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Research & advice

International Palm Oil Workers United

OSH in oil palm plantations

Workers' risk of exposure to agrochemicals in Colombia, Ghana, and Indonesia

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About this report

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Summary

Palm oil is the most widely used edible oil globally. Valued at over US$ 50 billion in 2021, the palm oil industry is projected to grow to US$ 65 billion by 2027, underscoring its significant economic importance. It also serves as a crucial source of employment, providing jobs for millions of people. However, palm oil production heavily contributes to deforestation and biodiversity loss, particularly in Southeast Asia, where plantations often replace secondary forests. From 2000 to 2016, deforestation linked to palm oil accounted for 25–30% of global forest loss. Furthermore, the sector's reliance on agrochemicals—such as pesticides and fertilizers—poses significant risks to workers and nearby communities, who face daily exposure to hazardous chemicals. This exposure can lead to both acute and chronic health issues, including cancer, neurotoxicity, and reproductive problems, disproportionately affecting vulnerable groups like women and children.

Despite widespread recognition of these risks, comprehensive documentation regarding workers' safety and health in the context of agrochemical exposure remains lacking. To address these knowledge gaps, the International Palm Oil Workers United (IPOWU), with support from Profundo and funding from Mondiaal FNV, conducted a survey among 1,436 oil palm plantation workers in Colombia, Ghana, and Indonesia to assess their risk of exposure to agrochemicals. An analysis of the public and private policies governing occupational safety and health (OSH) and the use of agrochemicals in the palm oil sector was also performed. Oil palm plantation workers are exposed to agrochemicals directly when applying fertilizers or mixing and spraying pesticides, as well as indirectly when performing tasks such as harvesting, replanting, field maintenance, and managing plant waste in areas that have recently been treated with agrochemicals.

This study found that comprehensive policies on chemical safety and occupational health remain lacking, leaving workers without adequate health monitoring, safety training, or protective equipment. In Colombia, Ghana, and Indonesia, regulatory frameworks for agrochemicals and OSH show both strengths and gaps. Despite rather comprehensive laws, compliance is weak due to insufficient oversight and enforcement mechanisms. None of the three countries have ratified key International Labour Organization (ILO) conventions such as C155 (Occupational Safety and Health) and C139 (Occupational Cancer Convention), while other relevant conventions (such as C184 – Safety and Health in Agriculture and C170 – Chemicals Convention) have only been ratified by one or two countries. Against this background, it is not surprising existing national policies often lack specificity regarding commercial plantations, leading to poor worker safety and health standards.

While initiatives like the Roundtable on Sustainable Palm Oil (RSPO) aim to improve practices in the palm oil industry, they face criticism for their limited effectiveness, insufficient monitoring, and failure to comprehensively address worker safety concerns, particularly regarding agrochemical exposure. At the same time, downstream buyers of palm oil often lack dedicated OSH policies for their suppliers, embedding worker safety commitments within broader frameworks that overlook specific risks associated with agrochemical use, particularly for female workers.

With regard to the survey results, most workers report undergoing regular OSH training; however, gaps exist, particularly in Indonesia, where training effectiveness may need improvement. Most Colombian and Indonesian workers express concern about health risks associated with their tasks. In contrast, many Ghanaian workers do not perceive their work as compromising their safety, which could indicate effective preventive measures. Many workers across Colombia and Indonesia do not report overtime, but a notable portion of Ghanaian workers do, potentially increasing their exposure to health risks. Differences in overtime reporting are also observed between direct and outsourced workers.

Whereas all surveyed workers come in contact with agrochemicals, many displayed significant gaps in awareness regarding their exposure. In Colombia, a considerable number of workers recognised their contact with agrochemicals, whereas fewer in Indonesia and Ghana did, indicating

varying levels of awareness across these countries. However, a notable proportion of workers remain uninformed about the specific agrochemicals they use. Many Indonesian and Colombian workers lack essential information, highlighting the need for improved training and communication.

The surveyed workers mentioned a total of 56 different agrochemicals used in the plantations. Among these, one insecticide (Beta-cyfluthrin) and one fertilizer (Zinc phosphide), both used in Indonesia, are classified by the World Health Organization (WHO) as highly hazardous. Additionally, Dicofol, an insecticide used in Indonesia, is severely restricted in the EU, while Kasugamycin, a fungicide used in Colombia, is banned in the EU. Benomyl, another fungicide used in both Colombia and Indonesia, has been withdrawn from the EU market. Alarmingly, 29 of the reported agrochemicals have hazard classifications that exceed those of the WHO for carcinogenic and mutagenic effects. This situation is concerning, especially given that agrochemicals such as tebuconazole and paraquat continue to be used in Colombia and Indonesia, respectively, despite their known dangers. Notably, the EU has banned the use of paraquat domestically since 2007 but continues to be a significant exporter to Indonesia, highlighting the profit derived from selling dangerous chemicals that it deems too hazardous for its own citizens.

Proper timing for re-entering treated fields is essential for minimising exposure risks. While many workers in Colombia and Ghana adhere to recommended waiting times, a concerning number in Indonesia work during pesticide applications, indicating lapses in safety compliance. Moreover, workers applying fertilizers often enter fields shortly after pesticide applications, increasing health risks. This situation highlights the urgent need for stricter safety measures and heightened awareness of agrochemical exposure.

Most workers reported receiving personal protective equipment (PPE) from their employers; however, some workers in high-risk roles, such as spraying and waste management, noted gaps in provision, highlighting inconsistencies in PPE distribution. A significant number of workers indicated that damaged PPE was not replaced, which raises serious concerns about safety and compliance with the ILO standards that mandate proper maintenance and replacement of PPE at no cost to workers. While many workers did not incur costs for PPE, some Indonesian workers reported having to purchase their own equipment. This situation reflects a failure to meet ILO requirements and places an unfair burden on workers.

Access to washing facilities for PPE is limited, leaving many workers unable to effectively clean their protective gear. This deficiency poses contamination risks not only for the workers themselves but also for their families, who face cross-contamination risks when workers wash their PPE at home due to the lack of facilities at the workplace. Additionally, many workers encounter challenges related to inadequate access to basic sanitation facilities, which undermines their ability to maintain personal hygiene and manage exposure to hazardous chemicals—an essential aspect of worker health and safety.

Further, while a majority of workers are able to perform their tasks while wearing PPE, some experience difficulties. This issue is particularly pronounced among workers in specific roles, indicating a need for better PPE design that accommodates the diverse requirements of different job tasks.

Access to information regarding safety practices is inconsistent among workers. While some reported awareness of daily agrochemical usage, others lacked access to safety labels and data sheets. This discrepancy highlights the need for improved communication and adherence to ILO standards regarding safety documentation. Smoking regulations vary significantly among surveyed countries. While many workers in Colombia and Ghana reported smoking bans on plantations, a portion of Indonesian workers stated they could smoke in certain circumstances. This inconsistency underscores the need for stricter enforcement of smoking policies in areas where hazardous substances are present.

Many workers reported no health symptoms, but headaches and dizziness are common across all regions. This consistency highlights the need for effective health monitoring and targeted preventive measures. Various skin irritations were reported, with blistering noted in Colombia, burning in Ghana, and ulceration in Indonesia. Women frequently reported ulceration, while men experienced more blistering. Many workers linked their symptoms to agrochemical exposure, but uncertainty about causes remains, especially among those with longer tenures in roles like spraying.

A considerable number of workers indicated they had no health issues, yet variations in reported conditions exist. Allergies and gastric diseases were common, with skin injuries particularly noted by Ghanaian workers. The likelihood of reporting no health conditions appears to diminish with increased years of service, suggesting that long-term employment may correlate with the emergence of health issues. Workers with less than a year of service reported better health compared to those employed for 15 years or more.

Gaps in medical screening practices were evident. Many workers in Colombia obtained a medical certificate before employment, while a significant portion in Ghana did not. Regular medical screenings varied widely, indicating barriers such as costs and access to healthcare. Enhancing adherence to screening requirements and improving access to health services are crucial for addressing health issues related to agrochemical exposure.

The findings reveal significant challenges in diagnosing and managing occupational diseases in the palm oil sector. A persistent issue is the difficulty in establishing clear links between diseases and their origins, compounded by poor coordination between occupational health services and general healthcare providers, leading to underreporting and misdiagnosis. There are considerable disparities in medical screening practices. Colombia shows relatively high compliance, while practices in Indonesia and Ghana are inadequate. This inconsistent application often targets only specific high-risk groups, neglecting the broader workforce and failing to ensure comprehensive occupational health coverage.

Transparency regarding medical screening results is a critical issue. Workers often reported not receiving their results, violating their rights to access health information. This lack of transparency hinders workers from taking proactive steps to address potential health issues, undermining the effectiveness of occupational health initiatives. Most workers reported being covered by social security schemes, yet a notable gap exists between direct and outsourced workers, with many outsourced workers lacking full coverage. This disparity underscores the vulnerability of outsourced workers, leaving them inadequately protected in case of occupational diseases or accidents.

A concerning lack of regular inspections by relevant authorities, particularly in Indonesia and Ghana, exacerbates health and safety issues on plantations. This absence of oversight contributes to negligence in health practices and hampers the collection of robust data to establish links between agrochemical exposure and occupational diseases.

Gendered differences are evident in the experience of exposure risks and PPE use. Many women workers reported difficulties completing their tasks while wearing full PPE compared to men, suggesting that PPE may not be adequately designed for women. This points to the need for inclusive PPE design to enhance safety and comfort for all workers.

Lastly, RSPO-certified plantations demonstrate generally better compliance with OSH practices compared to non-certified plantations, although more certified plantation workers reported paying for their PPE than their non-certified counterparts. Challenges persist, particularly with inadequate PPE washing facilities and hygiene amenities, which pose health risks. Certified plantations offer improved access to safety information, including updates on agrochemicals, and show higher rates of OSH team presence. However, communication gaps remain concerning employer

responsibilities for occupational disease reporting, underscoring the need for enhanced training and stricter RSPO oversight to ensure consistent safety standards.

Abbreviations

CSDS	Chemical Safety Data Sheet
EU	European Union
FFB	Fresh fruit bunches
ILO	International Labour Organization
IPM	Integrated Pest Management
IPOWU	International Palm Oil Workers United
OSH	Occupational safety and health
P&C	Principles and Criteria
POPs	Persistent Organic Pollutants
PPE	Personal protective equipment
RBC	Responsible Business Conduct
RSPO	Roundtable on Sustainable Palm Oil
WHO	World Health Organization

Introduction

Palm oil is the most widely used edible oil globally. In the past five decades, global palm oil production increased by 3,714% from 2.1 million tons in 1970 to 80.8 million tons in 2023.[1] Its versatility explains its increasing popularity. Palm oil not only can be harvested at any time throughout the year, but it also has a high yield per hectare of land, making it a relatively inexpensive crop to produce.[2] Adding to that, palm oil can be fried without deteriorating[3] and mixes well with other oils.[4] Its level of saturation is perfect for producing items that can be stored at room temperature. Moreover, palm oil acts as a natural preservative in food, a foaming agent in hygiene products, and a strong adhesive.[5] In recent years, the pursuit of renewable energy sources has led to the use of palm oil in biofuel production, thereby increasing the demand for this product.[6]

Palm oil is obtained from the fruits of the African oil palm (*Elaeis guineensis*), which is grown on plantations in the tropics. Two countries, Indonesia and Malaysia, contribute to 83% of global palm oil production, with Thailand, Colombia, and Nigeria jointly contributing another 8%.[7] The palm oil industry reached a market value of over US$ 50 billion in 2021 and is expected to grow at a compound annual growth rate (CAGR) of at least 4%, aiming to achieve US$ 65 billion by 2027.[8] The industry is also a crucial source of employment, providing jobs for millions of people. Although there are no precise global estimates for the workforce in this sector, it is known to be substantial. In Indonesia alone, approximately 16 million people are employed in the palm oil industry, with most workers employed by smallholder farmers.[9] Palm oil is also a major source of foreign exchange earnings in the country, rivalling rubber and coffee in Indonesia's non-oil and gas sector.[10]

Oil palm is Colombia's most extensive agricultural crop, covering nearly 600,000 hectares across four key regions. It has been the fastest-growing agricultural sector in the country over the past decade. According to the Colombian Ministry of Agriculture, the sector employs over 7,000 producers, 72% of whom are smallholders managing an average of 8.6 hectares each. In 2022, the industry generated over 197,000 jobs, with 82% being formal positions. Women comprise 31% of palm producers, accounting for over 14% of direct employment within the sector. That year, production reached a record 1.77 million tonnes of crude palm oil (CPO), valued at COP 9.71 trillion (approximately US$ 2.08 billion). Domestic sales represented 74% of total output, primarily serving the biodiesel, food, and feed industries, while exports accounted for 26% and generated approximately US$ 999 million.[11]

Ghana's palm oil industry is of strategic importance to the country's agricultural sector and the economy, serving as the second most important cash crop after cocoa.[12] The sector is economically significant, with small-scale producers generating 60-80% of the country's output. In 2021, Ghana imported palm oil valued at US$ 289 million, while exports reached US$ 78.1 million, underscoring the country's reliance on external sources to meet domestic consumption.[13] Despite this challenge of unmet demand, the sector remains a vital source of employment, particularly for women, who make up approximately 80% of wage workers in smallholder production. However, with production expected to grow at only 3% per year, the gap between supply and demand could widen significantly, potentially leading to a shortfall of 127,000 metric tonnes by 2025.[14]

Despite its economic importance, palm oil production is mired in deep controversy due to its destructive environmental impact, including extensive deforestation, peatland burning, and the loss of biodiversity. Southeast Asia, where palm oil is a leading cause of deforestation, has seen about half of productive plantations in Malaysia and Indonesia replace secondary forests.[15] From 2000 to 2016, deforestation linked to the palm oil industry contributed to 25–30% of global forest loss, and while this trend slowed for a decade, deforestation rates surged again in Indonesia in 2023.[16] This deforestation poses a significant threat to numerous plant and animal species.

These environmental impacts are compounded by the palm oil sector's reliance on capital-intensive inputs such as pesticides and fertilizers.[17] These substances, known as agrochemicals,

pose significant health risks to plantation workers and communities surrounding oil palm plantations. While numerous NGOs and trade unions have focused on addressing how the practices within palm oil production undermine core labour standards and contribute to broader social and ecological challenges, the negative effects of agrochemicals remain understudied,[18] with most of the existing literature focusing primarily on the impact of pesticides on yields, production, and biodiversity.

It is estimated that three million people worldwide are poisoned by pesticides each year, resulting in around 200,000 fatalities, primarily in developing countries. Pesticides can produce harmful substances in the body that lower antioxidant levels, diminishing their ability to protect cells from damage. This imbalance can disrupt crucial cellular functions. Given that pesticides are often applied imprecisely, this poses serious risks, leading to a range of negative effects on human health, including both short- and long-term health problems.[19]

Exposure to pesticides can lead to various short-term effects, including irritation in the nose, throat, and skin, resulting in burning, stinging, itching, rashes, and blisters. People may also experience nausea, dizziness, and diarrhoea. For those with asthma, certain pesticides—particularly pyrethrins, organophosphates, carbamates, and soil fumigants (see box 1 for more on these types of substances and section 3.6 on other substances)—can trigger severe reactions. The symptoms of pesticide poisoning often mimic those of colds or the flu, making it difficult to diagnose and leading to underreporting. Many individuals may not feel their symptoms are severe enough to seek medical attention, and doctors might overlook pesticide exposure when assessing health complaints.[20]

Box 1. Commonly used insecticides

Organophosphates and carbamates are common insecticides that target the nervous system. They are used widely in agriculture to control a variety of pests. Exposure to these pesticides can lead to symptoms such as headaches, nausea, dizziness, vomiting, chest pain, diarrhea, muscle pain, and confusion. In severe cases, they may cause convulsions, difficulty breathing, involuntary urination, coma, and even death. Neuropathy can develop days to weeks after exposure. Examples of carbamates include aldicarb and methomyl, while common organophosphates include chlorpyrifos, diazinon, dursban, fenthion, malathion, and parathion.

Soil fumigants are pesticides applied to soil that form gases to control pests living in the soil. They are effective against nematodes, fungi, bacteria, insects, and weeds, making them beneficial for high-value crops. However, these gases can escape from the soil into the air, exposing people nearby. Symptoms of fumigant exposure can range from mild skin, eye, and lung irritation to more severe effects, depending on the fumigant and exposure level. Some soil fumigants, such as dichloropropene, metam sodium, and metam potassium, are known to cause cancer and reproductive harm. Areas with high fumigant use have also reported increased rates of premature births. Common soil fumigants include 1,3-dichloropropene, chlorpicrin, metam sodium, and metam potassium.

Pyrethroids are synthetic insecticides that mimic natural compounds and are designed to be more persistent. They are applied to crops, garden plants, pets, and sometimes directly to humans. High levels of pyrethroid exposure can lead to dizziness, headaches, nausea, muscle twitching, reduced energy, changes in awareness, convulsions, and loss of consciousness. Symptoms may persist for several days after exposure ends. While there is no evidence that pyrethroids affect human fertility, some animal studies have indicated reduced fertility in both males and females.

Source: Agency for Toxic Substances and Disease Registry (n.d.), "ToxFAQs for Pyrenthrins and Pyrethroids", online: https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=786&toxid=153, viewed in January 2024; Agency for Toxic Substances and Disease Registry (n.d.), "Organophosphates and carbamates", online: https://wwwn.cdc.gov/tsp/substances/ToxChemicalListing.aspx?toxid=39#:~:text=Organophosphates%20are%20organic%20compounds%20that,system%20to%20stop%20working%20properly., viewed in January 2024; United States Environmental Protection Agency (2024, May 1), "What are Soil Fumigants?", online: https://www.epa.gov/soil-fumigants/what-are-soil-fumigants#:~:text=Soil%20fumigants%20are%20pesticides%20that,plant%20growth%20and%20crop%20production., viewed in May 2024.

The potential long-term health consequences of pesticide exposure are particularly alarming. Chronic exposure to these chemicals has been linked to various systemic health issues, including various types of cancer (brain cancer, breast cancer, prostate cancer, bladder cancer, and colon cancer), Alzheimer's disease, Parkinson's disease, neurotoxicity, infertility, leukaemia, and diabetes.[21] Moreover, the endocrine-disrupting properties of many agrochemicals present a significant risk to pregnant women and developing foetuses, potentially resulting in developmental and cognitive impairments in children.[22]

Despite the wide acknowledgement that pesticide use carries significant risks and adverse health effects, there is a lack of thorough documentation of these effects within the palm oil sector. With the limited information regarding workers' safety and health, it is necessary to create a comprehensive overview of the current use of pesticides in the palm oil sector, and to investigate the specific chemicals employed, existing health and safety measures, occupational safety and health (OSH) protocols, utilisation of personal protective equipment (PPE), medical monitoring, and worker awareness of and challenges related to health issues.

Against this background, the International Palm Oil Workers United (IPOWU)—an international trade union network established in 2022 to advocate for improved working conditions on palm oil plantations and in mills—commissioned this study to investigate pesticide and agrochemical use on oil palm plantations in Colombia, Ghana, and Indonesia, assessing the associated health and safety risks for workers. Its objective is four-fold:

1. To describe the actual situation of unionised workers using pesticides in Colombia, Ghana, and Indonesia employed at oil palm plantations, and to identify OSH risks faced by workers in charge of spraying pesticides and their peers.
2. To describe the policies of downstream buyers of palm oil from Colombia, Ghana, and Indonesia on the use and effects on workers of pesticides and other agrochemicals.
3. To describe the legislative framework (i.e., laws and regulations created to establish rules, rights, and responsibilities) in Colombia, Ghana, and Indonesia on the use of pesticides and agrochemicals in the palm oil sector and their effects on workers.
4. To map current academic literature on health effects on workers of pesticides and other agrochemicals.

In thoroughly researching the current use of pesticides in the palm oil sector, IPOWU seeks to deliver clear recommendations and demands towards employers, downstream buyers of Colombian, Ghanaian, and Indonesian palm oil, the Roundtable on Sustainable Palm Oil (RSPO), and local governments. Moreover, this information will be used by union members of IPOWU in their social dialogue with their employers, in awareness-raising campaigns, and in training workers and unions on the use of pesticides and agrochemicals.

This report is structured as follows: Chapter 1 outlines the study's methodological framework. Chapter 2 synthesises the factors that contribute to the risk of agrochemical exposure among oil palm plantation workers in the focus countries, covering legislative frameworks, implementation barriers, and enforcement issues. Chapter 3 presents the results of the digital survey conducted among workers in Colombia, Ghana, and Indonesia. Chapter 4 offers conclusions, and Chapter 5 provides recommendations aimed at supporting the efforts of IPOWU members, national governments, the RSPO, downstream buyers, and plantation owners in mitigating workers' exposure to agrochemicals.

A summary of the findings of this report can be found on the first pages of this report.

1

Methodology

This project combined qualitative and quantitative methods to capture oil palm plantation workers' perspectives in Colombia, Ghana, and Indonesia regarding their exposure to agrochemicals, their effects on their health, and their employers' management of occupational safety and health risks. A participatory research approach was applied, actively involving workers' representatives at each step. This chapter outlines the data collection process.

1.1 Study design

This research project was conducted between December 2023 and October 2024. Study sites in the three focus countries—Colombia, Ghana, and Indonesia—were selected based on the presence of IPOWU members at various oil palm plantations. The methods we describe followed the participatory action research principles and building blocks outlined by Cornish et al.[23]

1.1.1 Approach

This study employed a participatory mixed-methods approach, combining qualitative and quantitative methods to gain a comprehensive understanding of the risks of agrochemical exposure faced by oil palm plantation workers. In this context, both primary and secondary data were collected. Primary data collection involved capturing the perspectives of oil palm plantation workers and key informants in Colombia, Ghana, and Indonesia, while secondary methods consisted of reviewing and analysing published sources to contextualise the results obtained from primary data.

Workers' representatives (i.e., trade unions articulated through IPOWU), Mondiaal FNV (through its coordinators in Colombia, Ghana, Indonesia, and the Netherlands), and Profundo co-designed and implemented the collection of primary data, following the steps outlined in Table 1.

Table 1 Steps in implementing primary data collection

Research step	Participating research partners
1. Defining research questions and indicators	All
2. Determining research sites	IPOWU members
3. Determining a sample size	All
4. Translating research questions and indicators into a survey questionnaire	All
5. Building a digital survey form	Profundo
6. Provide feedback on the digital survey form	All
7. Training field enumerators and adapt the survey form to local settings	Profundo, IPOWU members

Research step	Participating research partners
8. Administering survey form using mobile phone application	IPOWU members
9. Validate and process survey responses	Profundo
10. Discuss survey results and provide feedback	All
11. Select key informants	IPOWU members and Mondiaal FNV
12. Conduct interviews with key informants	Profundo and IPOWU members

1.2 Sampling

Oil palm plantation workers can be considered hard-to-reach populations due to their geographic isolation and lack of formal employment records.[24] Many commercial plantations are located in remote or rural areas, and many workers are employed informally or seasonally. The transient nature of this seasonal work results in incomplete or non-existent employment records, further complicating efforts to identify and reach these individuals. Additionally, the recurrence of anti-union violence in Colombia, Ghana, and Indonesia complicates the establishment of trade unions at plantations,[25] limiting organised efforts to engage effectively with workers.

