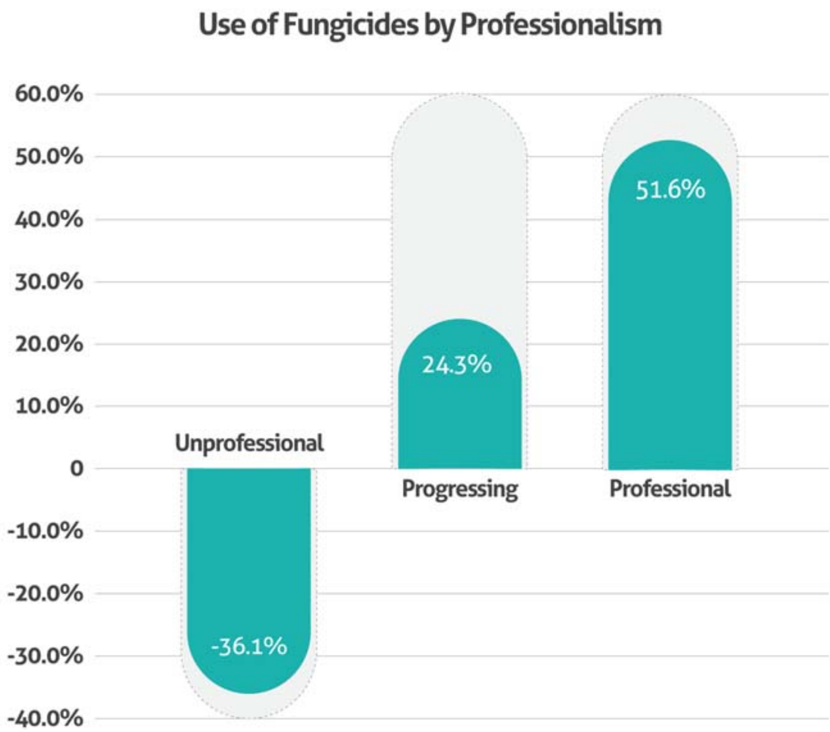


Figure 29: Use of Fungicides by Professionalism

1.2% of the farmers who apply fungicides are using the banned *Benhasil*. 28.6% use fungicides on the watchlist. In general, the use of fungicides much less problematic than use of insecticides and herbicides, considering health effects as stated by the WHO.

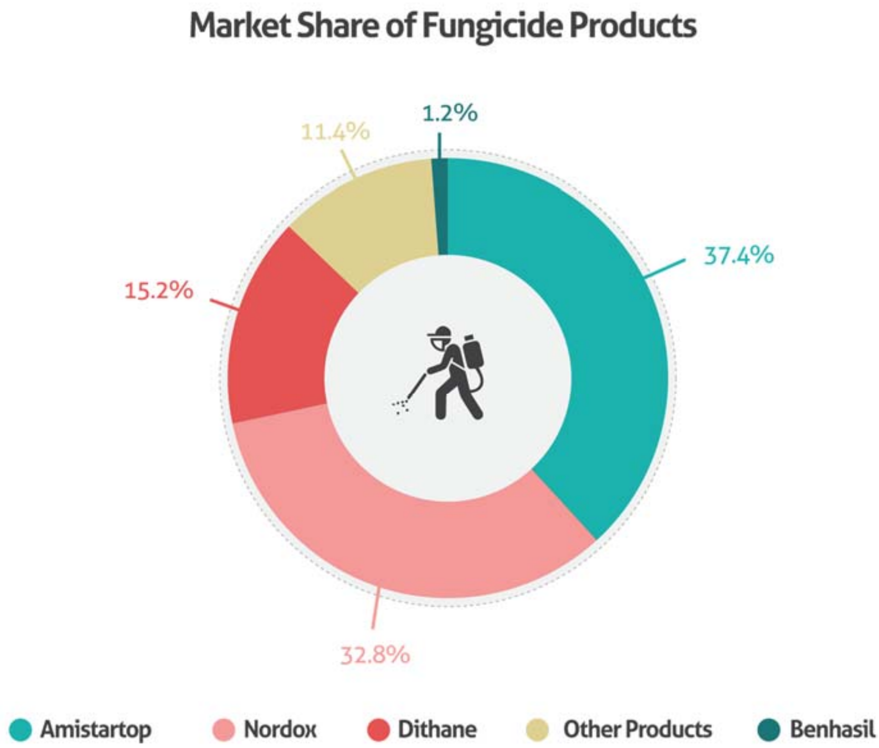


Figure 30: Market Share of Fungicide Products

The number of farmers reporting the use of fungicides after receiving training increased from 19.9% to 29.6%.

Case Study Palm oil

The conservation of biodiversity and the variation of species and ecosystems are fundamental for human survival, for livelihoods, physical health and overall well-being. The provision of food and water, pest control, pollination, soil processes and climate regulation are processes that can only be supported by functioning ecosystems. The sustainability of processes within ecosystems for continuing provision of such services and for ensuring ecosystem resilience to environmental perturbations is supported by biodiversity within the ecosystems.

The establishment of monoculture oil palm plantations usually involves replacement of rainforests for the plantations. Consequently, environment of the rainforests has drastically changed and became much more simplified. Plantations cannot support the same levels of biodiversity as forest. Research shows that plantations support just 47% of the biodiversity levels found in primary tropical forest and many of the highly specialized and rare species found in rainforest are replaced by widespread, generalist and open habitat species. The conversion of habitat, from natural forests to oil palm plantations, have adverse impact on other plant and animal species. “There are nearly eighty mammal species found in Malaysia’s primary forests, just over thirty in disturbed forests, and only eleven or twelve in oil palm plantations” (Wakker, 1998). Similar species reductions occur for birds, reptiles, soil microorganisms and insects.

Oil palm plantations in Indonesia use large quantities of pesticides. The plantations are usually owned by companies or state-owned enterprises which have the necessary financial means to purchase pesticides. Barnes et al. (2014) concluded that there is indeed a link between reduced numbers of species in oil palm plantations and lower ecosystem functions in the regions. It also found that pesticides or insecticides applied at higher levels in oil palm plantations potentially caused a reduced abundance of insects. Insects are important in ecosystems because they help recycle nutrients, pollinate and are a food source for other species. Some insects are predatory, keeping other species under control. Decline in predatory insects may cause difficulties in pest handling.

One effective and sound measure for reducing pests and pests' effects is biological control; that is: using living organisms that are predators of the pests. Such living organisms are usually called "natural enemies". Natural enemies are particularly important for reducing the numbers of pest insects and mites. However, biodiversity loss may cause reduction in number of insects hence number of natural enemies.

Cocoa farming around the palm oil plantation will be affected by the consequences of ecosystems disturbed by oil palm clearing. When pest insects and mites attack cocoa farms, because of the lesser natural enemies, farmers will find it harder to control them. This could force farmers to use more pesticides even though the farmers themselves already have the knowledge of proper dosage for pesticide use. Circumstances force them to use pesticides in high doses, probably above those already recommended.

Conclusions, Recommendations and Actions

Pests and diseases are major factors for production loss in cocoa farming. If they could be controlled, manually, biologically or chemically, farmers' productivity could increase, ensuring higher incomes. First step to control pests and diseases is through Good Agricultural Practices, e.g. removing black pods, pruning to allow wind and sun to dry wet trunks/branches faster or proper sanitation. Those are low-cost solutions. After good agricultural practices are applied, better results can be achieved with the proper application of insecticides and fungicides. Weeds are cleared either manually or through the application of herbicides. In order to ensure productivity, to manage entrepreneurial risks and to compete in the market in terms of quality and price, currently 79.8% of the farmers use any kind of pesticides.

SCPP trains cocoa farmers in Good Agricultural Practices, Good Environmental Practices, nutrition, financial literacy and others. The first two in particular address the topic of appropriate use and application of pesticides as well as disposal of containers. There are several critical issues regarding pesticides. The use of protective clothing is either little or not sufficient, by using e.g. only scarfs. Banned pesticides are used without being aware and they shouldn't even be available to smallholders in Indonesia. Both, how pesticide equipment is washed and how pesticide containers are disposed leaves room for improvement. Farmers are also less aware of the effect on the environment and retailers have little knowledge about health and environmental effects or banned pesticides.