In our study, these challenges make it impossible to obtain a sample that is representative of the entire palm oil workforce in the study countries. However, through information collected by IPOWU members about the workforce composition at each plantation where the digital survey was deployed, we were able to implement stratified sampling. This technique ensured that specific subgroups (or strata) within the plantations—such as different types of work tasks, employment types (i.e., direct and outsourced workers), and gender—were adequately represented. The power analysis for sample size was estimated with a 90% confidence interval using nQuery Advisor version 9.4, considering a p-value < 0.05 as statistically significant. This approach allowed us to draw meaningful insights specific to the plantations involved in the survey.

1.3 Data collection

1.3.1 Deployment of digital survey

The survey instrument (i.e., the digital form or questionnaire) was developed through an iterative process that began with Profundo reviewing the ILO code of practice on safety and health in agriculture, particularly regarding the use of agrochemicals.[26] From this review, a set of themes and questions was created and further refined with input from IPOWU members and Mondiaal FNV through its occupational safety and health advisor in agriculture.

After two rounds of review, the questionnaire was finalised to include general questions about the respondents' demographic characteristics, followed by six main themes: Preventive OSH Measures, Exposure to Agrochemicals, Management of OSH Risks, Storage of Agrochemicals, Health Effects of Agrochemicals, and Management of OSH Diseases. The survey comprised 96 main questions and 100 cascading questions. While most questions were multiple choice, open-ended questions were included to allow respondents to explain their answers, providing context and depth to the workers' responses.

The survey was deployed using KoboToolbox, a suite of open-source tools designed for collecting field data, particularly in challenging environments. Developed by the Harvard Humanitarian Initiative, it offers a web application for creating and completing forms online, as well as a mobile application called KoboCollect, which allows for offline data entry. Recorded data is transmitted

from mobile phones to the server once an internet connection is established. The full range of features is available free of charge, and the user-friendly interface ensures ease of adoption.[27]

Profundo wrote and tested the KoboToolbox forms and conducted online training of trainers (ToT) workshops in each country to equip IPOWU members to train enumerators or become enumerators themselves. Enumerators were recruited among the members of trade unions at each of the research sites. For the ToT, Profundo developed step-by-step manuals that instructed enumerators on how to download, fill out, save, and upload completed questionnaires, as well as how to maintain records of administered questionnaires, collect photographic materials while ensuring informants' anonymity, and provide advice for the interviews. These manuals were translated into Spanish and Bahasa and distributed among trainers and enumerators. IPOWU members compensated enumerators according to local wage standards. Enumerators conducted their work between April and July 2024.

Informants read and signed a prior informed consent (PIC) form that outlined the purpose of the research, the intended use of their responses, and the measures the research team would take to guarantee their anonymity. When informants were unable to read or write, the PIC form was read aloud to them, and their oral consent was obtained.

1.3.2 Key informant interviews

To complement the information gathered through the digital survey, we conducted key informant interviews. The informants were selected by IPOWU members, who also participated in the interviews. In total, we carried out online interviews with ten informants from Colombia, Ghana, and Indonesia. These informants represented various sectors, including labour support organisations, OSH doctors, OSH researchers with experience in commercial oil palm plantations, and government representatives. The interviews averaged one hour in duration. This qualitative approach allowed us to gain deeper insights and a broader context regarding the risks of agrochemical exposure faced by oil palm plantation workers, enriching our overall understanding of the issues at hand.

1.3.3 Literature review

We conducted a systematic review of academic literature to identify the pesticides and agrochemicals used in oil palm cultivation, as well as their effects on human health. Furthermore, we mapped various types of policies, including the Responsible Business Conduct (RBC) policies of seven major Netherlands-based palm oil buyers regarding their suppliers' use of pesticides and agrochemicals. This mapping also encompassed the provisions of voluntary sustainability standards and the international regulatory frameworks, such as ILO conventions, that govern this issue. Additionally, local consultants identified by IPOWU assessed the national regulatory framework for OSH and the use of agrochemicals in commercial plantations.

1.4 Data analysis

1.4.1 Analysis of data collected through the digital survey

Completed questionnaires submitted through KoboToolbox were validated by Profundo, with a total of 1,527 submissions. However, 91 questionnaires, all from workers employed at a Ghanaian plantation, were deemed invalid, as the plantation was in the process of transitioning to organic farming at the time the survey was deployed. Consequently, the workers' responses regarding agrochemical use did not reflect the plantation's current practices.

After completing the analysis, Profundo presented the results to IPOWU members and Mondiaal FNV coordinators in each country. Following each online presentation, they selected the findings to be included in this report. Due to the extensive volume of data collected, not all results could be presented, and in most cases, the data could not be disaggregated to provide insights at the

plantation level. Since IPOWU members plan to use the survey data to inform their social dialogue with employers and support collective bargaining, the database containing the survey results will be made available to each IPOWU member, along with training for the unions to conduct their own analyses at both the country and plantation levels.

1.4.2 Analysis of policies of Netherlands-based buyers of palm oil

We reviewed the RBC documentation of the largest Netherlands-based international traders in palm oil, alongside a prominent fast-moving consumer goods company and a retailer. Each of these companies sourced palm oil within the past year from at least one of the plantations included in this study. To identify the relevant buyers, we verified recent supplier lists to confirm the purchasing links.

The RBC documentation examined included publicly accessible resources, predominantly located on company Sustainability webpages. These resources encompassed policy statements, due diligence documentation, risk assessments, palm oil dashboards, grievance mechanisms, and sustainability reports, as well as broader governance and financial documents such as annual reports. Each document was systematically indexed, reviewed, and summarized.

Our analysis focused on how well these RBC documents aligned with established standards, such as conventions of the International Labour Organization (ILO), specifically in relation to the occupational health and safety (OSH) of workers in palm oil supply chains. We looked for explicit OSH policies applying to suppliers, assessed whether these policies were integrated into relevant ILO conventions on worker health and safety, and evaluated if companies limited worker exposure to agrochemicals and set obligations for suppliers to provide protective measures (such as adequate PPE and regular training) to safeguard workers against agrochemical exposure. Special attention was given to policies addressing the needs of female workers. Lastly, we assessed if companies had monitoring and response systems to verify supplier compliance with these commitments.

The purpose of this study is not to single out or shame individual companies but rather to offer a comprehensive overview of current practices in the palm oil sector and foster constructive dialogue with companies along the supply chain. Therefore, similar to the plantations in Colombia, Ghana, and Indonesia included in this study, the findings of the RBC policy analysis maintain the anonymity of downstream buyers. This approach aims to facilitate engagement and encourage shared commitment to advancing responsible business practices across the palm oil supply chain.

2

Policies governing the use of agrochemicals on oil palm plantations

This chapter outlines the policies governing the use of agrochemicals on commercial oil palm plantations at both international and national levels. It covers principles set by voluntary sustainability initiatives, such as the RSPO, as well as the Responsible Business Conduct (RBC) policies of Netherlands-based buyers of palm oil produced in the plantations included in this study.

2.1 Binding international instruments

Several international binding agreements govern the use of pesticides and other agrochemicals, either directly or indirectly, with most countries adopting one or more of these. In addition to these agreements, voluntary guidelines also influence agrochemical management. Together, these instruments form an international framework to address the most critical safety aspects of these substances.

2.1.1 Rotterdam Convention

The Rotterdam Convention, adopted on 10 September 1998, effective from 24 February 2004, and revised in 2019, aims to protect human health and the environment from hazardous chemicals in international trade. Its key objective is to promote cooperative efforts and shared responsibility among parties in managing such chemicals. Key provisions include the coverage of pesticides and industrial chemicals banned or severely restricted for health or environmental reasons. These chemicals, once added to Annex III of the Convention, require a "decision guidance document" (DGD) to be circulated among parties, detailing regulatory decisions for their ban or restriction.[28]

The Prior Informed Consent (PIC) procedure, a cornerstone of the Rotterdam Convention, is a mechanism for managing the international trade of hazardous chemicals listed in Annex III of the Convention.[29] Two types of chemicals are listed in Annex III: "banned or severely restricted chemicals" (including pesticides) and "severely hazardous pesticide formulations." These chemicals are subject to the PIC procedure, which all parties must follow. Under the Convention, countries must adopt legislative and administrative measures to manage import and export obligations, ensuring no stricter rules for imports than for domestic products.[30] As of 2024, Annex III lists 55 substances, including 36 banned or restricted pesticides, 3 severely hazardous pesticide formulations, 18 industrial chemicals, and one chemical in both pesticide and industrial chemical categories.[31]

Ratifications of the Rotterdam Convention:[32]

- Colombia: ratification on 3 December 2008. In force since 3 March 2009.
- Ghana: ratification on 30 May 2003. In force since 24 February 2004.
- Indonesia: ratification on 24 September 2013. In force since 23 December 2013.

2.1.2 Stockholm Convention

The Stockholm Convention, established on 22 May 2001, effective from 17 May 2004, and revised in 2019, addresses the adverse impacts of Persistent Organic Pollutants (POPs) on human health and the environment. It strives to eliminate or significantly reduce the release of these long-lasting, widely distributed, and harmful chemicals.[33] POPs are organic compounds that persist in the environment, accumulate in the fatty tissues of living organisms, concentrate at higher trophic levels, and pose long-term toxic risks to humans and wildlife.[34]

The Convention lists chemicals in three categories: Annex A for elimination, Annex B for restriction, and Annex C for reduction of unintended by-products. By 2014, 26 substances, including 16 pesticides, were listed. Chemicals like DDT (Annex B) can still be used for disease control under certain conditions. The Convention requires parties to prohibit the production, use, import, and export of most Annex A and B chemicals, with exemptions for specific uses and environmentally sound disposal.[35]

Ratifications of the Stockholm Convention:[36]

- Colombia: ratification on 22 October 2008. In force since 20 January 2009.
- Ghana: ratification on 30 May 2003. In force since 17 May 2004.
- Indonesia: ratification on 28 September 2009. In force since 27 December 2009.

2.2 ILO Conventions

Conventions are key legal instruments in international labour standards, formulated by the constituents of the International Labour Organization (ILO) — governments, employers, and workers. These conventions are legally binding international treaties that member states can ratify. Upon ratification, countries commit to integrating the conventions' principles into their national legal frameworks. Conventions are adopted at the annual International Labour Conference and must be submitted to the respective national authorities for consideration. Once ratified, a convention generally takes effect one year later, obligating the country to implement and report on its application. The ILO provides technical assistance as needed, and member states may face representation and complaint procedures for non-compliance with ratified conventions.[37] This section presents ILO conventions relevant to safeguarding the rights of agricultural workers employed in commercial plantations, with a particular focus on those who come into contact with agrochemicals.

In addition to the Conventions, the ILO, together with employers' and workers' organisations have developed Recommendations that can guide the implementation of Conventions. ILO Recommendations that are of relevance for work settings that expose workers to agrochemicals are presented in **Error! Reference source not found.**.

2.2.1 Convention No. 155 – Occupational Safety and Health

Convention No. 155 (C155) requires ratifying states to establish, implement, and regularly review a national policy on occupational safety and health. The Convention aims to prevent workplace accidents and health risks by minimising hazards inherent in the work environment. C155 shifts from industry-specific regulations to a legislative framework that covers all employers, employees, and workplaces, imposing general duties on all parties to ensure workplace safety.[38]

To support this goal, Article 19 establishes legal responsibilities and cooperative mechanisms for workers and employers in promoting occupational safety and health. Workers are expected to support their employer's efforts in meeting safety obligations, while worker representatives must also cooperate with employers to advance workplace health and safety. Importantly, the convention requires that worker representatives receive sufficient information on employer measures for securing workplace safety and are allowed to consult with their organisations on this information, provided confidentiality is maintained around commercial secrets.[39]

Furthermore, C155 emphasises training for workers and their representatives to enhance OSH knowledge. Workers and their representatives are also entitled to investigate, consult, and be consulted on all workplace safety aspects that affect their work, with the possibility of involving external technical advisers as needed. A critical provision ensures that workers can report situations posing an immediate, severe danger to their lives or health, and they cannot be compelled to return to hazardous conditions until the employer addresses these risks.[40]

Ratifications of C155:[41]

- Colombia: no ratification
- Ghana: no ratification
- Indonesia: no ratification

2.2.2 Convention No. 184 – Safety and Health in Agriculture Convention, 2001

Convention No. 184 (C184) aims to address the unique health and safety challenges faced by agricultural workers. It encompasses a wide range of issues, including the use of agricultural machinery, handling of chemicals, exposure to biological and environmental hazards, and the provision of adequate training and education for workers.[42]

To implement sound management of chemicals, C184 mandates that a competent authority establishes systems for the criteria of importation, classification, packaging, and labelling of agricultural chemicals while also addressing their restriction or banning. Producers, importers, and distributors of these chemicals are required to adhere to safety and health standards and provide comprehensive information in the country's official languages. The convention also highlights the necessity of safe practices for the collection, recycling, and disposal of chemical waste, obsolete chemicals, and empty containers, thereby reducing health, safety, and environmental risks.[43]

Additionally, it calls for preventive and protective measures at the workplace level for handling chemicals and chemical waste, including their preparation, storage, and disposal, as well as managing risks associated with biological agents in activities involving animals and livestock. Furthermore, the convention highlights workers' rights and duties, including the right to be informed and consulted on safety matters, the right to participate in safety measures, and the right to remove themselves from imminent risks. It also emphasises the protection of vulnerable groups such as young workers, temporary and seasonal workers, and women workers, ensuring that they receive the same safety and health protection as their counterparts in agriculture.[44]

Ratifications of C184:[45]

- Colombia: no ratification
- Ghana: ratification on 6 June 2011. In force.
- Indonesia: no ratification

2.2.3 Convention No. 170 – Chemicals Convention, 1990

Convention No. 170 (C170) aims to ensure the safe use and handling of chemicals in the workplace, thus protecting workers from the health risks posed by chemicals. It provides an extensive framework for national policies and regulations, ensuring that employers, workers, and governments collaborate effectively to manage chemical risks.[46] The convention is divided into several sections, among which:

- **General principles**

This section highlights the needed involvement of representative employer and worker organisations in formulating and updating national policies for chemical safety at work. It grants

the competent authority the power to restrict hazardous chemical use based on safety grounds, emphasising a proactive approach through advance notification and authorisation requirements.[47]

- **Classification of chemicals and related measures**

This section covers the establishment of classification systems for chemicals, including criteria for health and physical hazards, mixtures assessment, and alignment with international transport standards. It mandates clear labelling of all chemicals and additional labelling for hazardous ones. Chemical Safety Data Sheets (CSDS) are required for hazardous chemicals, providing detailed information, such as their identity, supplier, safety precautions and emergency procedures. Additionally, suppliers must ensure proper classification, labelling, and CSDS provision, with updates based on new safety information, and assess unclassified chemicals for their hazardous nature.[48]

- **Responsibilities of employers**

This section outlines the duties of employers in managing chemical safety. Employers must ensure proper labelling and availability of CSDS for all workplace chemicals. They are responsible for obtaining necessary information for unlabelled chemicals and must not use them until properly identified and assessed. A record of hazardous chemicals and corresponding CSDS should be maintained and accessible. When transferring chemicals into other containers, their identity and safety information must be clearly indicated.[49]

Moreover, employers are required to control chemical exposure within established limits, assess and monitor worker exposure, and maintain exposure records. Risk assessment is mandated, with protective measures such as choosing safer chemicals, technology, engineering controls, safe work practices, hygiene measures, and providing personal protective equipment. Employers must also limit exposure, provide first aid, and have emergency plans. They are responsible for the safe disposal of hazardous chemicals and containers. Information and training for workers about chemical hazards, label and CSDS usage, and safe chemical handling practices are required. Lastly, employers are encouraged to cooperate closely with workers or their representatives on chemical safety matters.[50]

- **Duties of workers**

Workers are required to collaborate with employers to ensure chemical safety at work and must follow all safety procedures. They are also responsible for taking reasonable steps to reduce risks from chemical use and protect themselves and others.[51]

- **Rights of workers and their representatives**

Workers hold the right to withdraw from chemical-related dangers in cases of imminent and severe threats to their safety or health, with an obligation to promptly inform their supervisor. Those exercising these rights, or any other rights under the Convention, are safeguarded against reprisal. Workers and their representatives are entitled to information on chemicals used at work, including their identity, hazardous properties, precautionary measures, education, and training. This includes details from labels, markings, and CSDS. If revealing a chemical's specific identity could harm the employer's business, safeguards may be applied with approval from the competent authority.[52]

- **Responsibility of exporting states**

In this section, exporting member states are mandated to communicate to importing countries any prohibition of hazardous chemical uses due to safety and health concerns.[53]

Ratifications of C170:[54]

- Colombia: ratification on 6 September 1994. In force.
- Ghana: no ratification
- Indonesia: no ratification

2.2.4 Convention No. 139 – Occupational Cancer Convention, 1974

Convention No. 139 (C139) focuses on the protection of workers from the risks of exposure to carcinogens in the workplace and represents a significant step in international labour standards regarding occupational health and safety. The primary focus is on replacing these harmful substances with non-carcinogenic or less harmful alternatives, considering their overall impact on health, including carcinogenic and toxic properties. The scope of this effort extends beyond mere replacement of substances. It involves a comprehensive approach to reducing the number of workers exposed to carcinogens, as well as limiting the duration and intensity of such exposures, ensuring safety. [55]

Additionally, there is an imperative for establishing a robust information and record-keeping system. This system documents workers' exposure to carcinogens, enabling ongoing assessment and management of associated risks. Transparency and knowledge dissemination form a critical component of this framework. Workers who are, have been or might be exposed to carcinogenic substances are entitled to comprehensive information about the risks they face and the protective measures they can adopt. Furthermore, the convention mandates regular health monitoring of workers who are at risk of exposure to carcinogens. This encompasses not just medical examinations during the period of employment, but also subsequent follow-ups as necessary. [56]

Ratifications of C139:[57]

- Colombia: no ratification
- Ghana: no ratification
- Indonesia: no ratification

2.2.5 Convention No. 148 – Working Environment (Air Pollution, Noise and Vibration) Convention, 1977

Convention No. 148 (C148) outlines measures to control and prevent exposure to air pollution, noise and vibration at the workplace, emphasising a preventive approach. The Convention mandates a collaborative approach involving consultations with employer and worker organisations to implement effective strategies for air pollution control. This includes establishing specific exposure limits for harmful substances and regularly updated based on current knowledge and data. The responsibility for compliance with these measures is placed primarily on employers, who must ensure a safe working environment. This responsibility extends to situations where multiple employers operate in a single workplace, necessitating cooperation to maintain health and safety standards.[58]

The Convention also emphasises the importance of protecting workers from exposure to harmful air pollutants. In this context, technical measures are prioritised, either through the design and installation of new plant processes or by modifying existing ones. When these technical measures are insufficient, supplementary organisational measures are recommended. In cases where exposure to air pollution cannot be adequately controlled, employers are required to provide suitable personal protective equipment. Additionally, C148 calls for regular health supervision of workers exposed to air pollution, including pre-assignment and periodic medical examinations, ensuring that their health is not adversely affected by their work environment. Lastly, the use of any processes or equipment due to air pollution must be reported to and potentially regulated by the competent authority. The Convention also requires that all affected persons be adequately informed and trained about these hazards and the measures for their prevention and control.[59]

Ratifications of C148:[60]

- Colombia: no ratification
- Ghana: ratification on 27 May 1986. In force.
- Indonesia: no ratification

2.3 Non-binding international instruments

Non-binding international instruments or "soft law" instruments, such as plans of action, declarations, codes of conduct, guidelines, and technical standards, are used in international relations to establish political commitments. These instruments aim to create consistent standards and guidelines across countries, despite not being legally enforceable. In the case of agrochemicals, they may influence how pesticides and other substances used in agriculture are regulated and managed at the national level.