The knowledge of retailers regarding pesticides and possible negative effects on health or environment is limited. The risks for the farmers are not being taken into account when retailers were selling the pesticides. Retailers often do not have a list of banned pesticides or active ingredients, and usually do not know that it exists. Although the situation improves, lack of knowledge about pesticides, both on farmer and retailer side, is probably the cause of why farmers are still spraying with banned pesticides. Availability of those pesticides indicate low law-enforcement. Sometimes protective clothes are unavailable in certain districts. It must be ensured that they are made available at affordable prices at the pesticide retailer stores. In addition, retailers should be included into trainings on pesticides to address the topics of available products, knowledge of active ingredients, seasonal calendar, when certain pesticides must be applied, quantity to be applied and how to apply pesticides safely.

Pest control on farms is essential and there is a trade-off between fighting pest and diseases efficiently and a safe application of the pesticides that are often harmful to the farmers' health. SCPP and its partners have had huge efforts to train farmers on more appropriate use of pesticides. Trainings, raising awareness, informing about banned and hazardous pesticides and educating about the proper use, have been successful. The use of Paraquat was reduced by 27.78%, being an important step to reduce the use of banned pesticides to zero.

The use of fungicides in combination with insecticides shows the highest yields and herbicides seem to have no visible effect on yield. Considering that less than 30% of the fungicides used are on the watchlist or banned, an appropriate application of fungicides has the potential to increase farmer yields by decreasing losses through diseases.

Some findings require more research that combines qualitative and quantitative methods. This includes topics like whether the pesticides are appropriately applied or not and if this might explain the difference yields when applying different pesticides in any combination. Other research could investigate on the emission of greenhouse gasses based on pesticide use, especially looking at higher yields, growth of the tree, but also possible effects on the soil, if biodiversity is decreased. Usefulness of organic pesticides in cocoa production would be another research question, not only related to productivity, but also health effects.

References

Barnes, Andrew D., Jochum, M.,Mumme, S.,Haneda, N.F.,Farajallah, A., Widarto, T., Brose, U. (2014) Consequences of tropical land use for multitrophic biodiversity and ecosystem functioning. *Nature Communications.*

Bateman, R. (2015). *Pesticide Use in Cocoa*. 3rd ed. London: International Cocoa Organization (ICCO)

Eyhorn, Roner and Specking (2015). Pesticide Reduction in Agriculture – What action is needed?

FairTrade International (2015). Fairtrade Prohibited Materials List

Hamim Sudarsono Purnomo Wagianto (2015). Pesticide monitoring system in Indonesia: Case study in Tanggamus, West Lampung and South Ogan Komering Ulu.

McMahon P. J., Purwantara A., Wahab A., Imron M., Lambert S., Keane P. J., Guest D. I. (2010) Phosphonate applied by trunk injection controls stem canker and decreases Phytophthora pod rot (black pod) incidence in cocoa in Sulawesi. Australasian Plant Pathology 39, 170-175.

Paraquat: Pesticide Action Network Asia and the Pacific, 2011. Available on: http://wssroc.agron.ntu.edu.tw/note/Paraquat.pdf

The Distribution of Paraquat: Does Syngenta Respect Human Rights? Berne Declaration and ECCHR, 2011. Available on: http://www.ecchr.eu/en/documents/publications/legal-opinions/articles/the-distribution-of-paraquat-does-syngenta-respect-human-rights-1338.html

UTZ certified (2015). List of Banned Pesticides and Pesticides Watchlist Version 1.0. (2015). 1st ed. Amsterdam

Vanegtern, B., Rogers, M., & Nelson, S. (2015). Black Pod Rot of Cacao Caused by Phytophthora palmivora. Plant Disease.

Wakker, Eric. (1998) Lipsticks from the Rainforest. Palm Oil, Crisis, and Forest Loss in Indonesia-The Role of Germany. November. *World Wildlife Fund Germany*

World Health Organization (2010). The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification.