2.3.1 Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

The GHS by ILO addresses the pervasive dangers that chemicals pose to human health and the environment throughout their lifecycle, from production to handling, transport, and use. Recognising the diverse global population exposed to these hazards, the GHS offers a standardised approach to classifying chemicals by types of hazards and introduces harmonised elements for hazard communication. This includes universally recognisable labels (pictograms) and CSDS, ensuring that information on the physical hazards and toxicity of chemicals is consistently available. The GHS serves as a vital tool for enhancing the protection of human health and the environment during the entire chemical lifecycle. Its framework not only empowers nations to establish comprehensive control infrastructures for chemical exposures but also lays the foundation for harmonising rules and regulations on chemicals at national, regional, and global levels, promoting effective trade facilitation.[61]

Implemented in response to the imperative of developing national programmes to guarantee the safe use, transport, and disposal of chemicals in the context of global trade, the GHS is pivotal for fostering a shared international understanding of chemical hazards. While primarily targeted at governments, regional institutions, and international organisations, the GHS also offers practical guidance for industry stakeholders responsible for implementing the system's requirements. The GHS has undergone regular updates and revisions, with the most recent edition, GHS Rev.10 (2023), marking the latest milestone in the ongoing commitment to global chemical safety. The two-year revision cycle ensures that the GHS remains responsive to emerging needs and experiences in its implementation, reflecting the international community's dedication to continuous improvement in chemical management and occupational safety.[62]

2.3.2 Code of Conduct on Pesticide Management

The International Code of Conduct on Pesticide Management is the only global instrument covering all aspects of pesticide management throughout its life cycle. It serves as a reference for governments, the pesticide industry, and stakeholders. Originally adopted in 1985, it has been revised multiple times, most recently in 2013. The Code is supported by detailed technical guidelines that help shape pesticide legislation, particularly in areas like registration, data requirements, and labelling. The International Code of Conduct on Pesticide Management is voluntary but widely adopted by governments to guide national pesticide legislation. It offers specific recommendations for designing national laws, particularly in Article 6, which urges the creation and enforcement of pesticide regulations. The Code also identifies additional government programmes needed for a comprehensive pesticide management framework and promotes Integrated Pest Management.[63]

2.3.3 ASEAN Regional Guidelines for Sustainable Agriculture

The ASEAN Regional Guidelines were adopted by members of the Association of Southeast Asian Nations (ASEAN) (including Indonesia) in October 2022 in recognition of the Association members' reliance on agriculture and the threats posed by climate change, overfishing, unsustainable farming methods, and other problems that affect the agriculture sector. These guidelines feature several key strategies for achieving sustainable agriculture:[64]

- **Improving overall soil health: Reducing overfertilization of the soil base, applying targeted organic fertilizers and amendments, and reducing the overapplication of agrochemicals to meet optimum soil productivity.**

This strategy aims to enhance soil health by reducing the excessive use of agrochemicals and pesticides. The focus is on nurturing the soil microbiome for global food security. Soil health is defined as the soil's ability to function as a vital ecosystem supporting various life forms. The goal is to optimise soil productivity while minimising environmental impacts associated with agrochemical use.[65]

- **Aligning ASEAN agricultural standards with those of our major export markets.**

This strategy highlights the need to align ASEAN agricultural standards with major export markets, focusing on ensuring compliance with health and safety regulations and meeting Maximum Residue Limits (MRL) for pesticides. The goal is to reduce and eliminate the use of Highly Hazardous Pesticides (HHPs), already banned in the European Union (EU). The EU's plan to ban all imported agricultural products containing banned pesticides underscores the importance of aligning export standards to meet international regulations and safeguard food safety.[66]

- **Strategising to replace Highly Hazardous Pesticides (HHPs), broad spectrum pesticides and neonicotinoids in ASEAN agriculture.**

The use of broad-spectrum pesticides has been linked to decreased farm biodiversity, which is critical for natural pest control through ecosystem services. Additionally, reducing neonicotinoids is important to mitigate their harmful impacts on pollinator bees, essential for crop pollination and ecosystem health.[67]

- **Reducing the reliance on the use of agrochemicals in agriculture, balancing the use of organic and chemical fertilisers.**

Excessive use of agrochemicals, including pesticides and chemical fertilizers, has adverse effects on both environmental health and the competitiveness of ASEAN's agricultural and food products. Rising prices of imported pesticides and fertilizers have intensified this challenge. Member states generate substantial volumes of agricultural and food waste, which can be efficiently utilised to create cost-effective organic inputs. By promoting a well-balanced approach through the combined use of organic and chemical fertilizers, ASEAN aims to achieve sustainable, productive agriculture, enhancing both economic and environmental outcomes.[68]

- **Improving the health and well-being of the farming community in ASEAN.**

Efforts include reducing and substituting HHPs and other toxic chemicals, coupled with improved health monitoring for those applying agrochemicals.[69]

2.3.4 Manual Técnico Andino – Resolution 2075 (2019)

The "Resolución N° 2075 - Manual Técnico Andino para el Registro y Control de Plaguicidas Químicos de Uso Agrícola" (“Resolution No. 2075 - Andean Technical Manual for the Registration and Control of Agricultural Chemical Pesticides”) was issued by the General Secretariat of the Andean Community in 2019. It replaces the earlier Resolution 630, which was adopted in 2002 and established updated guidelines for the registration and control of agricultural chemical pesticides in Andean Community member countries, including Colombia. It also supports the implementation of Decision 804, “Norma Andina para el Registro y Control de Plaguicidas Químicos de Uso Agrícola” (“Andean Standard for the Registration and Control of Agricultural Chemical Pesticides”).[70]

This resolution aligns with Decision 804, which came into effect on 1 May 2015, focusing on harmonised guidelines and procedures for the registration and control of agricultural chemical pesticides. It emphasises correct usage and management within the framework of good

agricultural practices, aiming to prevent and minimise health and environmental risks, ensure the biological effectiveness of the product, and facilitate trade within the sub-region.[71]

The resolution sets forth the adoption of the GHS for the classification and labelling of pesticides (see 2.3.1), with a transition period for existing stock labels to be used up. It also discusses the methodology for chemical equivalence registration, recommending further analysis and technical capacity strengthening among member countries. The resolution includes not only the description of pesticides, along with their properties, usage, toxicity levels, environmental impacts, safety, and health measures but also the labelling of these products, waste management, toxicity evaluations and environmental risk assessments. Furthermore, the resolution details a process for updating these guidelines, involving multiple meetings and consultations, including consideration of comments received through World Trade Organization notification.[72]

While not a binding instrument, it is important to note that decisions taken in the Andean Community are legally binding as long as they have been approved by all members of the community but are only applicable when they have been officially published.[73]

2.3.5 ECOWAS

The Sahelian countries successfully launched their regional pesticide regulator, the Comité Sahélien des Pesticides (CSP), in the early 1990s, driven by large-scale pest invasions and a shared interest in pooling technical resources for pest management and pesticide monitoring. However, establishing a consistent and enforceable legal framework required over ten years and two rounds of legislative action, despite the early effective collaboration among phytosanitary technicians. Two decades later, ECOWAS is working to introduce a similar harmonised regional pesticide registration system in the humid coastal zone countries, of which Ghana is one. These countries face additional challenges, including rapidly growing pesticide markets and established yet differing national regulatory structures that need harmonisation. Drawing from the CSP experience, key focuses for the coastal countries in implementing regional pesticide regulations include securing adequate financing for regulators, technical and legal harmonisation, and the establishment of a sub-regional technical secretariat.[74]

As an example, Gambia is seeing a rise in its pesticide use, led by increased vegetable production and exports. The country is facing significant issues, including scant data on pesticide imports, widespread sale of unregistered pesticides, and unchecked trans-boundary pesticide movement. Although Gambia aligns with regional pesticide policies and is part of the CSP registration process, the lack of a National Committee on Pesticide Management hampers effective pre- and post-registration activities. This case highlights the challenge of monitoring and controlling pesticides in the market, constrained by an inadequate number of inspectors and limited laboratory equipment for necessary tests like residue analysis. To address these issues in the region, ECOWAS recommends:[75]

- forming a dedicated pesticide monitoring committee in line with CSP guidelines,
- improving training for inspectors,
- providing sufficient resources for control structures,
- enhancing laboratory capabilities for pesticide analysis,
- establishing control centres for pesticide testing, including in human blood,
- setting up secure storage facilities for pesticides
- launching awareness campaigns about pesticide safety at the Member State level.

2.4 Voluntary sustainability standards

Voluntary Sustainability Standards (VSS) are private standards focused on economic, social, and environmental sustainability. They cover product quality, production methods, and transportation. Developed by NGOs or private firms, VSS are adopted across the value chain, from farmers to retailers, and are verified through certifications and labels.

2.4.1 Roundtable on Sustainable Palm Oil (RSPO)

The RSPO aims to transform the palm oil industry into a more sustainable and socially responsible sector. Established in 2004, RSPO is a global multi-stakeholder initiative that brings together palm oil producers, environmental NGOs, social NGOs, and key players in the supply chain to develop and implement standards for sustainable palm oil. At its core, RSPO aims to address the environmental and social challenges associated with conventional palm oil production, including deforestation, habitat destruction, and breaches of human and labour rights.[76]

The RSPO has developed a set of principles and criteria that member companies must adhere to achieve certification. Some of these principles touch on the use of pesticides and agrochemicals. The certification process entails an examination of palm oil production practices against the RSPO Principles & Criteria (P&C) by accredited Certifying Bodies.[77] The RSPO P&C document is a framework that evolved from its 2007 inception, with revisions in 2013 and 2018, it emphasises legal compliance, economic viability, environmental responsibility, and social benefits. The P&C's structured format includes specific indicators for each criterion, aiming to achieve practical applicability.[78]

The criteria are structured into three main goals, namely:[79]

- Impact Goal – Prosperity: Competitive, resilient and sustainable sector
    - Principle 1: Behave ethically and transparently
    - Principle 2: Operate legally and respect rights
    - Principle 3: Optimise productivity, efficiency, positive impacts and resilience
- Impact Goal – People: Sustainable livelihoods and poverty reduction
    - Principle 4: Respect community and human rights and deliver benefits
    - Principle 5: Support smallholder inclusion
    - Principle 6: Respect workers' rights and conditions
- Impact Goal – Planet: Conserved, protected and enhanced ecosystems that provide for the next generation
    - Principle 7: Protect, conserve and enhance ecosystems and the environment

Principles 5, 6, and 7 touch on the use of pesticides in RSPO-certified operations. Principle 5 (Support Smallholder Inclusion) calls for training for smallholders on pesticide handling (5.2.4).[80]

Principle 6 focuses on workers' rights, aligning its criteria and indicators with core ILO Conventions. These include eliminating workplace discrimination, ensuring fair remuneration for workers and contractors in line with statutory or industry standards, and providing decent living wages. It also guarantees freedom of association and collective bargaining, prohibits child labour, forced labour, and labour trafficking, and forbids harassment or abuse in the workplace.[81]

Additionally, Principle 6 mandates that the unit of certification ensures a safe working environment, free from undue health risks. Specifically, regarding pesticide exposure (and arguably other agrochemicals), Principle 6.7.3 (C) states: *"Workers use appropriate personal protective equipment (PPE), which is provided free of charge to all workers at the place of work to cover all potentially hazardous operations, such as pesticide application, machine operations, land preparation, and harvesting. Sanitation facilities for those applying pesticides are available so that workers can change out of PPE, wash and put on their personal clothing."*[82]

Similarly, Principle 7 of the P&C emphasises the importance of protecting the environment, conserving biodiversity, and ensuring the sustainable management of natural resources within the realm of palm oil production. The specific criteria and indicators outlined under this principle focus on the responsible use of pest management practices and pesticides to minimise environmental impact and safeguard human health:[83]

- One aspect addressed is the effective management of pests, diseases, weeds, and invasive species through Integrated Pest Management (IPM) techniques (7.1).
- Another key aspect is the responsible use of pesticides, ensuring they are applied in ways that do not endanger the health of workers, families, communities, or the environment (7.2). This involves using selective products and application methods specific to the target pest, while prioritising the reduction of pesticide use within a comprehensive plan. The criteria also stress justifying pesticide use, keeping detailed records, and minimising prophylactic applications, aligning with the goal of reducing pollution and resource consumption.
- Lastly, Principle 7 sets standards to protect workers' health, requiring actions such as annual medical surveillance for pesticide operators and restrictions on pesticide work for vulnerable groups (see Box 2).

Box 2. Specific actions mandated under Principle 7.2 of the RSPO

7.2.1 (C) Justification of all pesticides used is demonstrated. Selective products and application methods that are specific to the target pest, weed or disease are prioritised.

7.2.2 (C) Records of pesticide use (including active ingredients used and their LD50, area treated, amount of active ingredients applied per ha and number of applications) are provided.

7.2.3 (C) Any use of pesticides is minimised as part of a plan, eliminated where possible, in accordance with IPM plans. 7.2.4 There is no prophylactic use of pesticides, unless in exceptional circumstances, as identified in national best practice guidelines.

7.2.5 Pesticides that are categorised as WHO Class 1A or 1B, or that are listed by the Stockholm or Rotterdam Conventions, and paraquat, are not used, unless in exceptional circumstances, as validated by a due diligence process, or when authorised by government authorities for pest outbreaks. Due diligence refers to: a) Assessing the threat and verifying why this is a major threat; b) Explaining why there is no other alternative which can be used; c) Describing the process applied to verify why there is no other less hazardous alternative; d) Devising process to limit the negative impacts of the application; e) Estimating the timescale of the application and steps taken to limit the application to the specific outbreak.

7.2.6 (C) Pesticides are only handled, used or applied by persons who have completed the necessary training and are always applied in accordance with the product label. All precautions attached to the products are properly observed, applied, and understood by workers. Personnel applying pesticides must show evidence of regular updates on the knowledge about the activity they carry out.

7.2.7 (C) Storage of all pesticides is in accordance with recognised best practices.

7.2.8 (C) All pesticide containers are properly disposed of and/or handled responsibly if used for other purposes.

7.2.9 (C) Aerial spraying of pesticides is prohibited, unless in exceptional circumstances where no other viable alternatives are available. This requires prior government authority approval. All relevant information is provided to affected local communities at least 48 hours prior to the application of aerial spraying.

7.2.10 (C) Specific annual medical surveillance for pesticide operators, and documented action to treat related health conditions, is demonstrated.

7.2.11 (C) No work with pesticides is undertaken by persons under the age of 18, pregnant or breastfeeding women or other people that have medical restrictions and they are offered alternative equivalent work.

Source: Roundtable on Sustainable Palm Oil (2018), P*rinciples & Criteria For the Production of Sustainable Palm Oil*, Kuala Lumpur, Malaysia: Roundtable on Sustainable Palm Oil, pp. 53-55.

The RSPO is currently undergoing a review of its key standards, including the 2018 RSPO P&C and the 2019 RSPO Independent Smallholder (ISH) Standard with the aim to enhance their applicability and effectiveness. Led by the RSPO Secretariat, this revision process involves consultation with stakeholders and aligning standards with changing market expectations. The updated standards,

along with revised certification system documents, are expected to be available at the end of 2024. This review follows a five-year cycle, aiming to ensure the continued relevance and impact of RSPO standards. The process is aligned with ISEAL Alliance guidelines for sustainability standards.[84]

Despite efforts to promote a more sustainable palm oil industry, obtaining RSPO certification does not ensure responsible production practices. Moreover, concerns about the sustainability of large oil palm plantations persist, especially given their heavy reliance on pesticides and chemical fertilizers, which also consume vast amounts of water.[85] Within this framework, the RSPO certification system has been criticised for its limited effectiveness. Civil society organisations have raised issues regarding insufficient monitoring and ineffective audits, as well as overly lenient transition periods that allow companies to address non-compliance. Additionally, complaint and remedy processes often fall short of providing satisfactory outcomes for affected communities and worker groups.[86] Evidence also suggests that workers endure strict performance demands, such as minimum harvest quotas and designated pesticide application areas. Compounding these challenges, safety equipment is frequently inadequate or absent, and workers often face limited holidays or sick leave, coupled with poor housing conditions.[87]

2.5 National legislative frameworks

2.5.1 Colombia

Since 1974, Colombia has enforced strict controls on the production, importation, and distribution of certain agricultural chemicals. The Ministry of Health, the Ministry of Environment, the Ministry of Agriculture, and the Colombian Agricultural Institute (ICA) are responsible for issuing regulations aimed at restricting or prohibiting the use of these substances in crops. Although regulations on chemical substances are intended to cover all types of chemicals, national regulatory development has primarily focused on pesticides, reflecting Colombia's agricultural orientation. In recent years, however, this focus has expanded to include chemicals used in mining.[88]

There are more than 150 distinct regulations with over 2,000 articles—laws, decrees, resolutions, and technical standards—that govern OSH. This section outlines relevant instruments related to workplace chemical risks, enhancing the understanding of OSH legislation within the oil palm sector.

The current regulatory framework marks a significant shift from an earlier lack of protections to a more robust defence of worker health, particularly in the agro-industrial sector. It comprises comprehensive regulations addressing social protection and employer responsibilities in OSH. Approximately 60% of these regulations target the prevention of unsafe working conditions and the promotion of worker well-being, including mental health, prevention of workplace harassment, and control of psychosocial risks. This framework is also evolving, as demonstrated by laws implementing changes in the way work is organised, such as the reduction of weekly working hours without affecting wages or workers' rights (Law 2101 of 2021).[89]

Furthermore, nearly 80% of the regulations mapped focus on risk management, emphasising worker participation in OSH. Laws like Law 9 of 1979 and Decree 614 of 1986 require the formation of committees such as the Joint Occupational Health and Safety Committee (COPASST) and Labour Coexistence Committees to prevent workplace harassment. These committees, mandatory for companies with over ten employees, must have equal representation from employers and workers, with worker representatives elected by their peers. In smaller companies, Safety and Health Vigilantes must be appointed. Workers also participate by submitting self-reports of unsafe conditions, with companies required to offer a simple procedure for doing so. COPASST members are involved in health and safety inspections, ensuring vigilant oversight of workplace conditions.[90]

More than 50% of preventive regulations focus on education and training in OSH. These regulations mandate that companies train all workers on risk awareness, prevention, control

measures, and responsibilities—although compliance is often low, as seen with Law 9 of 1979, Decree-Law 1295 of 1994, Law 1562 of 2012, and Decree 1072 of 2015. Training COPASST and Labour Coexistence Committee members is more frequently complied with, and technical training on trades and professions must include OSH regulations. Occupational Risk Administrators (ARL) must also provide training for COPASST members. The Occupational Health and Safety Management Systems (SG-SST), established by Decree 1443 of 2014, Law 1562 of 2015, and Decree 1072 of 2015, require all companies, regardless of size, to implement prevention and control programmes that define policies, objectives, planning, organisation, execution, verification, and actions to mitigate workplace risks.[91]

Each company's SG-SST must also include epidemiological and medical monitoring programmes that specify preventive measures for health risks, such as those posed by chemicals. For example, regular medical check-ups and laboratory exams are mandatory, with cholinesterase tests required for workers exposed to organophosphate pesticides, and audiological tests for those working in noisy environments. These medical, laboratory, and biological controls must be clearly defined in each company's preventive programmes. Additionally, companies are required to conduct workplace monitoring, including inspections of hazards, environmental measurements of agrochemical concentrations, PPE and equipment checks, accident and disease investigations, emergency drills, and safety inspections.[92]

Technical standards also regulate agrochemical risk control, specifying working conditions and techniques for their transportation, storage, use, and application. As the results of this study suggest, these standards are the least known among workers, with only those directly involved being familiar with them, often through informal knowledge-sharing among experienced workers. Workplaces are also legally required to provide health services and appropriate medical and technical staff, a mandate established in 1979 and reaffirmed in Law 1562 of 2015 and Decree 1072 of 2015.[93]

In Colombia, reinforced job stability protects workers with health issues from dismissal due to illness, as established by Constitutional Court jurisprudence. Technical standards, such as the "Comprehensive Occupational Health Care Guide Based on Evidence for Workers Exposed to Cholinesterase Inhibiting Pesticides" (Resolution 1013 of 2008), provide guidelines for evaluating and treating workers exposed to pesticides. Additionally, regulations mandate that employers provide PPE tailored to specific risks, especially when hazardous chemicals like agrochemicals are involved, ensuring PPE is in good condition and replaced as necessary. Resolution 4050 of 1994 requires the reassignment of pregnant women exposed to substances that could cause embryotoxicity or teratogenicity (i.e., developmental malformations in a developing foetus). However, no explicit regulations allow workers to leave the workplace in cases of imminent danger, a decision typically reserved for higher-ranking personnel.[94]

Despite the robust regulatory framework of OSH, compliance is often weak, with implicit practices of disregarding regulations. The lack of state oversight, exacerbated by the shortage of labour inspectors with specialisations in OSH, especially in agrochemical control, contributes to this non-compliance. Colombia has only 1,300 labour inspectors, spread across 36 regional offices, responsible for overseeing over a million businesses.[95]

Regarding the types of permitted substances, Colombian regulations currently prohibit the importation, use, storage, and sale of more than 40 agrochemical products that have been identified as highly dangerous and harmful (see Table 2). However, both globally and in Colombia, progress toward developing alternatives to eliminate agrochemicals has been minimal. Instead, there has been an increase in the intensive use of agrochemicals, with more than half of the pesticides sold in the country in 2016 classified as highly hazardous to human health and the environment. The most innovative efforts, which tend to be isolated, focus on making oil production more sustainable, essentially aiming to maintain profitability in an "environmentally friendly" manner.[96]

Furthermore, the sheer volume of these regulations complicates their application and harmonious interpretation, as they often lack adequate command and control instruments. This situation is exacerbated by a regulatory framework that does not fully consider the country's institutional capacity, hindering effective compliance and leading to informal practices in managing contaminated substances and containers. Although many hazardous chemicals are regulated throughout various stages of their life cycle via different legal frameworks, these regulations lack coherence and fail to effectively prevent environmental damage and health risks. Recent regulatory advancements have prompted the establishment of new streams for hazardous chemicals and waste, underscoring the urgent need for further legal development.[97]

Table 2 Banned and restricted agrochemicals in Colombia

Substance	Restriction level	Legislative instrument	Details
Endrin	Prohibition	Resolution 1849 of 1985	Prohibits the import, production, and sale of agricultural insecticides containing the active ingredient Endrin.
DDT	Severe restriction	Decree 704 of 1986	Prohibits the use of DDT, its derivatives, and compounds unless employed in programmes or campaigns advanced or authorised by the Ministry of Health.
Dinoseb	Prohibition	Resolution 19408 of 1987	Prohibits the use and handling of pesticides based on Chlordimeform and its salts.
Organophosphate Insecticides	Prohibition	Resolutions 366 of 1987 and 531, 540, 723, 724, and 874 of 1988	Cancels the sales licenses of organochlorine insecticides containing the active ingredients: Aldrin, Heptachlor, Dieldrin, Chlordane, and Canfeclor.
Aldrin, Heptachlor, Dieldrin, Chlordane, and Canfeclor	Prohibition	Decree 305 of 1988	Prohibits the import, production, and formulation of organochlorine products. Dieldrin and Chlordane are temporarily exempted for use in wood, and a license for Canfeclor in an ultra-low volume formulation is temporarily valid.
Chlordimeform	Severe restriction	Resolution 47 of 1988	Cancels the sales licenses for pesticides containing Chlordimeform in their composition.
Paraquat	Prohibition	Resolution 3028 of 1989	Prohibits the aerial application of herbicides containing the active ingredient Paraquat in the national territory.
Dithane M-22 (Maneb)	Severe restriction	Resolution 4863 of 1989	Cancels the sales license corresponding to the agricultural fungicide named Dithane M-22 (Maneb).
Manzate D and Manzate	Severe Restriction	Resolution 5052 of 1989	Cancels sales licenses for agricultural pesticides named Manzate D and Manzate.
Captafol	Prohibition	Resolution 5053 of 1989	Prohibits the import, production, and sale of agricultural pesticides containing the active ingredient Captafol and cancels the corresponding sales licenses.
Terbucanazole	Prohibition	Resolution 2308 of 1990	Prohibits the import, production, sale, and application in the national territory of

Substance	Restriction level	Legislative instrument	Details
			agricultural fungicides containing the active ingredient Terbucanazole.
Lindane	Severe Restriction	Resolutions 2156, 2157, 2158, 2159, 2857, and 3501 of 1991	Cancels the sales licenses of insecticides based on Lindane, under the formulation of wettable powders and emulsifiable concentrates.
Methyl Parathion	Severe Restriction	Resolution 2471 of 1991	Restricts the uses of Parathion to cotton and technified grass pests and Methyl Parathion to pests of cotton and technified rice only.
Fonofos	Prohibition	Resolution 29 of 1992	Prohibits the use of insecticides for agricultural use based on Fonofos.
Fungicides (Maneb, Zineb)	Prohibition	Resolution 9913 of 1993	Prohibits the import, production, formulation, marketing, handling, use, and application of fungicides Maneb, Zineb, and their related compounds.
Dieldrin, Chlordane, Dodecachlor or Mirex, Pentachlorophenol, Dicofol, DDT, BHC, Heptachlor, Lindane	Prohibition	Resolution 10255 of 1993	Prohibits their import, production, formulation, marketing, and use. Temporarily exempted are Lindane formulated for use as an ectoparasiticide in human health until effective substitutes are determined by the Ministry of Health, and Endosulfan until evidence of a comparable substitute against the coffee borer beetle (*Hypotenemus hampei*) is provided.
Methyl Bromide	Prohibition	Resolution 00138 of 1996	Prohibits the import, manufacturing, marketing, and use of pesticides based on Methyl Bromide, alone or in combination.
Methyl Bromide	Severe Restriction	Resolution 02152 of 1996	Authorises the import, marketing, and use of Methyl Bromide only for quarantine treatment of exotic pest control in fresh plant materials at ports and border crossings until a viable substitute is found. Its application must be performed hermetically and with a closed recovery system, supervised by the Ministry of the Environment in coordination with the Ministry of Agriculture and Rural Development through the Plant Health Division of ICA.
Endosulfan	Prohibition	Council of State, ruling March 23, 2001	Although Resolution 01669 of 1997 initially authorised and restricted the use of Endosulfan-based products only for control of coffee borer beetles, the mentioned ruling declared nullity for Articles 1, 6, 7, and 8 of the cited resolution.
Lindane	Prohibition	Resolution 04166 of 1997	Prohibits the import, manufacturing, formulation, marketing, and use of pesticide products based on Lindane, alone or in combination with other chemical substances.
Canfeclor or Toxaphene	Prohibition	Resolution 02971 of 2000	Prohibits the import, manufacturing, formulation, marketing, and use of pesticide products based on Canfeclor or Toxaphene, alone or in combination with other chemical substances.

Substance	Restriction level	Legislative instrument	Details
Methyl Bromide	Severe Restriction	Agreement 000643 of 2004	Authorises the import, marketing, and use of Methyl Bromide only for quarantine treatment of pest control in fresh plant materials and wooden packaging at ports and border crossings.

Source: López Arias, A., Suárez Medina, O. J., Hoyos, M. C., Montes Cortés. C. (2021), *Perfil Nacional de Sustancias Químicas en Colombia*, pp. 115-118.

2.5.2 Ghana

The use of pesticides and agrochemicals in Ghana's palm oil sector is governed by four legislative frameworks: the Environmental Protection Agency (EPA) Act, 1994 (Act 490); the Pesticides Control and Management Act, 1996 (Act 528); the Workmen's Compensation Act of 1987; and the Labor Act, 2003 (Act 651). These frameworks outline the usage of pesticides and provide general guidelines for managing OSH risks. Ghana's occupational health and safety legislation is also informed by the ILO conventions. Key ILO conventions ratified by Ghana include the Underground Work (Women) Convention 1935 (No. 45), Radiation Protection Convention 1960 (No. 115), Guarding of Machinery Convention 1963 (No. 119), Hygiene (Commerce and Offices) Convention 1964, Working Environment (Air Pollution, Noise and Vibration) Convention 1977, and the Labour Inspection Convention 1947.[98]

The EPA Act (Act 490) includes legislation on pesticides, ensuring their effective and proper use to protect users. The EPA is the sole agency responsible for registering pesticides and managing their lifecycle. This includes ensuring that pesticides are properly labelled, distributed, stored, transported, used, and applied according to accepted procedures. The agency also monitors pesticide use, acts against illegal practices, and issues licenses for pesticide importation and usage (Section 11).[99] Moreover, the regulatory functions of the EPA are complemented by the Plant Protection and Regulatory Services Directorate (PPRSD), of the Ministry of Agriculture, through the Pesticide and Fertilizer Regulatory Division Act 803 (2010). Together, the EPA and PPRSD supervise and train pesticide inspectors, register and inspect pesticide dealers and provide information materials and training on pesticides.[100]

Part II of the Pesticides Control and Management Act (Act 528) governs the entire lifecycle of pesticides in Ghana, encompassing registration, importation, distribution, storage, transportation, usage, and disposal. It establishes licensing requirements for pesticide dealers, stating that no person may import, export, manufacture, distribute, advertise, or sell any pesticide without a license issued under the Act (sections 28-53). The EPA is responsible for enforcing these regulations and monitoring compliance. The law further classifies pesticides and their use under section 4 as (a) for general use; (b) for restricted use; (c) suspended; or (d) banned. Pesticides classified under subsection (1) as restricted, suspended or banned are subject to the Prior Informed Consent Procedure defined in section 41 of the Act.[101]

With regard to OSH, Ghana lacks a national policy for OSH management, as mandated by ILO Convention No. 155 (1981), which Ghana has not yet ratified.[102] However, there are existing regulations outlined in the Factories, Offices and Shops Act of 1970 (Act 328), the Mining Regulations of 1970 (LI 665), and the Labour Act of 2003 (Act 561) that address health and safety management in the workplace. Additionally, the Ministry of Health and the Ghana Health Service, in collaboration with the WHO country office, commissioned the development of a policy and guidelines for OSH in the health sector, which were published in June 2010.[103] However, the 1992 Ghanaian Constitution (Section 24(1)) affirms that *"every person has the right to work under safe and healthy conditions."* This fundamental right is reinforced by the Labour Act of 2003 (Act 651), which sets general guidelines for worker safety and health across all sectors, including agriculture.

In this context, the Act requires employers to provide a safe work environment and take measures to protect workers from health hazards.[104]

The Labour Act also aims to facilitate employment opportunities for both unemployed and employed individuals while safeguarding the interests of both employers and employees to ensure a harmonious working environment. Part XV of the Act specifically addresses health, safety, and environmental conditions in workplaces, mandating employers to maintain satisfactory, healthy, and safe working conditions. Other relevant sections pertain to the protection of employment relationships, general employment conditions, remuneration protection, unions, collective bargaining, and labour inspection. In cases of workplace injuries, the Act outlines how to calculate workers' earnings and compensation for injuries sustained. It mandates that employers provide and maintain safe workplaces and systems of work. Additionally, employers must ensure safety in handling, storing, and transporting hazardous substances and provide necessary training and supervision based on workers' age and literacy levels.[105]

The Workmen's Compensation Act of 1987 compels employers to ensure a safe working environment and imposes liability to compensate employees incapacitated by work-related accidents. Compensation is independent of any negligence on the part of the employer or fellow workers. Employers must also cover hospital expenses for injured workers and provide earnings during treatment. There are exceptions to the employer's liability, such as injuries resulting from the worker being under the influence of intoxicating substances or deliberately self-inflicted injuries. This law applies to individuals employed by both public and private organisations.[106]

With respect to agrochemical governance, Ghana prohibits the importation of several agrochemicals that fall under the PIC procedure of the Rotterdam Convention. Among the 35 restricted substances, the following agrochemicals are banned: 2,4,5-T and its salts and esters, aldrin, binapacryl, captafol, chlordane, chlordimeform, chlorobenzilate, DDT, dieldrin, dinitro-ortho-cresol (DNOC) and its salts, dinoseb and its salts and esters, HCH (mixed isomers), heptachlor, hexachlorobenzene, lindane (gamma-HCH), monocrotophos, pentachlorophenol and its salts and esters, toxaphene (Camphechlor), dustable powder formulations containing a combination of benomyl at or above 7%, carbofuran at or above 10%, and thiram at or above 15%, methyl-parathion (emulsifiable concentrates at or above 19.5% active ingredient and dusts at or above 1.5% active ingredient), and phosphamidon (soluble liquid formulations of the substance that exceed 1000 g active ingredient/l).[107]

Regarding workplace inspections, the Department of Factories Inspectorate (DFI) and the Labour Department are responsible for enforcement in Ghana. Inspections assess various hazards, including physical, chemical, biological, ergonomic, psychosocial, and emergency preparedness. The frequency of inspections is determined by industry risk levels, with high-risk workplaces subject to more frequent checks. The inspection process begins with a notice, followed by an opening meeting to outline the scope. Inspectors systematically examine the workplace, consult with workers, document findings, and hold a closing meeting to discuss corrective actions. Employers must address identified hazards within specified timelines and inform the DFI upon completion. Non-compliance can lead to fines, prosecution, or workplace closure.[108]

Despite the presence of established standards, Ghana encounters numerous obstacles in the enforcement of OHS regulations. Key challenges include inadequate enforcement stemming from a shortage of inspectors, difficulties in regulating and applying OHS standards within the informal sector, a general lack of awareness among both employers and employees regarding OHS principles and their legal obligations, and limited resources that impede the establishment of comprehensive OHS systems, particularly in smaller businesses.[109]

Moreover, given the diverse potential and actual undesired events across various work groups and settings, there appears to be a disconnect between legislative or policy provisions and their practical application by employers. While existing legislative acts assign responsibilities to both employers and employees for ensuring health and safety in the workplace, they often outline

obligations without providing clear guidance on how to implement necessary safety measures. As Ghana awaits the establishment of comprehensive OSH standards, there is a pressing need for a strategy that can serve as a practical guide for all stakeholders, thereby enhancing the practice, management, and monitoring of workplace health and safety across the nation.[110]

Likewise, the existing laws regulating occupational health, safety, and environmental protection in Ghana do not impose sanctions on factories and businesses for their environmental impacts. Consequently, the legislation lacks provisions for holding businesses accountable for maintaining environmental quality standards and ensuring that their operations do not adversely affect the livelihoods of surrounding communities.[111] A sole focus on workplace safety and health can lead to conflicts between companies and communities, as neglecting the environmental implications of business operations may disrupt local livelihoods.

Lastly, the presence of unregistered and banned pesticides among farmers and dealers, unregistered applicators, improper disposal of pesticide waste and containers, and inadequate regulatory oversight remain problematic. There are considerable difficulties in addressing the roles of non-state actors, including pesticide importers, dealers, and farmers, particularly regarding pesticide choice, technical knowledge of pest diagnosis, proper dispensing, and the use of PPE. State actors also face challenges, including a lack of pesticide user manuals for dealers, insufficient accredited laboratories to test product quality, inadequate financial incentives for inspectors, and limited transportation facilities for reaching pesticide users.[112]

2.5.3 Indonesia

The Government of Indonesia (GoI) has declared pesticides as a toxic product with the potential to create adverse impacts on the environment and biodiversity, causing resistance, resurgences, new pest emergence, and disruptions to human and other living organisms' health.[113] Therefore, since 1962, Indonesia has had the Law on Hygiene for Public Businesses (currently the Health Law) and, in 1973, Government Regulation Number 7 Year 1973 on the Supervision of the Circulation, Storage, and Use of Pesticides.

In line with its ratification of the Stockholm Convention, Indonesia has established regulatory frameworks and institutions to monitor Persistent Organic Pollutants (POPs) with the aim of encouraging the development of national regulations, policies, and technical guidelines for managing these substances. The country is also working to enhance regional capacities for managing POPs residues and overseeing their monitoring. Collaborative research and technology initiatives related to the impacts of POPs are being developed, following the Best Available Techniques (BAT) and Best Environmental Practices (BEP) outlined by the Convention and decisions made by the Conference of the Parties (COP). Furthermore, Indonesia is focused on promoting the use of environmentally friendly alternative chemicals in production processes, reducing dioxin and furan emissions, strengthening law enforcement efforts concerning prohibited POPs, and creating a National Implementation Plan (NIP) to ensure the effective implementation of the Stockholm Convention in the country.

The existing regulations do not provide detailed explanations regarding the classification of herbicides, insecticides, and fungicides. However, MoA Regulation 43/2019 outlines various classifications based on active substances, the dangers posed by synthetic pesticides, and their intended use. According to Article 4, pesticides are categorised into synthetic and natural types. In this context, Article 6 defines synthetic pesticides as those composed of one or more synthetic compounds, while Article 7 describes natural pesticides as those derived from living organisms or natural minerals, further subdivided into biological pesticides, metabolite pesticides, and mineral pesticides.

Regulation 43/2019 also addresses the danger classification of pesticides. Article 8 distinguishes between prohibited and non-prohibited pesticides, with prohibited substances detailed in Article 9 based on their active ingredients, additives, or test results. Appendix I lists prohibited substances,

considering factors such as carcinogenic, mutagenic, and teratogenic effects, as well as POPs. Additionally, Article 11 mandates testing pesticide formulations to determine hazard classes according to WHO standards, prohibiting classes Ia and Ib.[114]

Regarding the scope of use, Article 12 classifies pesticides into restricted and general use categories. Restricted pesticides, specified in Article 13, contain active substances and additives listed in Appendix III, posing risks such as ocular or dermal damage, inhalation toxicity, or chronic poisoning. By contrast, pesticides for general use, outlined in Article 14, do not fall under the restricted category. Appendices I, II, and III provide detailed lists related to prohibited and restricted pesticides, including active substances, additives, and hazard classifications as regulated by MoA Regulation 43/2019.[115]

The use of restricted pesticides, as regulated in Article 12 and Appendix III of MOA 43/2019, is further detailed in Articles 93 and 94, which outline the requirements for their application. According to Article 93, users of restricted pesticides must undergo training conducted by the holder of the registration number and permanent pesticide permit. This training must be coordinated with the relevant agricultural department in the district or city, and the training certificate will be valid throughout the Republic of Indonesia. In implementing this training, holders of registration numbers and permanent pesticide permits are required to adhere to the technical instructions provided by the Director General regarding the use of restricted pesticides, as stipulated in Article 94.[116]

Regulations concerning the labelling, containers, instructions for use, safety precautions, and environmental impacts of pesticides are outlined in MOA Regulation 43/2019, particularly in Articles 86 to 88. Article 86 mandates that registered pesticides and technical materials must be stored in containers that are durable, resistant to breakage or tearing, and non-reactive with the pesticides to minimise risks to human health and the environment. Specifications for these containers can be found in Attachment V of the regulation.[117]

In addition to container requirements, Article 87 stipulates that pesticides must be properly labelled. Labels must either be affixed to the containers or printed directly on them and should remain securely attached. Registrants are required to submit printed labels to the Director General through the Central Chief. The label information and usage instructions must be provided in Bahasa Indonesia and must adhere to specific guidelines: they must avoid agitative or exaggerated terms, such as "awesome," "great," "super," "powerful," "most," or "top"; refrain from comparing the product with other registered pesticides; and exclude images of non-target organisms and commodities. Furthermore, all information and warning signs on the label must be clearly printed, easily readable, and understandable, ensuring that they are not easily erased. Detailed label information is outlined in Appendix V, which is an integral part of this Ministerial Regulation.[118]

Occupational safety and health are governed by Law No. 13 of 2003 on Manpower. According to Article 86, every worker has the right to protection in occupational safety and health, protection against immorality and indecency, and treatment that respects human dignity and religious values. The goal of worker safety protection is to ensure optimal productivity (Article 86, paragraph 2).

Companies are required to implement an OHS management system integrated with their broader management framework, as mandated by Article 87. This system must adhere to Government Regulation No. 50 of 2012, which outlines the implementation of OHS management systems. Article 3 of this regulation sets forth safety provisions that aim to prevent accidents, fires, and explosions while ensuring appropriate rescue routes during emergencies. Companies must also provide PPE and address hazards such as temperature extremes, humidity, dust, smoke, gas, and radiation. Further, measures must be in place to prevent work-related diseases, ensure adequate lighting and ventilation, and maintain cleanliness and order in the workplace. Safety protocols must secure transport, buildings, and loading activities while also preventing exposure to hazardous electrical currents and adjusting safety measures for tasks with high accident risks.[119]

Company oversight includes regular health and physical condition checks for workers, both at hiring and during employment, conducted by a company-appointed doctor approved by the director (Article 8). Companies must also coach new workers on potential workplace hazards, required safety measures, PPE, and safe working methods (Article 9). Workers can only begin tasks once they demonstrate an understanding of these safety conditions. Managers are responsible for ongoing safety training, accident prevention, fire safety, and first aid procedures.[120]

Workers are also obligated to follow safety protocols as outlined in Article 12 of Law No. 1 of 1970 on Occupational Safety. These duties include providing accurate information to safety officials, wearing PPE, complying with safety standards, and objecting to unsafe work conditions when necessary. In certain cases, supervisory officials may override such objections within justifiable limits. Likewise, companies are required to prominently display OHS guidelines and safety symbols in easily visible locations. They must also provide PPE at no cost to workers and to anyone entering the workplace, along with necessary instructions for its use (Article 14).[121]

The Ministry of Health (MoH) regulates the use of PPE for workers engaged in spraying activities through MoH Regulation 2/2023. PPE is essential during chemical control operations. Vector control officers and implementers must select PPE that complies with occupational safety and health standards and pesticide classification criteria, which consider the physical form, routes of entry into the body, and toxicity of the pesticides being used.[122] Consequently, the chosen PPE should include the items listed in Table 3.

Table 3 Required PPE elements according to the different types of handling with pesticides

Type of work	Pesticide classification	Types of PPE							
		Boots	Canvas boots	Coveralls	Hats	Gloves	Apron	Face shield	Mask
Securing pesticides	Ia	+		+	+	+	+	+	+*
	Ib	+		+	+	+	+	+	+*
	II	+		+	+	+	+	+	+*
	III	-	+	+	+	+	+	+	+*
Indoor spraying	II	-	+	+	+	-	-	-	+
	III	-	+**	+	+	-	-	-	+
Outdoor spraying	Ia	+		+	+	+	+	+	+*
	Ib	+	+	+	+	+	+	+	+*
	II	-	+	+	+	-	-	-	+
	III	-	+	+	+	-	-	-	-

Source: Government of Indonesia (2023), *Peraturan Menteri Kesehatan Nomor 2 Tahun 2023 tentang Peraturan Pelaksanaan Peraturan Pemerintah Nomor 66 Tahun 2014 tentang Kesehatan Lingkungan*. + = mandatory; - = not necessary; * = if face shield is not worn; ** = if boots are not worn.

Personal protective equipment is classified into four categories based on its ability to protect the wearer from pesticides:[123]

1. **Highly Chemical Resistant**: Designed for use for no more than eight hours; it must be cleaned and washed after each use.
2. **Moderate Chemical Resistant**: Suitable for wear for one to two hours, and should be cleaned or replaced after use.
3. **Slightly Chemical Resistant**: Intended for use for no more than ten minutes.

4. **Non-Chemical Resistant**: Offers no protection against pesticide exposure and is not recommended for use.

When working with Class II or III pesticides, workers may wear regular cotton uniforms, such as long-sleeve coveralls and long trousers with socks and shoes. For Class Ia and Ib pesticides, it is recommended to wear coveralls that provide full-body coverage, including the arms, ankles, and neck, minimizing openings, seams, or pockets that could retain pesticides. These coveralls should be worn over regular work uniforms and inner clothing.[124]

Goggles that protect the front and sides of the eyes are advised when pouring or mixing concentrated Class Ia and Ib pesticides. If there is a risk of facial contact, a face shield should be used. Additionally, it is crucial to have equipment and materials available to handle spills or leaks, including absorbent cloth, sand or sawdust, a shovel, and containers or plastic bags. A first aid kit should include medications and an emergency plan card listing important contact numbers and addresses, such as poison control centres, ambulances, the nearest hospital, police, and fire departments. Furthermore, providing a portable fire extinguisher is recommended when working with spraying machines that may pose a fire hazard.[125]

Despite the extensive legislative framework governing the use of agrochemicals and workplace safety with these substances, Indonesia has yet to collect and aggregate comprehensive data on occupational accidents and diseases. When it comes to accidents and injuries, the government relies on data from the National Social Security Body for Employment (BPJS Ketenagakerjaan). The annual Labour Force Survey (SAKERNAS) also reports accident figures, but both sources only reflect the formal sector. BPJS data is limited to workers registered in the social security programme, excluding informal workers and formal workers who are not enrolled by their employers. The government also faces challenges in gathering accurate data on occupational diseases, particularly in identifying the specific types of diseases affecting workers across Indonesia.[126]

Moreover, Indonesia faces significant challenges in implementing its OSH law, including a lack of government supervision and inspection. There is a substantial gap between the number of labour inspectors and the total number of enterprises, making it difficult to ensure compliance across the board. Many companies, particularly small and medium-sized enterprises (SMEs), do not adhere to existing OSH regulations, largely due to poor awareness of the importance of occupational health and safety. Additionally, some companies view OSH as a financial burden rather than an essential part of business operations, further complicating the effective implementation of OSH measures in the country.[127]

Lastly, in Indonesia, there is a pressing need to strengthen efforts to improve the safety, health, and working conditions of informal economy workers, including home workers, domestic workers, street vendors, those on small construction sites, as well as informal and casual agricultural workers, often found in remote villages. These workers account for a significant portion of the labour force and contribute enormously to the country's economy. However, they frequently face substandard working conditions, exposed to numerous hazards without adequate safety and health training or access to vital information. Delivering practical OSH protection measures to these workers is urgently needed.[128]

2.6 RBC policies of NL-based buyers of palm oil

This section presents our analysis of the policies of seven Netherlands-based companies with trade relations with the mills linked to the plantations included in this study, comprising five international commodity traders, one fast-moving consumer goods company (FMCGC), and one retailer. A summary of these companies' performance against the items listed in section 1.4 is provided in Table 4.

Table 4 Summary table of companies' policies

Indicator	Trader 1	Trader 2	Trader 3	Trader 4	Trader 5	FMCGC	Retailer
1. Dedicated OSH policy that applies to suppliers?	No*	Yes**	No****	Yes*****	Yes*****	Yes	Yes
2. Policy embedded in key conventions and/or other legal frameworks?	Yes	No	No	Yes	Yes	Yes	Yes
3. Set out limits to the exposure of workers to agrochemicals at oil palm plantations?	No	No	No	No	No	No	No
4.a. Set out obligations to suppliers to provide workers with protective measures against agrochemical exposure?	No	No	No	Yes	Yes	Yes	No
4.b. If so, are there specific guidelines for female workers?	No	No	No	Yes	No	No	No
5. Monitoring and response systems in place to verify supplier compliance?	Yes	Yes***	Yes	Yes	Yes	Yes	Yes

Source: Profundo

*But supplier expectation guidelines include an OSH element that applies to direct suppliers; **But vague and does not explicitly apply to all suppliers; ***Based on group-level risk review; ****But OSH commitments are included in their Human Rights Policy and the Policy on Sustainable Palm Oil; *****But not clear whether this applies to all suppliers

Several patterns emerge when reviewing the overall trends among palm oil traders and buyers regarding occupational safety and health (OSH) and related worker protection policies.

Firstly, the majority of these companies have not published (or altogether may lack) a dedicated OSH policy specifically tailored to apply to their suppliers. Instead, published OSH commitments are often integrated within broader human rights or sustainability policies, which means that the emphasis on OSH can be diluted. This indicates a general lack of focused attention on ensuring that suppliers adopt robust safety and health practices. Although some companies include suppliers within the scope of their human rights or sustainability policies, they rarely have standalone OSH policies that apply throughout the supply chain.

Secondly, while many companies embed their policies in key conventions such as the ILO standards and other recognised human rights frameworks, the commitment to these conventions does not often extend to the specifics of occupational health and safety or agrochemical exposure. In this context, in many of these companies' policies, there is a noticeable gap in referencing key OSH-related conventions related to agrochemical exposure (e.g., C139 – Occupational Cancer Convention, C184 – Safety and Health in Agriculture Convention, C170 – Chemicals Convention and C148 – Working Environment (Air Pollution, Noise and Vibration) Convention.

Moreover, most companies fail to set limits to worker exposure to agrochemicals according to international frameworks or national legislation applicable at the oil palm plantations they source from. Despite the potential dangers posed by agrochemicals, including their link to occupational diseases, very few companies make explicit commitments to limit exposure or to ensure their suppliers are taking the necessary precautions to protect workers from such risks.