Annex 1: Pictures

Photo 1: Most Common Storage of Pesticides at Farmer's House, South-East Sulawesi, 2014

Photo 2: No Protection - Common Sight in Indonesia how Farmers Apply Herbicides, Sulawesi, 2014

Photo 3: Advertisement for Gramoxone at a village shop close to a cocoa buying unit, West Sulawesi 2015

Photo 4: A cooperative pesticide shop in Sigi, Aceh

Annex 2: Government and Other Regulations

There are a number of regulations in Indonesia, concerning pesticides:

Indonesian government

Name	Year	Concerns	Extra information
	1973	Monitoring of distribution, storage and use of pesticide	Pesticides which have been registered and/or obtained permission. Permission can be given as a temporary permit or trial license (when pesticide has not been registered/not obtained permission).
UU. No 12	1992	Plant cultivation system and sustainable plant cultivation	Through sustainable agriculture which needs good quality of human resources
PP. No 6	1995	Plant protection	Implemented in pre-planting, growing and post-harvest through the use of IPM and prevention control and eradication activities by involving community and government. The protection activities are not only knowledge-, and technology based but also includes government policy and community support.
UU. No 23	1997	Environment management	Preservation of environmental capacity, environmental pollution, the standard criteria of environmental pollution, conservation of natural resources, hazardous materials and hazardous wastes etc.
Pertanian No. 887/KPTS/OT.210 /9	1997	Guidelines for Controlling Plant Pest Organisms	
UU. No. 8	1999	Consumer protection	Right to comfort, security and safety in the consumption of goods or services; the right to choose the goods and services and acquire goods and/or services in accordance conditions and guarantees; the right to be served properly, honestly and no racial; the right to obtain compensation and/or replacement, if the goods or services does not match with agreement etc.
Permentan/ OT.140/1	2007	List of banned/restricted active ingredients	
Permentan 24/SR.140/4	2011	Condition and procedures of pesticide registration	
Permentan 107/ Permentan/SR.14 0/9	2014	Monitoring of pesticides	
Permentan No. 39	2015	FAO and WHO standard of pesticide implementation worldwide	Guidelines and requirements

International regulations

There are also international regulations, which need to be taken into account when shipping to other countries.

EU regulations for pesticides and commodities

Regulation (EC) No 396/2005: sets MRLS for pesticide residues in food and animal feed produced, or being imported into, the EU. All cocoa beans imported into the EU must conform to the new Regulation, although temporary MRLs (tMRL) may apply to certain Al for a transitional period.

Regulations in the United States of America

In the USA, the Environmental Protection Agency (EPA) established the Food Quality Protection Act (FQPA) of 1996 and was considered approximately equivalent to 91/414/EEC (http://www.epa.gov/opp00001/regulating/laws/fqpa/backgrnd.htm), but regulates the amount of pesticide residues permitted on food for consumption. The EPA also requires that all approved pesticides are clearly labelled with instructions for proper use, handling, storage and disposal.

Regulations in Japan

On 29 May 2006, the Ministry of Health, Labor and Welfare (MHLW) established a positive list system for agricultural chemicals remaining in foods, including cocoa, as part of the implementation of its Food Sanitation Law. A number of samples were found to have excessive residue levels and shipments have been rejected over the years. The high rejection rate has been attributed to the method of analysis used, which was different to that used by other importing countries, but is now being harmonized.

Annex 3: SCPP Training Modules on Integrated Pest Management

Pest and disease management, is an important topic in the SCPP FFS. Farmers are taught about the proper use of the pesticides, active ingredients, health effects and others:

Pests, diseases, weeds	• To learn about main pests, diseases and weeds which attack cacao trees and farms • To understand the life cycle and management control (biological, mechanical, cultural and chemical) of main pests, diseases and weeds in cocoa plantations • To learn about integrated pest, disease and weed management in environmentally-friendly way	Farmers can recognize the main pests, diseases and weeds on their farms and know how to deal with it in environmentally friendly and economically efficient way. They understand the linkage between pests and diseases occurrence, climate and soil, shade and farm management.
Chemical pesticides	• To learn about systemic and contact pesticides, the differences, economical return and pros and cons • To understand the kinds of pesticides (herbicide, fungicide and insecticide), and active ingredients • To learn how to read information on pesticide label • To understand the effects of pesticides for human and environment • To learn how to manage the pesticide use safely and what are banned pesticides in the market • To learn and practice how to apply pesticides wisely and in environmentally-friendly way	Farmers understand the pros and cons of applying chemical pesticides. They are able to assess and calculate the suitability of its use on their farms and are able to apply it wisely, in right dose, time and way, in a safe and environmentally-friendly way.
Organic pesticides and its preparation	• To learn about organic pesticide, its application, effectiveness, pros and cons, and how they work • To know and identify species of plant which can serve as organic pesticide • To prepare and apply organic pesticide and test the effectiveness	Farmers understand the pros and cons of organic pesticides, are able to make their own from locally available plants and know its effectiveness.