Likewise, a small number of companies do set out obligations for suppliers to provide protective measures, such as personal protective equipment (PPE), against agrochemical exposure. However, this is not universally applied across the sector, and those that do mention such protections often fail to provide specific guidelines for female workers, who may have additional vulnerabilities in this regard, such as reproductive health concerns. Even when protective measures are outlined, they tend to lack gender-specific provisions, highlighting a gap in addressing the unique risks faced by women in these environments.

3

Survey results

This chapter presents the results of a digital survey designed to capture the experiences of oil palm plantation workers in Colombia, Ghana, and Indonesia who are exposed to agrochemicals in their workplaces. The results of the survey are contrasted with information obtained through a review of the literature and interviews with key informants.

Ensuring the health and safety of workers on commercial oil palm plantations is the responsibility of employers. To meet this obligation, plantation companies should implement Occupational Safety and Health (OSH) management systems that are tailored to the specific needs of the agricultural sector and aligned with ILO guidelines. These systems should include regular risk assessments, which guide the development and implementation of short- and long-term action plans, prioritising risk prevention over management and control. Additionally, these interventions should foster a preventive culture, be evaluated for effectiveness, and consider psychosocial and general health issues alongside safety risks from physical, chemical, and biological hazards.[129]

Regarding chemical hazards, the ILO recommends a comprehensive approach to managing these substances in commercial plantations to minimise occupational exposure. This involves eliminating hazardous chemicals, substituting them with less harmful alternatives, implementing controls like proper storage and dispensing systems, and applying administrative controls such as restricted access to treated areas. As a last resort, suitable personal protective equipment (PPE) should be provided, with PPE intended to complement, not replace, other preventive measures.[130]

3.1 Demographic characteristics of survey respondents

This survey included a sample of 1,436 oil palm plantation workers, 436 of whom were employed in Colombia, 451 in Ghana, and 549 in Indonesia. In total, 32 plantations were surveyed, including 21 that were RSPO-certified. These 21 certified plantations employed 89% of the surveyed workers. Broken down by country, 94% of the surveyed Colombian workers were employed in RSPO-certified plantations, along with 100% of workers in Ghana and 76% of workers in Indonesia. None of the surveyed workers indicated having migrated from a country other than the one where they worked. Over half of the surveyed workers (55%) identified as men, 44.8% as women, and 0.2% as members of the LGBTQI+ community. By country, the proportion of surveyed workers identifying as women was highest in Indonesia, at 59%. Disaggregated by the type of employment relation, 89% of the surveyed workers were employed directly by the plantation. The highest share of outsourced workers was registered in Ghana, where 16% of the survey respondents were hired through a subcontracting company or individual (Table 5). As discussed in the methods section, this sample does not reflect the composition of the workforce, as, globally, the palm oil sector heavily relies on outsourced and casual workers.[131]

Table 5 Demographic profile of survey respondents

Country	No. of companies included in the study (RSPO-certified)	No. of surveyed workers							
		Men		Women		LGBTQI+		Total	
		Direct	Outsourced	Direct	Outsourced	Direct	Outsourced	Direct	Outsourced
Colombia	16 (7)	276	31	112	14	3	0	391	45
Ghana	3 (3)	224	33	155	39	0	0	379	72
Indonesia	13 (11)	199	27	314	9	0	0	513	36
Total	**32 (21)**	**699**	**91**	**581**	**62**	**3**	**0**	**1,283**	**153**

Question: In which country do you work? What is your gender? You are:

To identify where and how oil palm plantation workers might be exposed to agrochemicals, this study considered twelve major tasks and roles:

1. Workers employed in the application of pesticides, herbicides, and fungicides (henceforth called spraying).
2. Nursery and planting workers (nursery and planting).
3. Workers employed in the maintenance of palm trees (maintenance).
4. Workers employed in the harvest of fresh fruit bunches (FFB harvest).
5. Workers employed in the loading and transportation of FFB (FFB transport).
6. Workers employed in the warehouse where agrochemicals are stored, mixed, and/or unloaded (storage of agrochemicals).
7. Workers employed in the transplantation of palm seedlings (replanting sites).
8. Workers employed in the application of fertilizers (fertilizer application).
9. Workers employed in the management and disposal of plant waste (waste management/disposal).
10. Workers employed in artificial pollination (pollen application).
11. Workers conducting more than one of the previous tasks (multiple tasks).
12. Workers whose tasks did not fit any of the previous categories (other).

These tasks and roles are described in more detail in Box 3.

Box 3. The productive cycle of a commercial oil palm plantation

Palm oil is predominantly produced from the African oil palm (*Elaeis guineensis*), favoured over other species like the American oil palm (*E. oleifera*) and the maripa palm (*Attalea maripa*) due to its significantly higher yields. The oil is extracted from the fruit pulp, with the kernels also yielding economically valuable oil. Optimal growth occurs in humid tropical regions with consistently high temperatures (29-33°C) and abundant rainfall (2,000 mm annually).

Oil palms are mostly propagated from seeds. Oil palm seeds naturally take a long time to sprout, but in plantations, a process called the dry heat method is used to speed this up. The seeds are heated to 37-39°C for 50 days, and their moisture is increased to encourage germination. After germination, seedlings grow in **nurseries** for 10 to 16 months, often in soil-filled polyethylene bags, taking care to prevent overheating and ensure proper irrigation and weed control. Seedlings are **transplanted** to plantations either year-round or during the rainy season, depending on the region. Palms are typically planted in a triangular pattern with a spacing of 7.5 to 10 m, resulting in a density of 115 to 205 palms per hectare.

Around two years after being transplanted, oil palms begin to develop a trunk and grow 25 to 50 cm annually, depending on environmental conditions. The palms start to grow flower clusters where the leaves meet the stem, with young palms first producing male flowers. It takes 26 to 44 months from when a leaf starts growing until the fruit is ready to be harvested. The first fruit bunches are small and low in oil yield, with significant harvests beginning around four years after planting. Mature fruit bunches typically weigh 15-50 kg and contain 1,000 to 4,000 fruits. Although oil palms can live for over 200 years and reach heights above 30 meters, they are usually replanted after 20 to 25 years in commercial plantations due to difficulties in harvesting from tall palms, increased damage to fruit during harvesting, lower oil quality from larger bunches, and the higher productivity of newer palm varieties.

Maintenance of oil palm plantations involves managing the vegetation between the palms. Irrigation is rarely used due to its high cost. Keeping the area between palms free from excess vegetation helps to maintain access to the palms, prevent soil erosion, and support soil quality. In mature plantations, vegetation is managed manually (through weeding and pruning) or with herbicides. Pruning consists of removing dead leaves rather than green ones, as heavy pruning of green leaves can reduce yields. Some plantations prune to make fruit bunches more visible for ripeness checks. Maintenance workers also tend to leguminous plants that fix nitrogen in the soil (such as *Mucuna bracteata, Mimosa diplotricha* var. *diplotricha,* and *Centrosema* spp*.,* among others) and are often used as ground cover.

Typically, **fertilizers** are used to enhance yields. In oil palm plantations, conventional fertilizers made from petrochemicals and non-renewable minerals are typically used. Alternatively, organic fertilizers can be created from recycled biomass and by-products from plantations and oil mills. This is done by workers employed in the **management of plant waste**. Likewise, **artificial pollination**, a labour-intensive task, can significantly enhance fruit set and oil yield, especially where natural pollination is insufficient. This involves collecting and drying pollen from male flowers, then manually applying it in a liquid suspension or a solid mixture to receptive female flowers using tools like blowers or sprayers.

Harvesting in oil palm plantations is ongoing throughout the year, as fruit bunches do not ripen seasonally. Fresh fruit bunches (FFB) are picked when some fruits are loose. Regular visual checks are needed to determine the best harvest time. Harvesting is done manually: smaller palms are harvested with chisels, while larger ones use sickles tied on poles. During this process, the harvester often must be in an awkward position to keep control of the sickles. Older palms often require removing lower leaves to reach the fruit. The process remains labour-intensive and has not yet been mechanised due to the complex structure of the palms. During harvest, loose fruits that fall from bunches are collected to prevent them from growing uncontrolled into new palms. Collectors gather these loose fruits and load them into sacks. They also follow the tractors or trucks that **transport FFB** to pick up fallen fruits.

Oil palms are vulnerable to pests and diseases, especially when planted in monocultures, requiring various pesticides, herbicides, and fungicides for control. While application methods vary, the most common technique is workers using backpack **sprayers** to apply these chemicals.

Source: Schleicher, T., Hilbert, I., Manhart, A., Henneberg, K., et al. (2019, February), *Production of palm oil in Indonesia*, Freiburg, Germany: Öko-Institut, pp. 10-15; EOS Data Analytics (2022, January 14), "Cultivo De Palma De Aceite: Gestión y Consejos", online: https://eos.com/es/blog/cultivo-de-palma-de-aceite/, viewed in May 2024; Wurz, A., Grass, I., Tscharntke, T. (2021), "Hand pollination of global crops – A systematic review", *Basic and Applied Ecology 56*: 299-321.

According to the WHO, the primary tasks leading to worker exposure to agrochemicals include opening containers, mixing and loading spraying solutions, applying insecticides with hand-held or vehicle-mounted equipment, cleaning and maintaining spray equipment, and disposing of empty containers. Accidental exposure commonly results from spills, splashes, and leakages of concentrated insecticides.[132] Against this background, workers involved in spraying, storing agrochemicals, applying fertilizers, and applying pollen were categorised as having direct contact with agrochemicals. Conversely, workers performing all other tasks described above were classified as having indirect contact with agrochemicals.

Survey respondents were asked to select all relevant job categories from the 12 options provided. Since workers could choose multiple categories, the total count of job tasks recorded was 1,675, exceeding the number of individual respondents. Of these, 48% reported performing multiple functions. The most frequently cited job functions were FFB harvest (431 responses), maintenance

(323 responses), and spraying (214 responses) (Table 6). The category "other" included fuel transportation, irrigation, pest monitoring, counting FFB, cleaning of PPEs, cleaning of facilities, and cleaning of ditches. Because not all tasks categorised as "other" involved direct or indirect contact with agrochemicals, this research only considered workers who performed "other" tasks in addition to at least one of the 11 tasks involving agrochemical exposure.

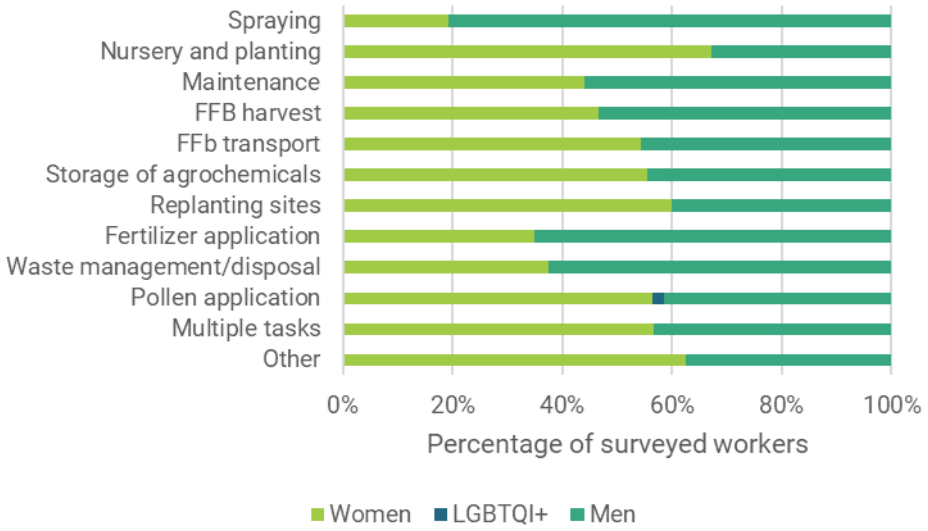
Table 6 Work tasks disaggregated by country

Stage of the productive cycle	Colombia		Ghana		Indonesia		
	Direct	Outsourced	Direct	Outsourced	Direct	Outsourced	Total
Spraying	29	12	45	11	107	10	214
Nursery and planting	26	3	13	0	19	0	61
Maintenance	70	9	115	39	84	6	323
FFB harvest	121	20	111	9	165	5	431
FFB transport	14	3	55	12	15	4	103
Storage of agrochemicals	7	0	7	1	19	2	36
Replanting sites	4	0	2	1	13	0	20
Fertilizer application	32	6	24	2	136	3	203
Waste management/disposal	4	1	14	0	10	3	32
Pollen application	144	5	3	0	0	2	154
Multiple tasks*	12	6	15	2	37	2	74
Other	8	2	7	0	6	1	24
Total	**471**	**67**	**411**	**77**	**611**	**38**	**1,675**

Question: What type of work do you conduct at the plantation (please select all that apply)?
* These workers did not specify which multiple tasks they conducted.

Disaggregated by gender, job tasks such as nursery and planting and "other" were made up of at least 60% of women. By contrast, 80% of the workers employed in spraying and over 60% of the workers employed in fertilizer application and waste management/disposal were men. The LGBTQI+ workers were employed in pollen application (Figure 1). It is noteworthy that the proportion of men and women employed in the FFB harvest is rather balanced. This does not reflect the trend in the sector, where men typically work as FFB harvesters and somewhat reflects the gender composition of the workforce in tasks such as maintenance and fertilizer application that employ a balanced number of men and women,[133] except in Indonesia, where fertilizer application and spraying is mostly done by women.[134]

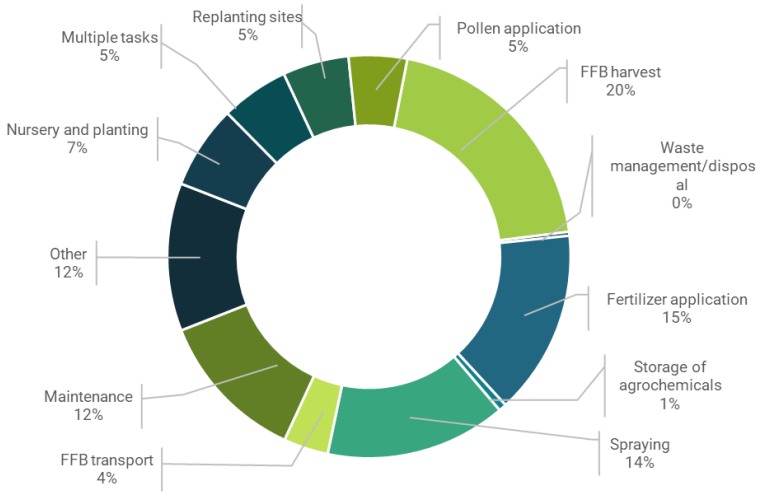
Figure 1 Work tasks disaggregated by gender



Question: What type of work do you conduct at the plantation (please select all that apply)? What is your gender?

With respect to the age groups of the surveyed workers, the majority (84%) were between 25 and 54 years old, 12% were between 18 and 25, and 4% were between 55 and 64. Two workers reported being 65 or older. No workers under 18 were captured in this study. The workers were also asked how long they had been employed at the plantation where they worked. Eleven per cent (11%) of them had been employed for less than a year, 32% between 1 and 4 years, 38% between 5 and 9 years, 13% between 10 and 14 years, and 6% had been employed for 15 years or more. Additionally, the surveyed workers were asked if they had previously worked at another plantation. Twenty-eight per cent (28%) reported having been employed at a different plantation. Notably, 50% of the Colombian respondents indicated that they had previously worked at another plantation. This is largely because 41% of all surveyed workers from Colombia were transferred to a new company following an acquisition after their employer filed for bankruptcy in 2019.

Figure 2 Workers' previous tasks at the plantation where they currently work

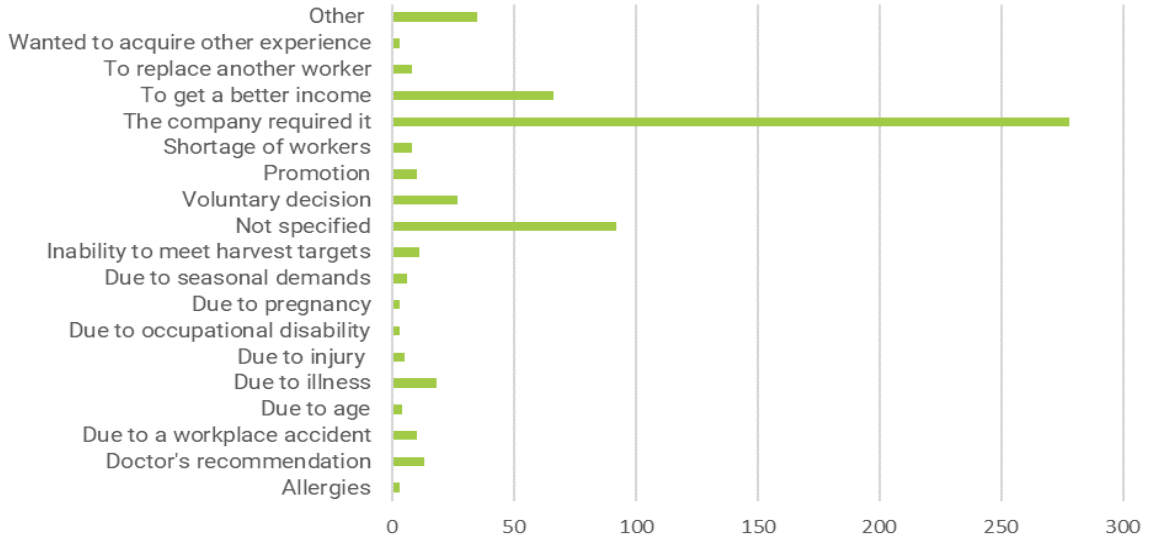


Question: Have you conducted a different function at the plantation where you currently work previous to your current function? Which previous function(s)? n = 603

The surveyed workers were also asked whether they had performed tasks different from those they were handling at their company at the moment of the survey. Forty-two per cent (42%) reported having previously carried out a different task while working at the same company.

Disaggregated by country, 55% of Indonesian workers, 28% of Ghanaian workers, and 41% of Colombian workers indicated that they had previously performed a different task at the same company. Among those who reported having conducted a different task at the plantation, the most common previous tasks were FFB harvest (20%), followed by fertilizer application (15%), and spraying (14%) (Figure 2). The top three reasons for remaining employed at the plantation but switching to a different task were company requirements (46%), unspecified reasons (15%), and the pursuit of better income (11%) (Figure 3). For workers employed in spraying and those in fertilizer application, the primary reason for changing tasks was the company's requirement.

Figure 3 Workers' reasons for changing tasks at the same plantation



Question: Why did you change jobs? n = 603

Regarding unionisation among the surveyed workers, 72% reported being members of a workers' union. The highest rate of union affiliation was found in Colombia, where 82% of surveyed workers were union members, followed by Indonesia (78%) and Ghana (58%). In Colombia, the surveyed workers were represented by four unions belonging to the *Coordinadora Sindical Palmera* (Palm Oil Union Coordination Organisation) and one independent union. The *Coordinadora Sindical Palmera* is the national coordinating body for palm oil sector unions in Colombia and a member of the *Central Unitaria de Trabajadores* de Colombia (CUT Colombia), the largest trade union federation in the country. The *Cordinadora Sindical Palmera* was established to coordinate efforts, promote solidarity, unify demands, and strengthen the labour movement within the palm oil sector.[135] Indonesia's trade union movement is built on enterprise-based unions, which can form federations and confederations to represent workers nationally.[136] Seven trade union federations represented the enterprise-based trade unions captured in this survey. In Ghana, all unionised workers were members of the General Agricultural Workers' Union (GAWU), the largest trade union for farmers and agricultural workers in Ghana that is affiliated with the Trade Union Congress-Ghana (TUC-Ghana)[137] (Table 7).

Table 7 Union membership among surveyed workers in different companies

Country	Union	No. of members in the surveyed companies
Colombia	Sindupalma	10
	SINTRAIMAGRA	54
	SINTRAINAGRO	225

Country	Union	No. of members in the surveyed companies
	SINTRAPALMA	59
	Sintraproaceites	3
	Not specified	9
Ghana	GAWU	241
Indonesia	Minamas	46
	Sinarmas	27
	FSBKS Kalbar	72
	SBSS	68
	SEPASI	48
	GSBI	19
	SERBUNDO	138
Total	**13**	**1,019**

Question: Are you a member of a workers' union? Which union?

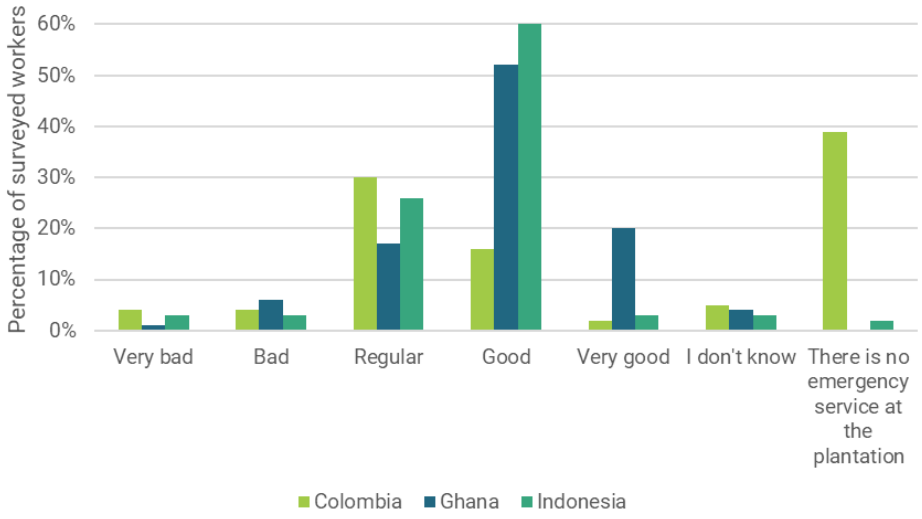
Disaggregated by gender, 71% of the surveyed women and 77% of the surveyed men were union members, with all three LGBTQI+ informants also being unionised. It is important to mention that the high rate of unionisation among the surveyed workers does not reflect the reality of these three countries. In 2019, for instance, the unionisation rate in Colombia was 4.7%,[138] while unionisation rates were 13% in Indonesia[139] and 16.8% in Ghana.[140] Moreover, the high level of outsourcing and casual work among oil palm sector workers, compounded by violence against unions, may contribute to lower overall unionisation rates in each country, as the right to free association is not always guaranteed for these workers.[141]

3.2 Preventive OSH measures

The ILO recommends that commercial plantations ensure trained personnel and appropriate first aid means are available during the use of acutely toxic pesticides and hazardous chemicals. First-aiders should be trained on the specific hazards, protective measures, and emergency procedures. Employers should assess first aid needs in consultation with workers, considering factors like the number of employees, the nature and location of the work, and proximity to medical services.[142]

Against this background, surveyed workers were asked to rate the first aid response at their workplace. Forty-two per cent (42%) found the first aid response good, 8% very good, 24% regular, 4% bad, and 2% very bad. Four per cent (4%) did not know, and 13% said there was no emergency service at the plantation. Sixty per cent (60%) of the Indonesian workers and 52% of the Ghanaian workers found the first aid response to be good. By contrast, 39% of the Colombian workers responded that there was no emergency service at the plantation where they worked (Figure 4). Among the subcontracted workers, opinions were mostly divided between 'regular' (38%) and 'good' (37%). Similarly, the majority of direct workers rated the first aid response at their plantations as 'good' (45%) and 'regular' (23%).