Example Pictures from the Training Material – Flipcharts:

MELINDUNGI DAN MELAKUKAN KONSERVASI

Petani dan pemegang sertifikat melindungi dan melakukan konservasi semua badan dan sumber air (termasuk air tanah) didalam dan disekitar tanah pertanian dari kontaminasi dan polusi.

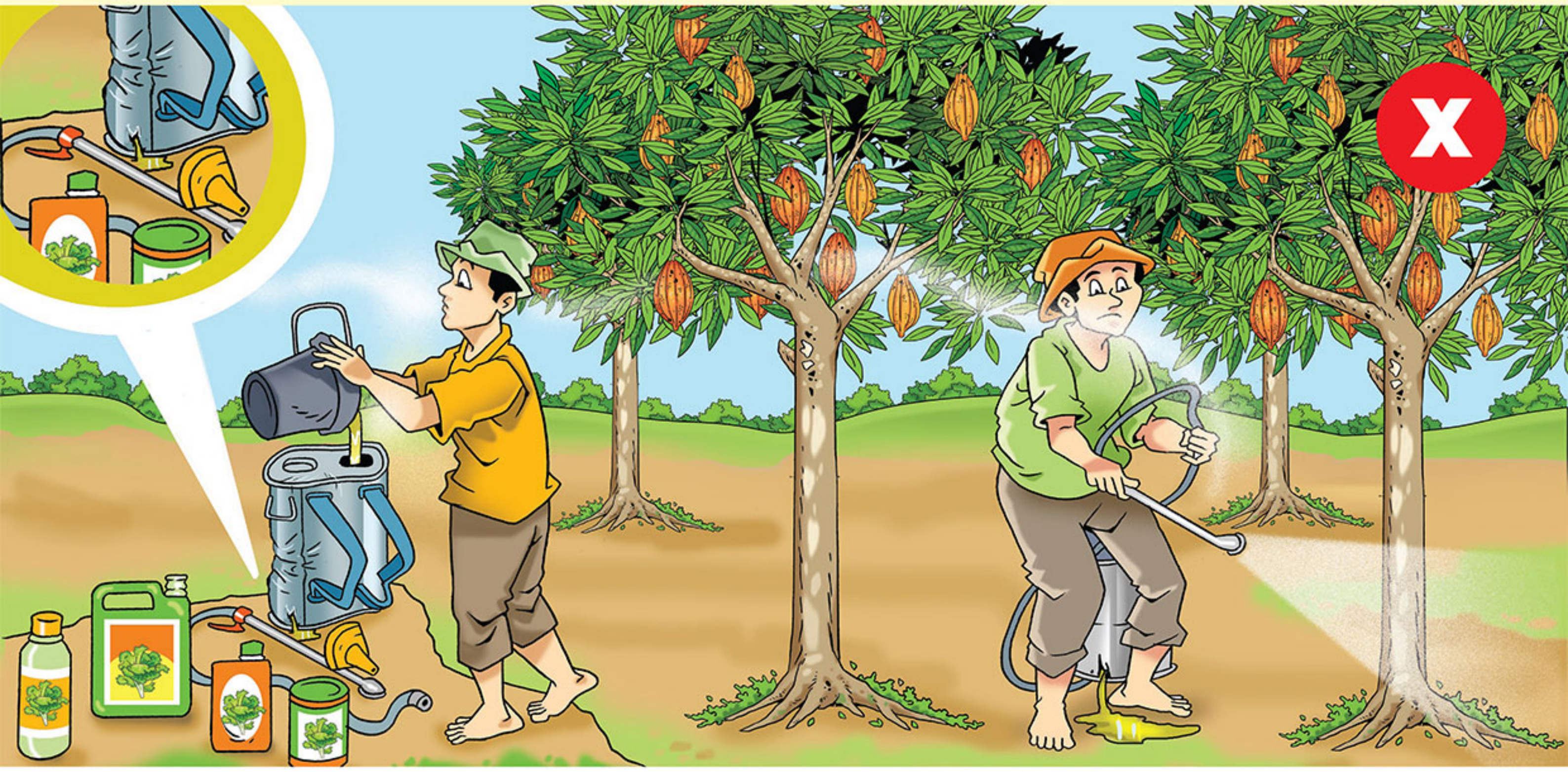
- ✓ Petani wajib mengenakan pakaian penyemprotan pestisida saat menyemprot
- ✗ Dilarang membuang sisa limbah pestisida kedalam sungai