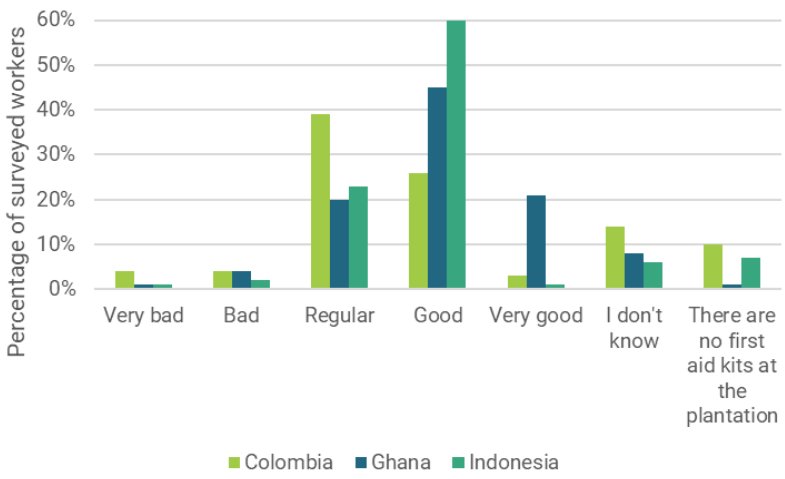
Figure 4 Workers' rating of the first aid response at their workplace



Question: In the plantation where you work, the first aid response is:

The ILO recommends that employers in commercial plantations provide first-aid equipment and facilities specifically designed to address the hazards associated with pesticide and chemical use. This includes ensuring the availability of emergency showers and eyewash stations for immediate decontamination. Additionally, first-aid equipment and supplies should always be readily accessible.[143] In light of these recommendations, surveyed workers were asked to rate the quality of the first aid kits at their workplaces. Forty-five per cent (45%) of respondents rated the quality of the first aid kits as good, 8% as very good, 27% as regular, 3% as bad, and 2% as very bad. Moreover, 9% did not know, and 6% reported that there were no first aid kits at the plantation. While most workers in Indonesia and Ghana rated the first aid kits as good, most surveyed workers in Colombia rated them as regular (Figure 5). Among the subcontracted workers, most rated the first aid kits as regular (36%), followed by good (33%), while the direct workers rated them as good (46%) and regular (25%). Although most RSPO-certified and non-certified plantation workers rated the quality of first-aid kits as 'good,' a much higher proportion of non-certified plantation workers (60%) did so compared to those at certified plantations (42%). Notably, 10% of workers at RSPO-certified plantations reported that there were no first-aid kits available, compared to less than 1% of workers at non-certified plantations.

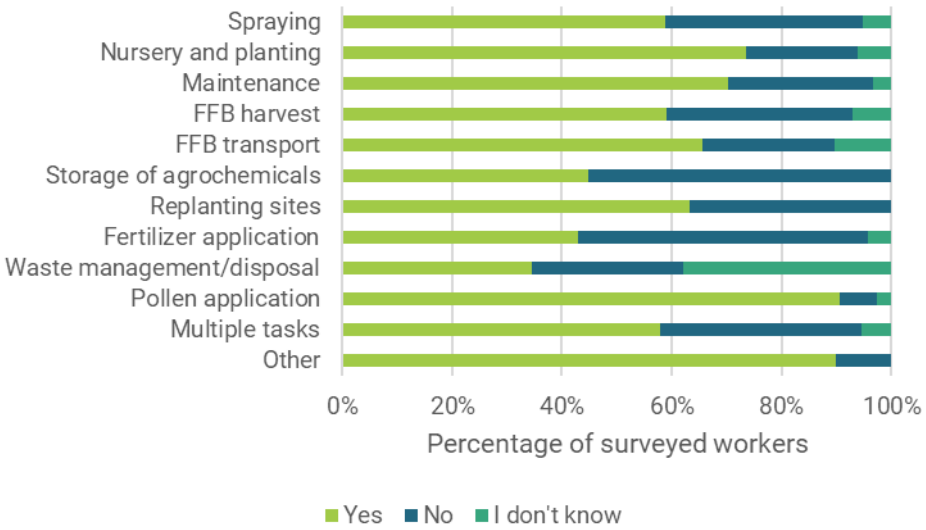
Figure 5 Workers' rating of the first aid kits at their workplace



Question: In the plantation where you work, the first aid kits are:

The ILO also recommends that employers in commercial plantations establish and maintain up-to-date emergency response plans for dealing with accidents related to pesticide and hazardous chemical use. These plans should include arrangements for medical assistance, availability of antidotes, and proper decontamination procedures. Employers are also responsible for training workers on risks associated with exposure to agrochemicals, the proper use of personal protective equipment, and emergency procedures, including how to raise an alarm, decontaminate, and evacuate the area if necessary.[144] Considering this, the surveyed workers were asked whether they received OSH training throughout the year. Overall, 62% reported receiving training, 32% did not, and 6% were unsure. In Indonesia, 75% of workers indicated they did not receive OSH training, while 91% of Colombian and 89% of Ghanaian respondents reported receiving it. Moreover, 61% of the direct workers and 69% of the outsourced workers reported receiving OSH training. Disaggregated by work function, most of the workers employed in fertilizer application (53%) and storage of agrochemicals (55%) reported not receiving OSH training throughout the year (Figure 6). At both RSPO-certified and non-certified plantations, most workers reported on the availability of OSH training throughout the year. However, there was a notable difference: while the majority (67%) of workers at certified plantations reported receiving training, there were more workers (77%) at non-certified plantations indicated they reported receiving this.

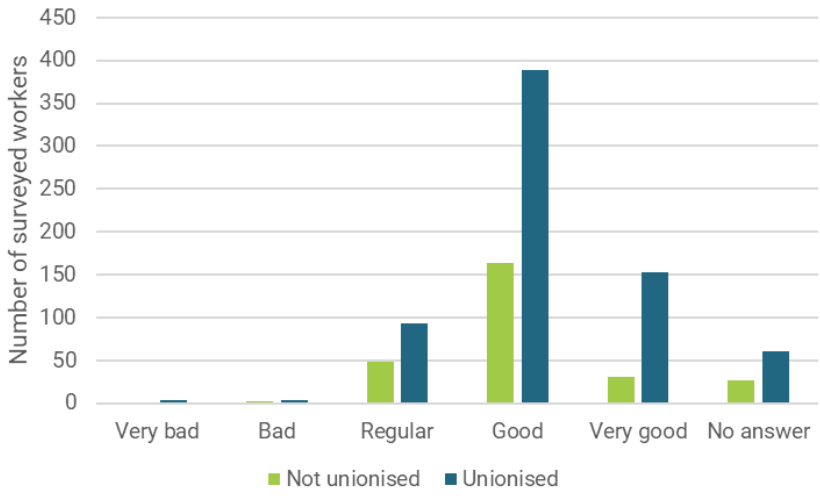
Figure 6 **Workers' responses on receiving OSH training throughout the year, disaggregated by work task**



Question: In the plantation where you work, do you get OSH training throughout the year?

Likewise, the workers who reported receiving OSH training throughout the year were asked to rate the quality of the training. In Colombia, 61% of the workers rated the training as good, while 54% of the workers in both Ghana and Indonesia gave it the same rating. Notably, 28% of the Ghanaian workers rated the quality of their OSH training as 'very good,' compared to 13% of the workers in Colombia and 4% of the workers in Indonesia. Disaggregated by work tasks, it is notable that 87% of the workers employed in maintenance tasks rated the quality of the training as good or very good. By contrast, 48% of the workers employed in waste management gave it the same rating. The rating of both unionised and not unionised workers echoed the ratings per country (Figure 7). Across both RSPO-certified and non-certified plantations, the majority of workers rated the quality of OSH training as good, with 62% in certified plantations and 61% in non-certified ones.

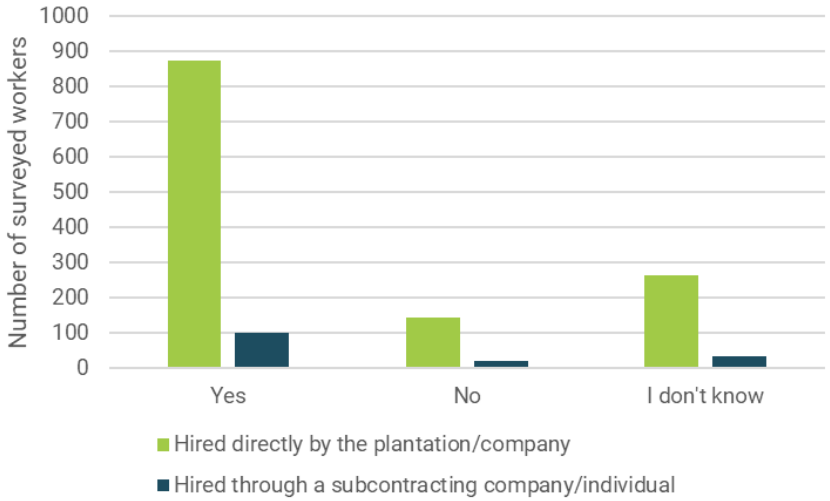
Figure 7 Workers' rating of the quality of OSH training, disaggregated by union membership



Question: The quality of the OSH training is: n = 972

According to the ILO, OSH teams play a crucial role in maintaining a safe and healthy work environment by identifying and managing risks, ensuring compliance with regulations, providing OSH training, investigating workplace incidents, coordinating emergency responses, and conducting health checks and surveys.[145] Against this background, workers were asked whether there was an OSH team at their plantation. In Colombia, 88% of respondents reported the presence of an OSH team, compared to 75% of workers in Ghana and 45% in Indonesia. In Indonesia, 32% of workers were unsure about the existence of an OSH team. When broken down by unionisation status, 70% of unionised workers reported the presence of an OSH team, while 65% of non-unionised workers reported the same. Disaggregated by employment type, most of both direct and subcontracted workers indicated that there was an OSH team at their plantation (Figure 8). Nearly 67% of workers at RSPO-certified plantations reported having an OSH team, compared to 47% of workers at non-certified plantations.

Figure 8 Presence of an OSH team at the plantation by employment type (direct vs. outsourced)

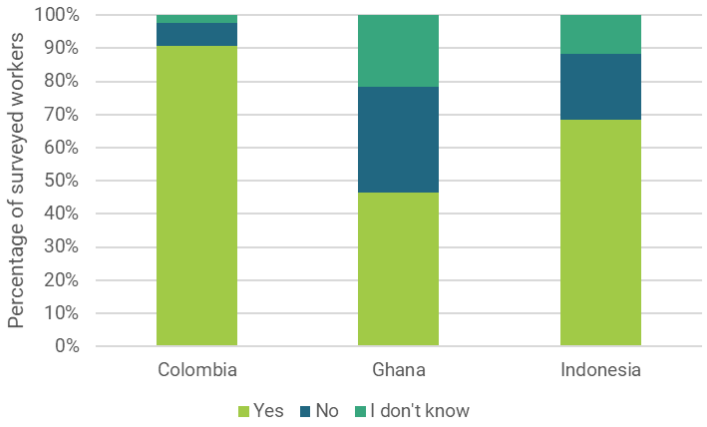


Question: Is there an OSH team at the plantation where you work?

The surveyed workers were asked whether they felt their work tasks compromised their safety and health. In Colombia, most workers reported feeling that their tasks did compromise their health and safety. By contrast, over 45% of workers in Ghana felt that their tasks compromised their

health and safety (Figure 9). Broken down by work tasks, 28% of workers in replanting sites and 31% in FFB transport reported not feeling that their tasks compromised their health and safety. Additionally, 43% of workers in waste management/disposal and 25% in FFB transport indicated they did not know whether their tasks compromised their health and safety. A higher percentage of workers at non-RSPO-certified plantations (74%) believed their work tasks posed risks to their safety and health, compared to 68% of workers at certified plantations.

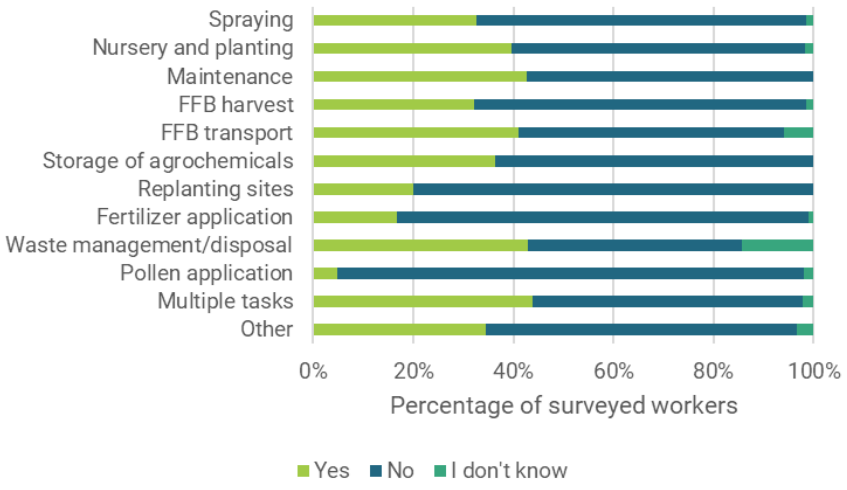
Figure 9 Workers' awareness of safety and health risks associated with their work tasks



Question: Do you feel that any of the tasks you conduct at work can compromise your safety and health?

The ILO recommends implementing administrative control measures to protect workers from agrochemical exposure, which may include limiting the duration of workers' exposure.[146] Against this background, the workers were asked whether they did overtime. Over 70% of all workers reported not doing overtime. Disaggregated by country, 89% of Colombian workers and 84% of Indonesian workers reported not doing overtime, compared to 68% of Ghanaian workers who reported doing overtime. Overtime was more commonly reported among the direct workers, of whom 32% reported doing overtime. By contrast, almost 5% of the outsourced workers did not know whether they did overtime. Broken down by work task, over 95% of workers involved in pollen application and 83% of those in fertilizer application reported not working overtime (Figure 10). Additionally, more workers at RSPO-certified plantations reported working overtime (31%) compared to workers at non-RSPO-certified plantations (17%).

Figure 10 Workers' responses to doing overtime

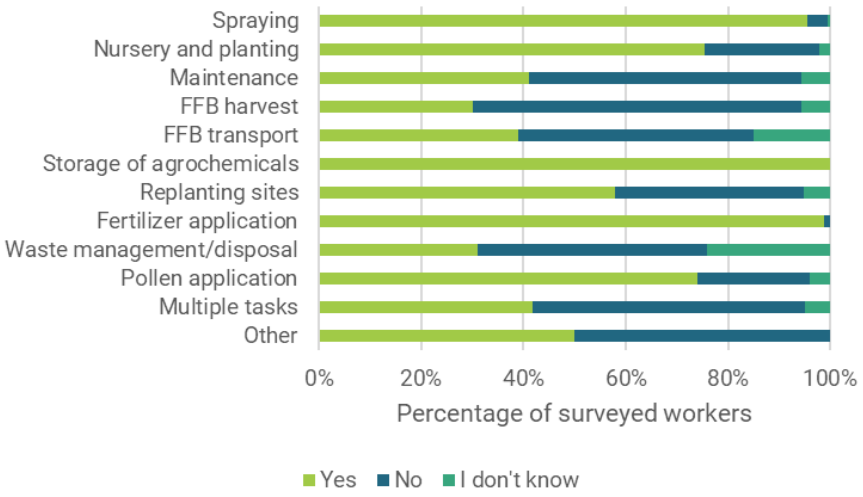


Question: Do you do overtime?

3.3 Exposure to agrochemicals

As stated earlier, the ILO identifies the primary tasks leading to worker exposure to agrochemicals as opening containers, mixing and loading solutions, applying insecticides, cleaning and maintaining equipment, and disposing of empty containers.[147] The ILO also considers that workers moving through plants recently treated with pesticides are exposed through skin or clothing contact.[148] Following these insights, we categorised exposure to agrochemicals into two types: direct and indirect. Against this background, workers were asked whether they came into contact with agrochemicals in their work. Fifty-five per cent (55%) of respondents reported contact with agrochemicals, while 39% said they did not, and 6% were unsure. Disaggregated by country, 69% of Colombian workers reported exposure, compared to 41% of Ghanaian and 58% of Indonesian workers. Broken down by work tasks, 64% of workers employed in FFB harvest and 53% of those in maintenance stated they did not come into contact with agrochemicals at work. It is remarkable that 1% of workers in fertilizer application and 4% of those in spraying claimed no contact with agrochemicals, whereas all workers in agrochemical storage reported exposure (Figure 11). Moreover, 55% of surveyed workers in RSPO-certified plantations reported contact with pesticides and fertilizers, compared to over 56% of workers in non-RSPO-certified plantations.

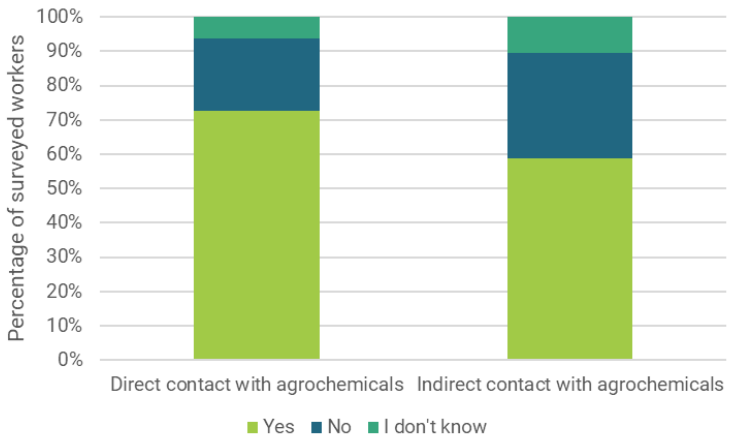
Figure 11 Workers' awareness of their contact with agrochemicals, disaggregated by work task



Question: In your work, do you come in contact with chemical substances such as pesticides and fertilizers?

The ILO recommends that information about pesticide applications, toxicity, and restricted entry intervals be posted in the workplace or otherwise made available to workers.[149] With this in mind, workers were asked whether they were informed about the agrochemicals they used at work, including their risks and the preventive and protective measures necessary to avoid health hazards. Disaggregated by country, 85% of workers in Ghana reported being informed about the agrochemicals used at work. By contrast, 61% of Colombian workers and 53% of Indonesian workers reported receiving this information. Notably, 40% of Indonesian workers and 20% of Colombian workers stated they were not informed about the agrochemicals used in their work. When broken down by work tasks, 50% of workers in the FFB harvest reported not being informed about the agrochemicals used. Additionally, 12% of workers in spraying, 23% in fertilizer application, and 23% in agrochemical storage also reported not receiving information about the chemicals they used. Disaggregated by employment type, 62% of direct workers and 72% of indirect workers reported being informed about the agrochemicals used at work. When considering the type of contact with agrochemicals, over two-thirds of workers with direct contact reported being informed about the chemicals they used (Figure 12).

Figure 12 Workers' responses on receiving information about agrochemicals used in the plantation



Question: Are you informed about the agrochemicals you use, their risks, preventive and protective measures, and first aid?

Acutely toxic pesticides are classified by the World Health Organization into three hazard categories: extremely hazardous (Ia), highly hazardous (Ib), and moderately hazardous (II). Most insecticides fall into these high-risk categories, while most fungicides and herbicides are considered less hazardous. However, some commonly used fungicides and herbicides still pose significant risks. This classification reflects the acute health risks associated with accidental exposure during proper handling, storage, and transportation.[150]

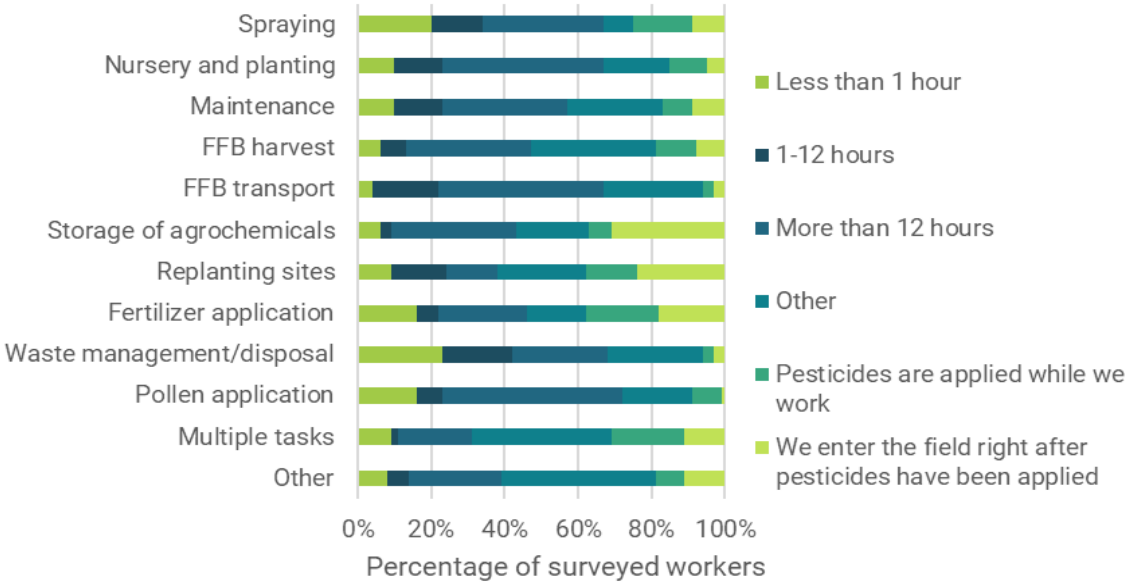
The surveyed workers were also asked to name the chemical substances they came in contact with at the plantation where they worked. In total, 56 agrochemicals were named of which 12 were herbicides, 15 were insecticides, 13 were fungicides, 14 were fertilizers, one was a plant hormone (α-Naphthaleneacetic acid (NAA)), and one was an adjuvant (i.e., a supplemental substance added to a spray mixture to enhance the performance of pesticides). Out of the 56 agrochemicals, 24 were used in Colombia, 7 in Ghana, and 39 in Indonesia. The WHO classified one of the cited insecticides (Beta-cyfluthrin, used in Indonesia) and one fertilizer (Zinc phosphide, used in Indonesia) as highly hazardous, while one insecticide (Dicofol, used in Indonesia) is severely restricted in the EU, one fungicide (Kasugamycin, used in Colombia) is banned in the EU, and another fungicide (Benomyl, used in both in Colombia and Indonesia) has been withdrawn from the EU market. Moreover, 29 of the 56 agrochemicals have hazard classifications beyond those of the WHO for their carcinogenic and mutagenic effects, among other concerns. Tebuconazole, a fungicide reported in use in Colombia, has been banned there since 1990. Paraquat, classified as moderately hazardous, has been banned in the EU since 2007 due to its exposure risks. In Indonesia, its use is restricted as a limited pesticide under Appendix III of Regulation 43 of 2019 due to risks of ocular and dermal damage, inhalation toxicity, and chronic poisoning. Nevertheless, it continues to be used on Indonesian oil palm plantations (Appendix 2).

Walking through plants recently treated with pesticides often results in significant exposure through skin or clothing contact. Pesticide residues can persist on plant surfaces and in the soil for extended periods, leading to potential exposure when workers enter these treated areas. Repeated contact with toxic pesticides, such as organophosphorus compounds (which can convert into even more toxic forms) or carbamates (which block nerve signals), can cause serious intoxication, sometimes requiring medical attention. Therefore, the ILO recommends establishing restricted entry intervals—periods during which workers should avoid treated areas—based on risk assessments by national authorities or specific guidelines for each pesticide-crop combination.[151]

Against this background, surveyed workers were asked how long they had to wait after pesticide application before being allowed to re-enter the field. Disaggregated by country, it is concerning that 21% of Indonesian workers reported that pesticides were applied while they were working, and

23% said they entered the field immediately after pesticide application. By contrast, 44% of Colombian workers and 61% of Ghanaian workers indicated they waited more than 12 hours before re-entering the field. When broken down by work task, 20% of workers involved in fertilizer application stated that pesticides were applied while they worked, and 17% reported entering the field immediately after pesticides were applied (Figure 13). Regarding RSPO-certified plantations, 39% of workers reported waiting more than 12 hours to re-enter the fields after pesticide application, compared to 7% of workers on non-certified plantations. Moreover, 9% of certified and 6% of non-certified plantation workers reported entering the fields immediately after pesticide application or working while pesticides were being applied.

Figure 13 Re-entry waiting time after pesticide application, disaggregated by job task

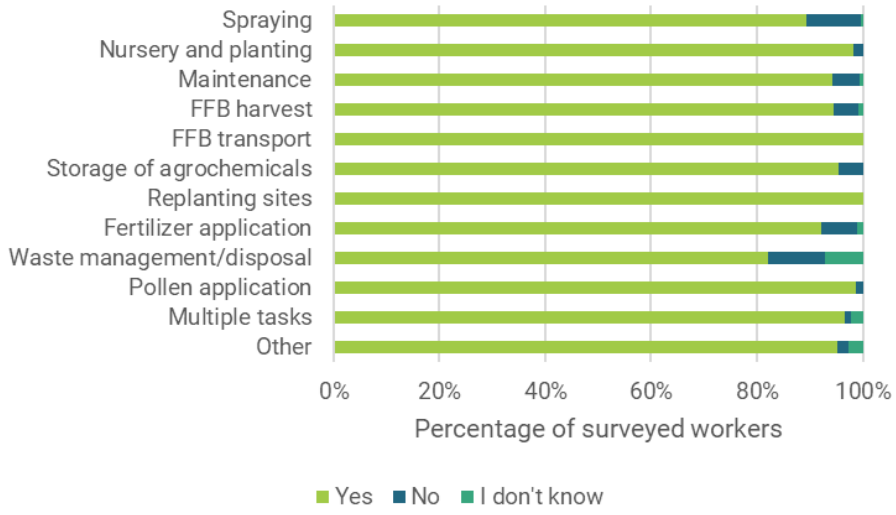


Question: How long do you have to wait after pesticides (insecticides, fungicides, herbicides) are applied before you are allowed to re-enter the field?

3.4 Management of OSH risks

According to the ILO, Personal Protective Equipment (PPE) should not replace preventive measures or safe handling practices but should be used when collective measures cannot fully protect workers. Employers must continue to develop and apply control measures to reduce risks to a level where PPE becomes unnecessary. PPE, including respiratory protection, chemical protective clothing, gloves, footwear, and eye/face protection, must provide adequate protection, comply with national laws or standards, and be available in appropriate sizes for all workers.[152] Against this background, workers were asked whether their employer provided them with PPE. Ninety-five per cent (95%) of respondents reported receiving PPE from their employer, while 4% said they did not receive PPE, and 1% were unsure. Disaggregated by work tasks, 100% of workers in replanting sites and FFB transport reported receiving PPE. Notably, however, 10% of workers in spraying and waste management/disposal reported not receiving PPE from their employer (Figure 14). Most respondents working on non-RSPO-certified plantations (97%) reported receiving PPE, compared to 96% of workers on RSPO-certified plantations.

Figure 14 Workers' responses to receiving PPE by the company where they work, disaggregated by work task



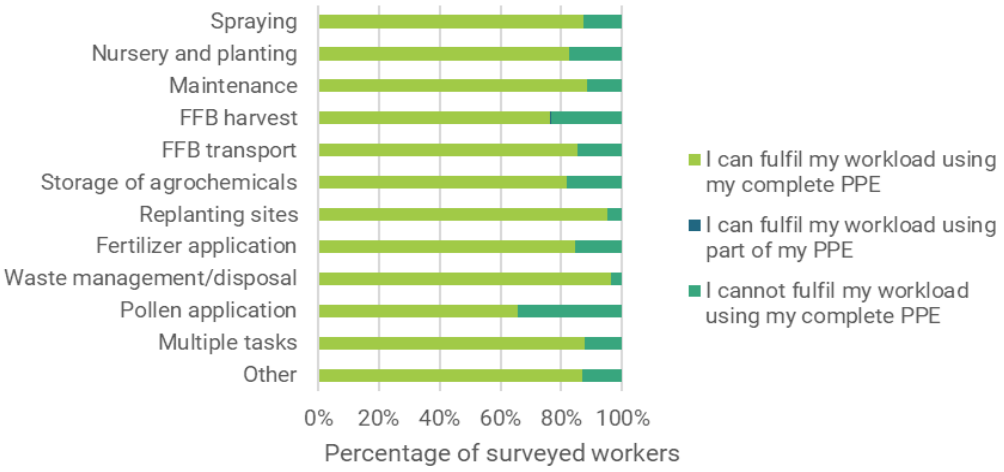
Question: Does the company you work for provide you with personal protective equipment?

The ILO states that protective clothing should be well-fitting, and workers should be consulted on comfort and fit. Selection should consider the material's resistance to pesticides, design suitability, the work environment, and the potential for heat or allergic stress.[153] Against this backdrop, workers were asked if they could complete their workload using their full PPE. Over 80% reported being able to do so. However, 24% of Colombian and 25% of Indonesian informants said they could not. In contrast, only 4% of Ghanaian workers reported difficulties. An informant from a Colombian labour-support organisation explained: *"If you put on glasses and it's 45 or 50 degrees [Celsius] outside, the glasses will fog up immediately. So, how do you apply the product correctly? What workers do is take off the glasses, remove the gloves, and apply the product, because that's the only way they can actually apply it properly."*

Disaggregated by gender, 24% of women reported being unable to complete their workload while wearing their full PPE. In contrast, only 13% of men reported similar difficulties. Broken down by work task, 34% of workers in pollen application and 23% of workers in FFB harvest reported challenges in fulfilling their workload while wearing complete PPE (Figure 15). Notably, more workers on non-RSPO-certified plantations reported being able to complete their tasks using full PPE compared to those on certified plantations (84% vs. 81%).

The problem of not being able to complete their workload using their full PPE not only puts workers at mid- and long-term risk of adverse health effects caused by the chemical substances they use at work, but also poses an immediate risk for the most irritating substances. For example, alkyl-polyglycol ether, a substance employed to enhance the efficacy of herbicides by improving their wettability and penetration into weeds that is used in Colombia and Indonesia (see Appendix 2), is yet to be classified by the WHO for its toxicity; however, according to the European Chemicals Agency, this substance causes serious eye damage.[154]

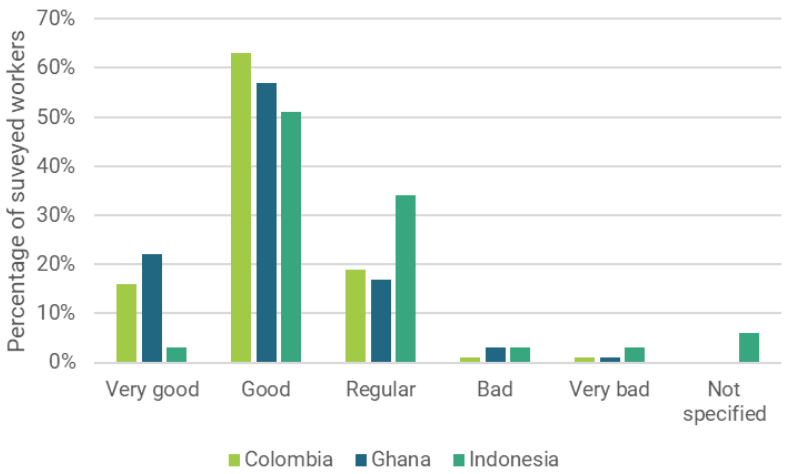
Figure 15 Workers' ability to fulfil their workloads while wearing their PPEs, disaggregated by work task



Question: Please select the option that aligns with your experience at work:

Moreover, the ILO states that PPE must be kept in good condition, stored cleanly, and replaced at no cost to workers when it is no longer suitable. Employers should maintain adequate PPE stocks to ensure timely replacement as recommended by the manufacturer, and the equipment should not be used beyond its recommended time or exposure limits.[155] With this in mind, workers were asked to rate the quality of their PPE. Overall, most respondents rated their PPE as "good" or "very good." Disaggregated by country, 63% of Colombian workers and 57% of Ghanaian workers rated their PPE as "good." In contrast, 51% of Indonesian workers rated their PPE as "good," while 34% rated it as "regular" (Figure 16). Broken down by union affiliation, 55% of unionised workers and 63% of non-unionised workers rated their PPE as "good." Conversely, 24% of both unionised and non-unionised workers rated their PPE as "regular." Additionally, 57% of women and 58% of men rated their PPE as "good". On both RSPO-certified and non-certified plantations, the majority of workers rated the quality of their PPE as 'good' (55% vs. 59%).

Figure 16 Workers' rating of the quality of their PPE

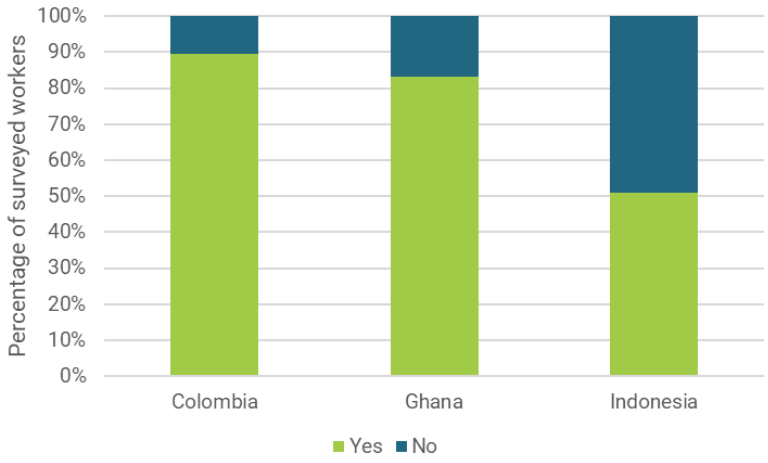


Question: The quality of the personal protective equipment you wear is:

The workers were also asked whether their employers provided new PPE after damage. Notably, almost 50% of Indonesian workers reported that their employer did not replace damaged PPE (Figure 17). When broken down by employment type, 30% of direct workers and 15% of subcontractors indicated that they did not receive new PPE after damage. By work tasks, 30% of

workers in each spraying and fertilizer application, 27% of those in FFB harvest, and 29% of workers in other tasks reported not receiving replacement PPE from their employers after damage. Moreover, a higher percentage of workers on non-RSPO-certified plantations (88%) reported receiving new PPE after damage, compared to workers on certified plantations (78%).

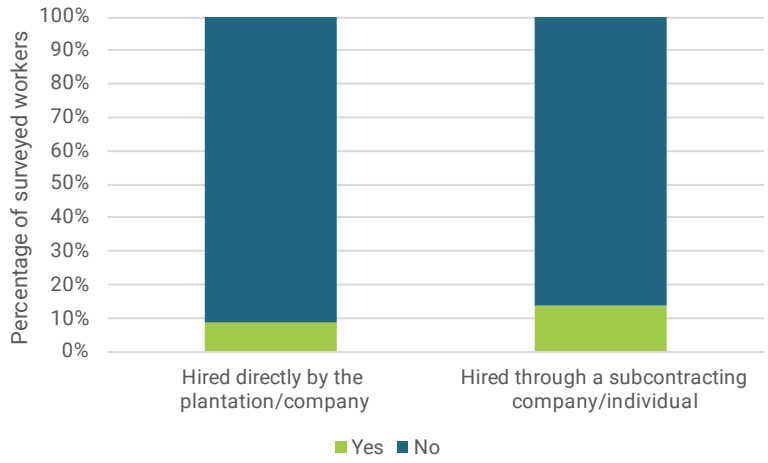
Figure 17 Workers' responses to getting a new PPE after damage



Question: When one item of your personal protective equipment breaks, do you get a new one?

According to the ILO, all PPE that is necessary for safety in the use of chemicals should be provided and maintained by the employer without cost to the worker.[156] With this in mind, workers were asked whether they had to pay for their PPE or purchase it outside the plantation. While most workers reported that they did not have to pay for or buy their PPE outside, it is noteworthy that 22% of Indonesian workers indicated they either had to pay their employer for their PPE or purchase it independently. Broken down by employment type, 14% of subcontracted workers reported having to pay for their PPE or purchase it outside the plantation, compared to 9% of direct workers who indicated they had to do the same (Figure 18). Likewise, the proportion of workers who reported having to buy or pay their employer for their PPE was higher among those employed on RSPO-certified plantations compared to their counterparts on non-certified plantations (9% vs. 8%).

Figure 18 Workers' responses to having to pay for their PPE by employment type (direct vs. outsourced)

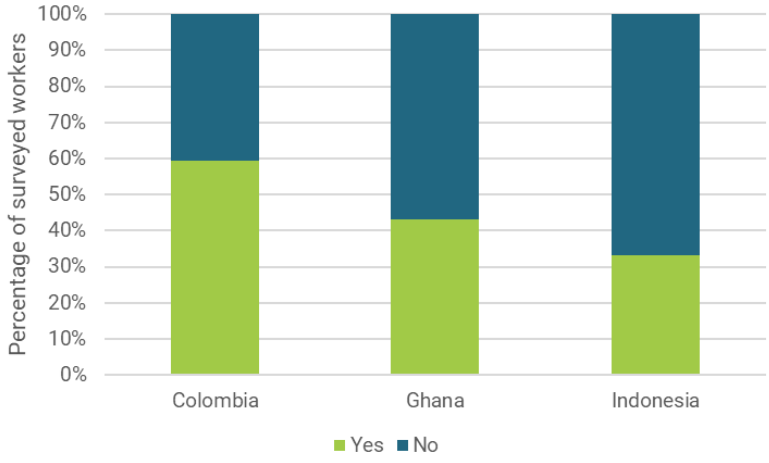


Question: Do you have to pay your employer for your personal protective equipment, or do you have to buy it outside the plantation?

Moreover, the ILO states that PPE should be cleaned and stored at the workplace. Employers are responsible for laundering, cleaning, disinfecting, and examining chemical protective clothing and equipment. Proper protocols must be followed to prevent contamination of other clothing and water sources during the cleaning process.[157] Against this background, workers were asked whether washing facilities were available at their plantation for cleaning their PPE. Broken down by employment type, 56% of the subcontracted workers and 55% of the direct workers said there were no washing facilities at the plantation where they worked. Nearly 60% of Colombian workers reported having such facilities, while 42% of Ghanaian workers and 32% of Indonesian workers indicated the absence of washing facilities at their workplaces (Figure 19). The proportion of workers who reported the absence of PPE-washing facilities was higher among the RSPO-certified plantations (45% in RSPO-certified plantations vs. 38% in non-certified plantations).

In this regard, the field observations by Indonesian coordinators of Mondiaal FNV illustrate the problems related to the lack of washing facilities: *"The community and labourers lived close to the plantation, separated only by a river. They used this river for bathing and washing, while groundwater was used for drinking and cooking. A sampling site located behind the enumerator's house, near the river, was tested for total copper concentration. The measurement, taken after the rain stopped, showed a concentration of 0.8 mg/L, which is 40 times higher than the national standard of 0.02 mg/L. Copper, used in fertilizers and pesticides, can cause skin allergies, headaches, nausea, vomiting, diarrhoea, and abdominal pain."* Likewise, the testimony of an Indonesian male worker employed as a sprayer describes the negative health outcomes of this situation: "*The company should provide facilities for washing work tools and toilets. Workers often rinse or clean themselves in rivers within the plantation and use the river for defecation and urination because there are no sanitation facilities, which frequently causes itching and skin irritation."*

Figure 19 Workers' responses on the availability of facilities at the plantation to clean PPEs

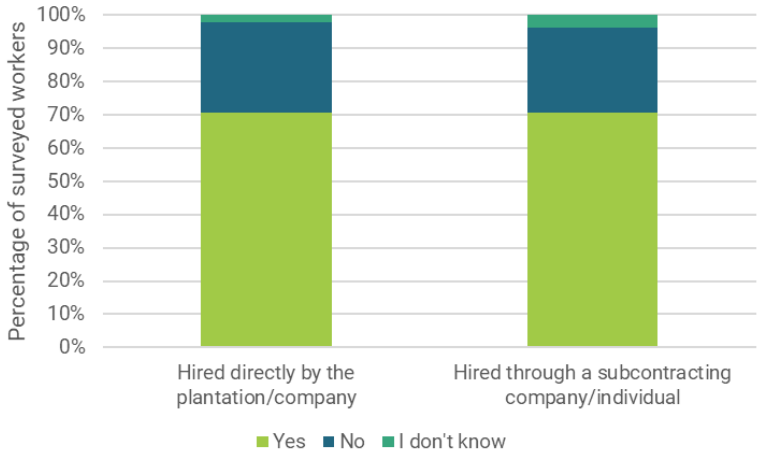


Question: Are there washing facilities at the plantation where you work that you use to clean your personal protective equipment?

The ILO also states that laundering, cleaning, or storing PPE that may be contaminated by hazardous chemicals should be prohibited at workers' homes.[158] Against this backdrop, workers were asked whether they were allowed to take their PPE home. Over 70% of all workers reported that they were allowed to take their PPE home. Broken down by employment type, 70% of both direct and outsourced workers said they were allowed to take their PPE home. Disaggregated by country, 61% of Colombian workers reported that they were not allowed to take their PPE home, while 87% of Ghanaian workers and 82% of Indonesian workers said they were allowed to do so (Figure 20). Although most workers, both at RSPO-certified and non-certified plantations, reported being allowed to take their PPE home, this proportion was slightly higher among RSPO-certified workers (71%) than their non-certified counterparts (68%).

One of the Indonesian OSH doctors interviewed for this study explained the possible reasons for this situation: *"I imagine that, often, to cut costs, there isn't enough investment in building the necessary infrastructure for workers to clean themselves at the workplace and for their personal equipment to be cleaned by trained personnel […] Unfortunately, sometimes this is not even a cost issue, as many measures would not incur significant expenses but would simply require clearer implementation. I believe that some companies are unaware of their own responsibilities under the regulations and also fail to appreciate the scale of the problem they are dealing with."*

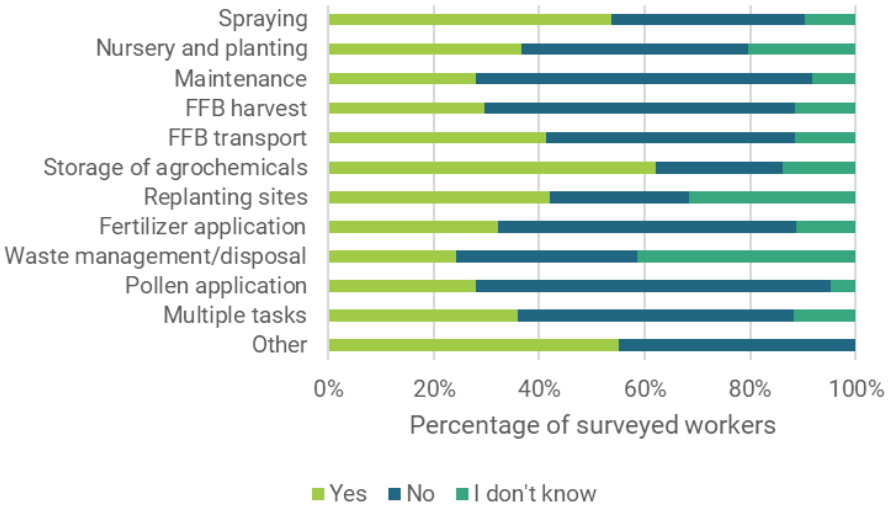
Figure 20 Workers' responses on permission to take PPE home by the plantation, by employment type (direct vs. outsourced)



Question: Are you allowed to take your personal protective equipment home?

Regarding personal hygiene facilities, the ILO stipulates that adequate washing facilities must be provided to maintain personal hygiene and control exposure to hazardous chemicals. These facilities should be easily accessible but positioned to prevent contamination from the workplace, and there should be separate facilities for women and men.[159] Against this backdrop, workers were asked if there were basic sanitation facilities at the plantation where they could wash themselves before eating or going home. Disaggregated by country, 55% of Colombian workers, 51% of Ghanaian workers, and 56% of Indonesian workers reported that such facilities were not available at their workplaces. Additionally, 3% of Colombian, 7% of Ghanaian, and 20% of Indonesian workers said they did not know whether such facilities were available. Broken down by type of employment, 54% of direct workers and 51% of outsourced workers reported the absence of personal hygiene facilities at their plantation. By work tasks, 63% of maintenance workers, 56% of fertilizer application workers, and 59% of FFB harvest workers said there were no personal hygiene facilities at their plantation (Figure 21). It is concerning that a majority of workers on RSPO-certified plantations reported the absence of personal hygiene facilities at their workplaces, and this proportion was even higher than among workers on non-RSPO-certified plantations (51% vs. 38%).

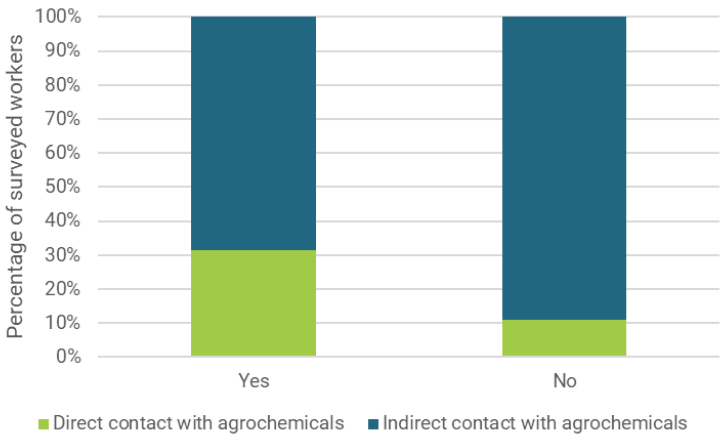
Figure 21 Workers' responses on the availability of personal hygiene facilities at the plantation, disaggregated by work task



Question: Are there basic sanitation facilities at the plantation where you work that you use to wash yourself before eating a meal or going home?