Memperhatikan batas hutan lindung saat penyemprotan bagi kebun yang berdekatan dengan kawasan hutan lindung

PENGGUNAAN PRODUK PERLINDUNGAN TANAMAN

Petani melakukan penyemprotan tidak sesuai anjuran:

- Melakukan penyemprotan tanpa menggunakan pakaian pelindung
- Penggunaan alat semprot yang tidak standar
- Tidak memperhatikan arah angin

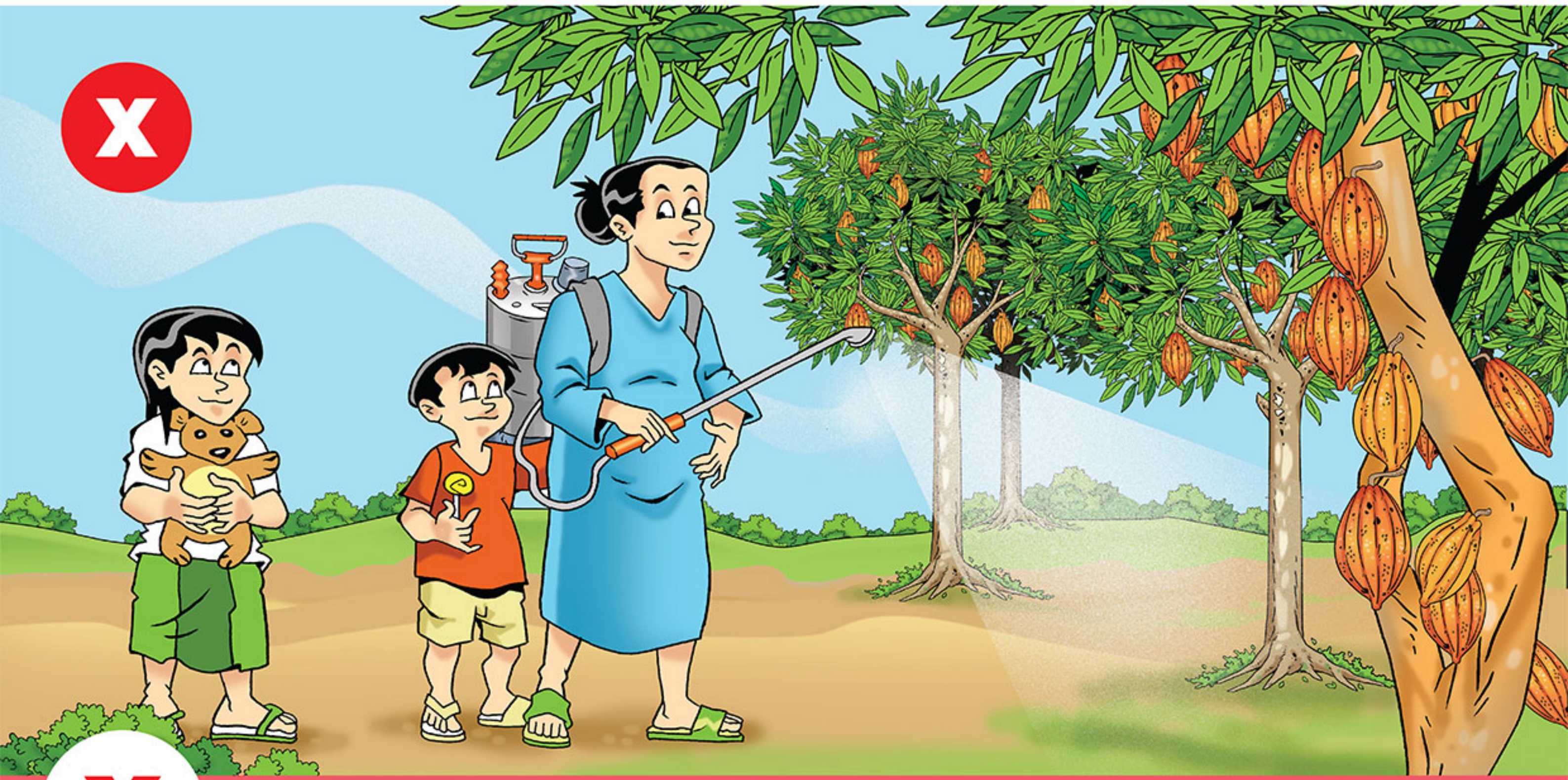


Akibat yang ditimbulkan:

- Mata perih
- Mual-mual
- Kulit gatal
- Keracunan

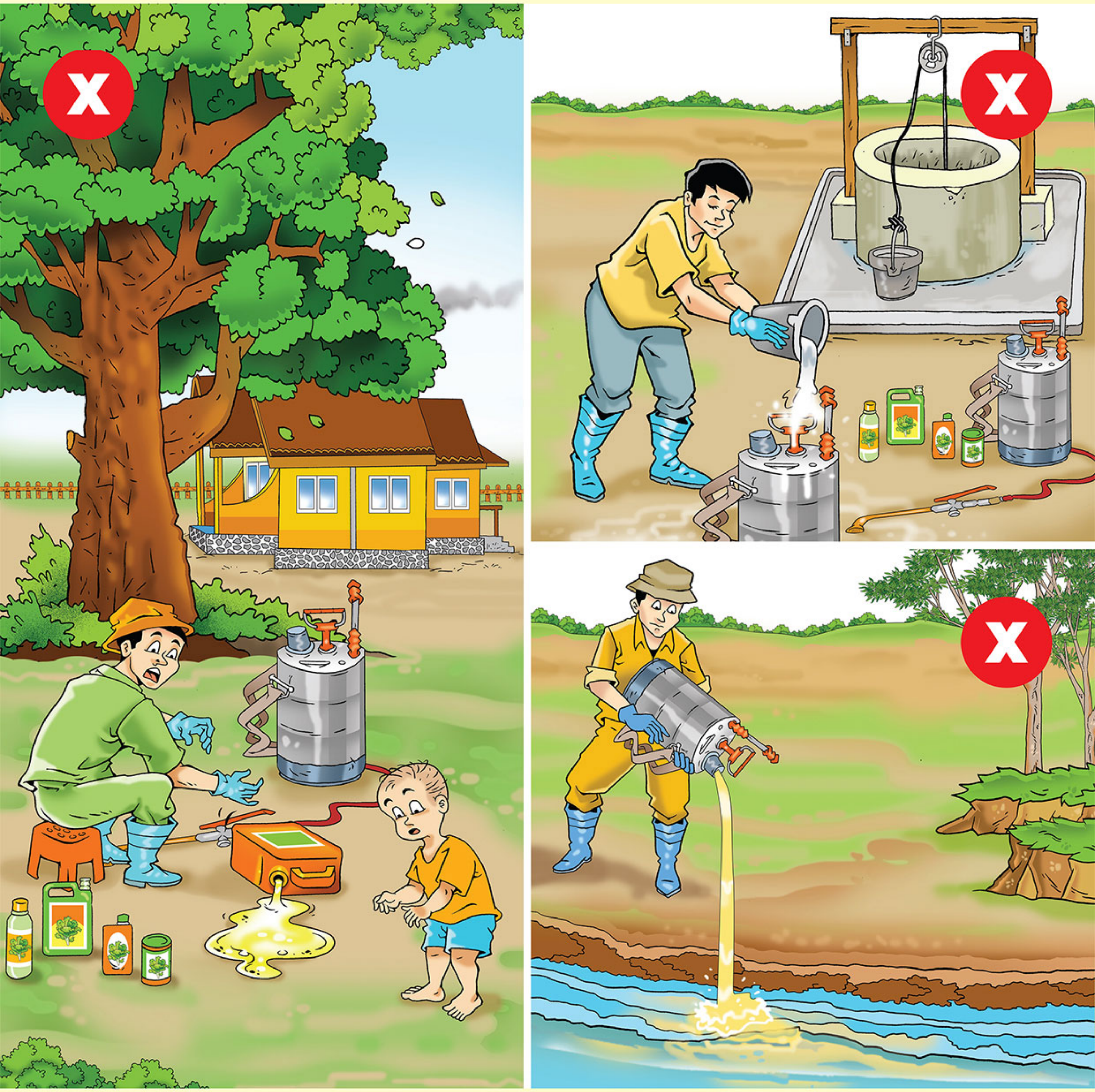
TEKNIK PENYEMPROTAN YANG DIANJURKAN

- Menggunakan pakaian pelindung lengkap
- Memberi tanda peringatan "berbahaya atau memasang kain/plastik berwarna merah" bagi kebun yang telah dilakukan penyemprotan, serta dipasang ditempat yang mudah dilihat



Praktek penyemprotan pestisida dilarang bagi ibu hamil dan anak usia dibawah 18 tahun karena merupakan pekerjaan berbahaya

PRAKTEK PASCA PENYEMPROTAN YANG TIDAK DIANJURKAN



- Menumpahkan sisa pestisida disekitar rumah dimana anggota keluarga sering bermain
- Membersihkan peralatan semprot pestisida dekat sumber air (sumur)
- Membuang sisa pestisida ke dalam sungai

Annex 4: Pest, Diseases and Weeds

Diseases are fought be Fungicides		
1	Canker	See figure: 32
2	Black pod (*Phytophthora palmivora*)	
3	Pink disease	
4	Root disease	
5	VSD (Vascular Streak Dieback)	
6	Antracnose (*Colletotrichum gleosporioides*)	
Pests are fought be Insecticides		
7	CPB (*Conopomorpha cramerella*)	See figures: 29 and 30
8	Helopeltis (*Helopeltis antonii*)	
9	Stem borer (*Zeuzera coffeae*)	
Weeds are fought by Herbicides		
10	*Ageratum conyzoides*	See figures: 20, 21 and 22
11	*Clidermia hirta*	
12	*Melastima*	
13	*Synedrella nodiflora*	
14	*Borreria alata*	
15	*Ottcohloa nodosa*	
16	*Axonopus compressus*	
17	*Paspalum conjugatum*	
18	*Alternathera philoxeroides*	
19	*Asystasia sp*	
20	*Banaue melastoma fr*	
21	*Cyclosorus*	
22	*Cyperus kylingia*	
23	*Cyperus rotundus*	
24	*Uncaria sp*	

Annex 5: Categories of Pesticide Toxicity

The US Environmental Protection Agency (EPA) system:

Categories of Acute Toxicity					
Category	**Signal Word Required on Label**	**Oral Ld50[15] Mg/kg**	**Dermal LD50 mg/kg**	**Inhalation LC50 mg/l**	**Approximate Oral dose that can Kill an Average Person**
I Highly toxic	DANGER-POISON[16] (skull and crossbones)	From 0 to 50	From 0 to 200	From 0 to 0.2	A few drops to 1 teaspoon full (or a few drops on the skin)
II Moderately Toxic	WARNING!	From 50 to 500	From 200 to 2000	From 0.2 to 2	Over 1 teaspoonful to 1 ounce
III Slightly Toxic	CAUTION!!	From 500 to 5000	From 2000 to 20,000	From 2.0 to 20	Over 1 ounce to 1 pint or 1 pound
IV Relatively Non-toxic	CAUTION!!	More than 5000	More than 20,000	Greater than 20	Over 1 pint or 1 pound

The WHO (World Health Organization) class:

WHO Class		LD_{50} for the rat (mg/kg body weight)	
		Oral	Dermal
Ia	Extremely hazardous	< 5	< 50
Ib	Highly hazardous	5–50	50–200
II	Moderately hazardous	50–2000	200–2000
III	Slightly hazardous	Over 2000	Over 2000
U	Unlikely to present acute hazard	5000 or higher	

Reference: The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification. (2009). 1st ed. World Health Organization, p.10.

[15] LD50 tests measures how much of a chemical is required to cause death. The lower the score, the more dangerous it is.

[16] 'Extremely hazardous by skin contact – rapidly absorbed through skin', 'Corrosive – causes eye damage and severe skin burns'