The workers were also asked whether they were informed about the agrochemicals to be used each day. Nearly two-thirds of all workers reported being informed about the daily use of agrochemicals. Disaggregated by country, 68% of Colombian workers, 67% of Ghanaian workers, and 54% of Indonesian workers said they were informed about the agrochemicals used daily at their plantation. By type of contact with agrochemicals, over 80% of workers in direct contact reported being informed about the agrochemicals used daily, compared to 53% of workers in indirect contact with agrochemicals. (Figure 22). Broken down by work tasks, 17% of workers in spraying, 19% in fertilizer application, and 22% in agrochemical storage reported not being informed about the agrochemicals used daily. Among direct and outsourced workers, 62% said they were informed about the agrochemicals used daily. Additionally, 62% of the surveyed workers in RSPO-certified plantations reported receiving information about the agrochemicals used daily at their workplaces, compared to 44% of the workers at non-certified plantations.

Figure 22 Workers' responses on being informed about daily agrochemical use by the plantation, disaggregated by type of contact with agrochemicals

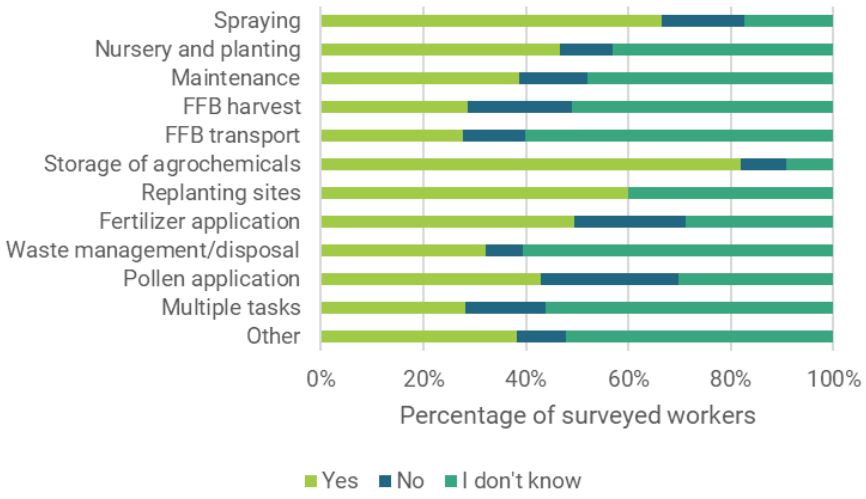


Question: At the plantation where you work, are workers informed about the agrochemicals that will be used that day?

According to the ILO, chemical safety data sheets (CSDS) and pesticide labels should be written in simple, clear, and precise language. They must include advice on the safe handling of chemicals to

ensure adequate prevention and protection. Additionally, all personnel involved in the storage and handling of chemicals, as well as general housekeeping, should receive training and adhere to safe work practices at all times.[160] With this in mind, workers were asked whether the labels and CSDS for the agrochemicals used were always available on the plantation where they worked. Over 55% of Colombian workers reported that these labels and datasheets were always available, compared to 31% of Ghanaian workers and 39% of Indonesian workers. Conversely, 64% of Ghanaian workers and 41% of Indonesian workers said they did not know whether this information was always available. Disaggregated by employment type, 31% of both direct and outsourced workers reported that the information was always available. However, 41% of direct workers and 44% of outsourced workers indicated that they did not know whether this information was available. Broken down by work task, over 60% of workers employed in FFB transport and waste management/disposal reported not knowing whether this information was always available to them (Figure 23). Disaggregated by the RSPO certification status of the surveyed plantations, the proportion of respondents indicating the presence of CSDS and pesticide labels was higher among non-certified plantations (35% vs. 31%). Moreover, the proportion of workers who did not know whether those datasheets and labels were present at their workplace was higher among RSPO-certified plantations (42% vs. 39%).

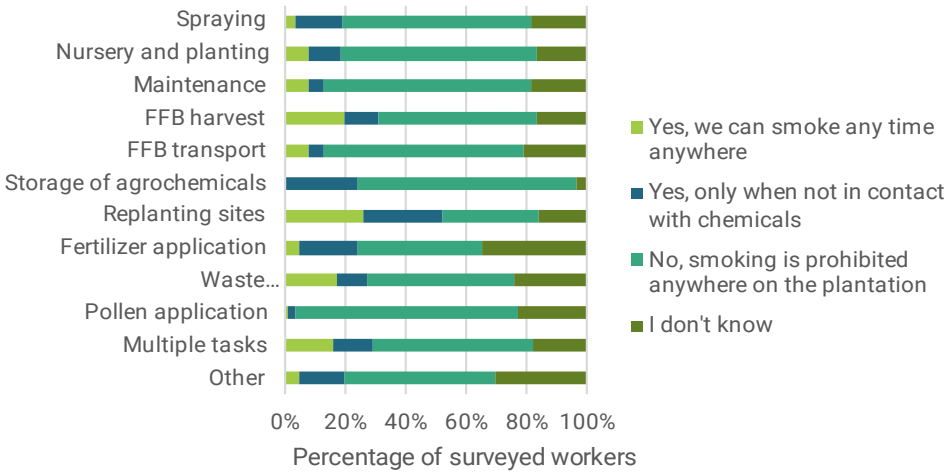
Figure 23 Workers' responses on the socialisation of agrochemical labels and chemical safety data sheets by their employer, disaggregated by work task



Question: At the plantation where you work, are the labels and material safety data sheets of the agrochemicals used always available to workers?

The ILO emphasises that smoking should be prohibited, especially near the areas where agrochemicals are stored, with warning signs posted accordingly.[161] With this in mind, the workers were asked whether they were allowed at the plantation where they worked. Seventy per cent (70% of the Colombian workers and 92% of the Ghanaian workers said smoking was prohibited everywhere on the plantation. By contrast, 26% of the Indonesian informants said they were allowed to smoke anytime, anywhere, and another 24% said they were allowed to smoke when not in contact with chemicals. Broken down by work tasks, 16% of the workers conducting multiple tasks and 20% of the workers in FFB harvest reported being allowed to smoke anytime, anywhere (Figure 24). Disaggregated by gender, 20% of the women reported being allowed to smoke anytime, anywhere, compared to 2% of the men. While a higher proportion of surveyed workers on RSPO-certified plantations indicated that smoking was prohibited throughout the plantation compared to non-certified plantations (64% vs. 22%), it is notable that 24% of respondents on certified plantations were unsure whether smoking was prohibited, compared to 18% on non-certified plantations.

Figure 24 Workers' responses on permission to smoke at work, disaggregated by work task

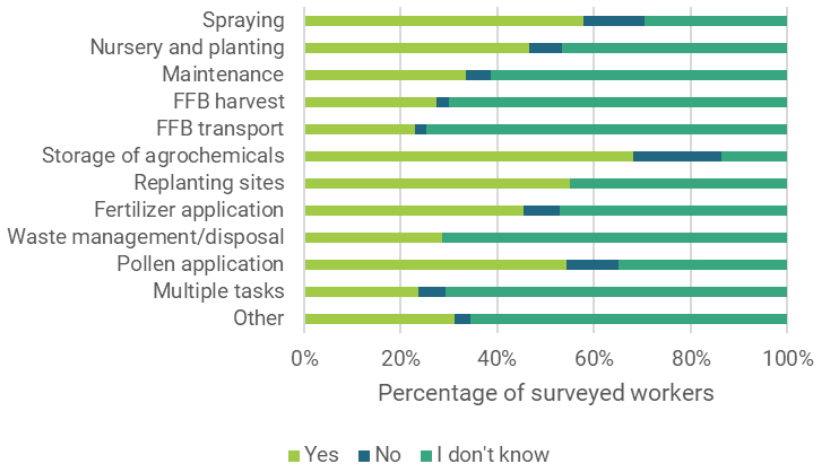


Question: Are you allowed to smoke at work?

3.5 Storage of agrochemicals

The ILO recommends that agrochemicals be stored in secure, well-ventilated, and fire-resistant areas with restricted access. These storage areas should not be accessible to pregnant workers, children, or animals, and containers should be placed on platforms to prevent leakage.[162] Against this background, workers were asked whether there was a designated area for mixing agrochemicals that was well-ventilated and restricted. Over 70% of the Colombian workers reported that agrochemicals at their plantation were stored in such an area. In contrast, 64% of Indonesian workers and 62% of Ghanaian workers said they did not know if such an area was available at their workplace. Disaggregated by work task, 58% of workers in FFB harvest, 48% in fertilizer application, 54% in maintenance, and 51% performing other tasks reported not knowing if there was a designated area for agrochemical mixing at their plantation (Figure 25). Similarly, 54% of workers on RSPO-certified plantations reported having a designated area for mixing agrochemicals, compared to 38% of workers on non-certified plantations.

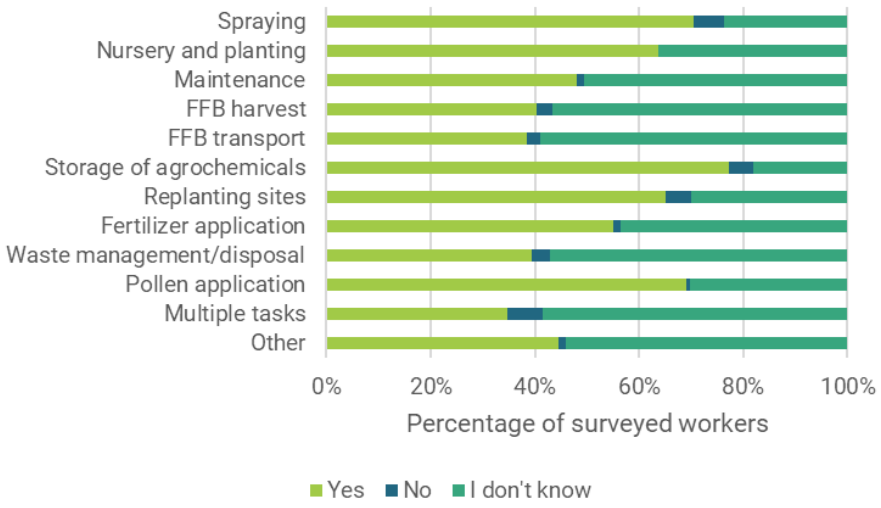
Figure 25 Workers' responses on the availability of designated, well-ventilated areas for agrochemical mixing, disaggregated by work task



Question: Is there a specially designated area that is well-ventilated and of restricted access for the mixing of agrochemicals?

The ILO states that used agrochemical containers should be thoroughly cleaned (triple or pressure rinsed), punctured or crushed to prevent reuse, and disposed of properly, ideally through a collection scheme or an authorised waste disposal method. Containers must not be reused for storing food or drink.[163] With this in mind, workers were asked whether empty agrochemical containers were disposed of in a designated area with restricted access. Nearly 75% of the Colombian workers reported that empty containers were disposed of in such a designated area. By contrast, 63% of Ghanaian workers and 56% of Indonesian workers said they did not know whether the empty containers were disposed of in a restricted access area. Almost 50% of the direct workers reported that there was a designated place for disposing of empty agrochemical containers. In contrast, over 65% of the outsourced workers indicated that they did not know whether such a place existed at their plantation. Broken down by work task, almost 60% of the workers in FFB harvest, FFB transport, and waste management/disposal indicated not knowing whether there was a designated area for the disposal of empty agrochemical containers (Figure 26). By the same token, 61% of workers on RSPO-certified plantations reported that empty containers were disposed of in a specially designated area, compared to 44% of workers on non-certified plantations.

Figure 26 Workers' responses on the disposal of empty agrochemical containers in designated, restricted access areas, by work task



Question: Are the empty containers of agrochemicals used at the plantation disposed in a designated place of restricted access?

3.6 Health effects of agrochemicals

Agrochemicals can cause acute health effects that manifest within 24 hours of exposure. These effects may be local, such as skin irritation or burning sensations, or systemic, involving absorption and distribution throughout the body.[164]

Organophosphorus and carbamate insecticides are prominent among those causing acute occupational pesticide poisonings. Organophosphorus insecticides, such as Dimethoate and Chlorpyrifos (see Appendix 2), contain phosphorus and inhibit acetylcholinesterase, an enzyme crucial for nervous system function. Symptoms from exposure to these chemicals can range from headaches and nausea to severe respiratory distress and potentially death. Carbamate insecticides, such as Carbosulfan (see Appendix 2), are derived from carbamic acid and similarly affect acetylcholinesterase, causing comparable symptoms. Most poisonings from these kinds of chemicals occur through skin absorption, and sensitivity to these chemicals can suddenly increase, with various antidotes available for treatment.[165]

Moreover, persistent organic pollutants like Paraquat and Diquat (see Appendix 2) are herbicides that cause severe local effects, including blistering and ulcerations from skin contact, and ingestion can lead to irreversible lung damage and be fatal. Paraquat, in particular, poses significant inhalation risks and is banned in many countries, including the EU, Brazil, South Korea, Vietnam, Malaysia, Thailand, and Taiwan.[166]

Agrochemicals can also cause chronic (i.e., long-term) health effects. Agrochemicals with proven carcinogenicity are being phased out in the EU and USA; however, they are still used elsewhere. Occupational exposure to pesticides, particularly herbicides, has been linked to cancers such as leukaemia, non-Hodgkin's lymphoma, multiple myeloma, and lung cancer. Pesticide exposure can also adversely affect reproductive health, impacting both male and female fertility and potentially harming offspring if it occurs before conception or during pregnancy. Endocrine disruption, where pesticides or their breakdown products interfere with the hormone system, is a recognised chronic health effect, potentially affecting organ development at critical stages.[167] Pesticides such as Paraquat have been found to be associated with an increased risk of thyroid cancer.[168]

Additionally, pesticides have been associated with other chronic health issues, including neurotoxicity, liver and thyroid diseases, and allergic dermatitis. For example, Dicofol, an insecticide that is severely restricted in Europe but still used on Indonesian oil palm plantations (see Appendix 2) may damage the nervous system and affect the liver and kidneys, causing symptoms such as numbness, "pins and needles," weakness in the hands and feet, muscle twitching, seizures, and in severe cases, unconsciousness or death.[169]

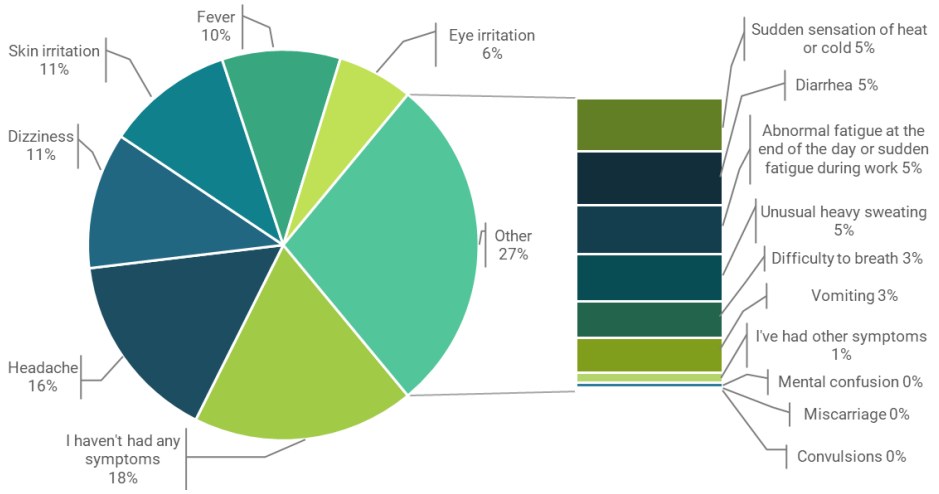
Against this background, surveyed workers were asked about symptoms they had experienced in the past year. The most common response was "I haven't had any symptoms" (18%), followed by headaches (16%) and dizziness (11%) (Figure 27a). In Indonesia, dizziness (16%) and headaches (14%) were the most frequently reported symptoms, while 26% of Colombian respondents and 23% of Ghanaian workers indicated that they did not experience any symptoms. Headaches were the second most mentioned symptom in both Colombia and Ghana, with a prevalence of 16% in each country).

Disaggregated by gender, the majority of both men and women reported not having any symptoms, with headaches being the second most common symptom across both gender groups. Among RSPO-certified plantation workers, headaches were the most frequently reported symptom (18%), followed by no symptoms (17%) and skin irritation (11%). In contrast, non-RSPO-certified plantation workers more commonly reported no symptoms (17%), followed by headaches (15%) and dizziness (13%).

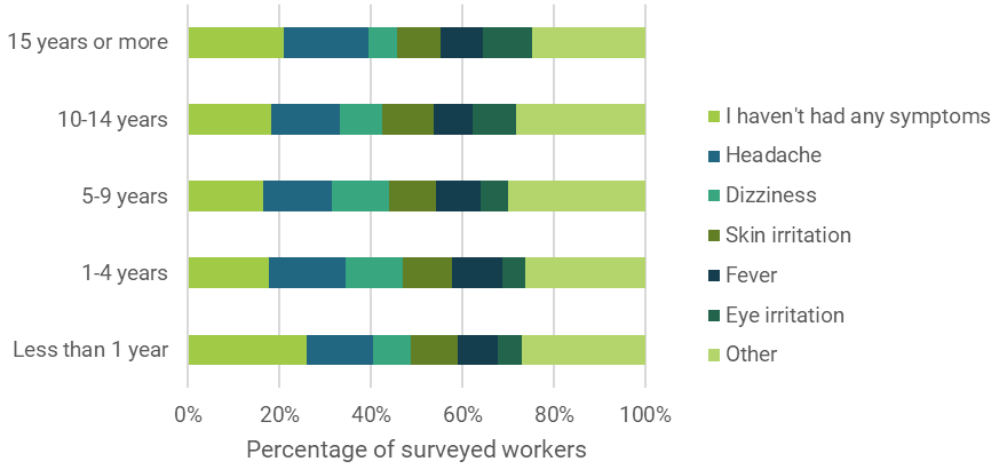
Disaggregated by length of service (i.e., the number of years workers had been employed at the plantation), across all length of service segments, workers most often reported not having any symptoms. In all length of service segments, the second most common symptom reported was headaches. When broken down by work task, 'I haven't had any symptoms' was the most common response among workers involved in maintenance, FFB harvest, FFB transport, storage of agrochemicals, replanting sites, waste management/disposal, pollen application, and those performing multiple tasks. Among workers employed in fertilizer application, dizziness was the most common symptom, while headaches were most frequently reported by those employed in spraying, nursery and planting, and other tasks (Figure 27b,c).

Figure 27 Symptoms experienced by surveyed workers, a) overall responses, b) length of service, and c) work task

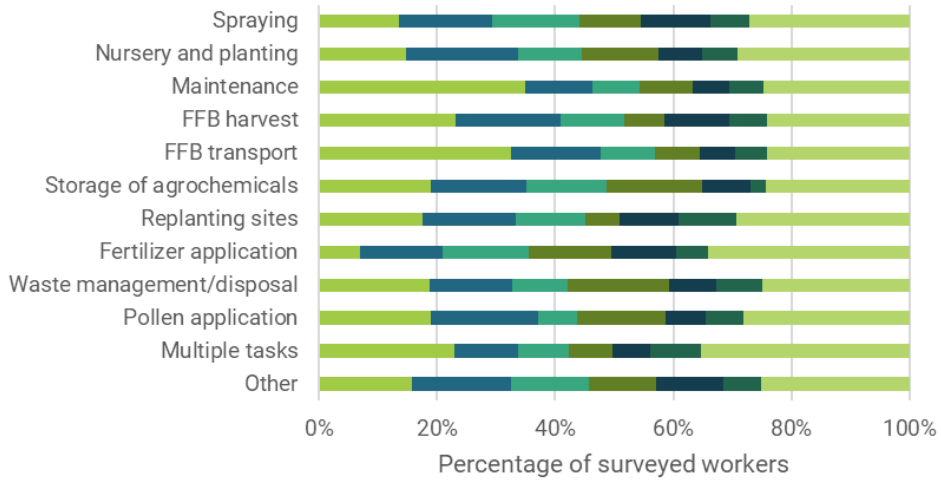
a)



b)



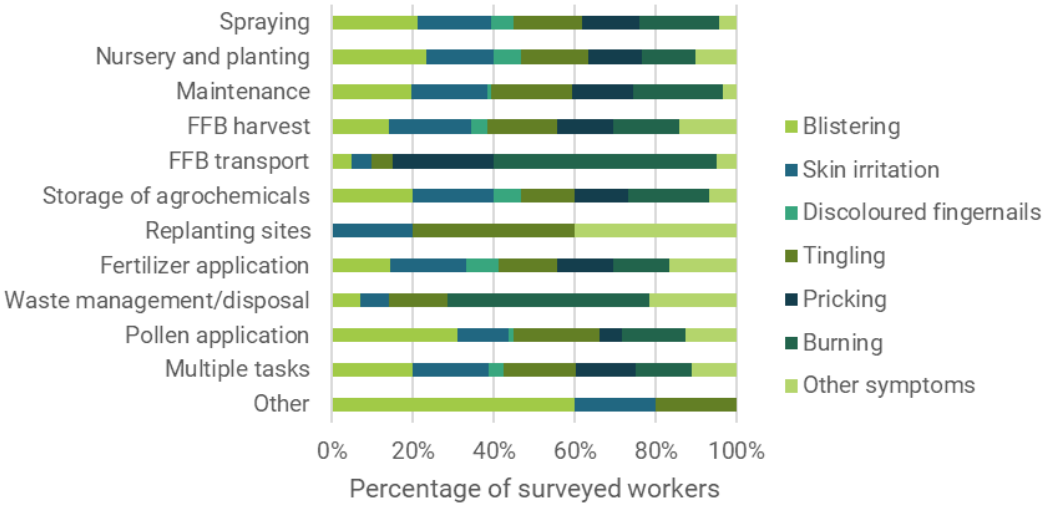
c)



Question: Have you experienced any of the following symptoms in the past year (select all that apply):

Workers who reported experiencing skin irritation were asked to specify the type of irritation they had encountered. Among Colombian informants, the most common response was blistering (33%), while in Ghana, burning was more prevalent (34%), and in Indonesia, ulceration was the most common (26%). Disaggregated by gender, ulceration was most frequently reported by women (20%) and blistering by men (19%). When broken down by work task, blistering was the most cited type of skin irritation among workers employed in spraying, nursery and planting, pollen application, and those performing multiple or other tasks. Skin irritation was most common among workers involved in fertilizer application and FFB harvest, while burning was most prevalent among those in waste management/disposal, FFB transport, and maintenance. Among workers employed in the storage of agrochemicals, blistering, skin irritation, and burning were cited most often (Figure 28). Blistering was the most common type of skin irritation reported (24%) among RSPO-certified plantation workers, while tingling was the most commonly cited issue (18%) among non-RSPO-certified plantation workers.

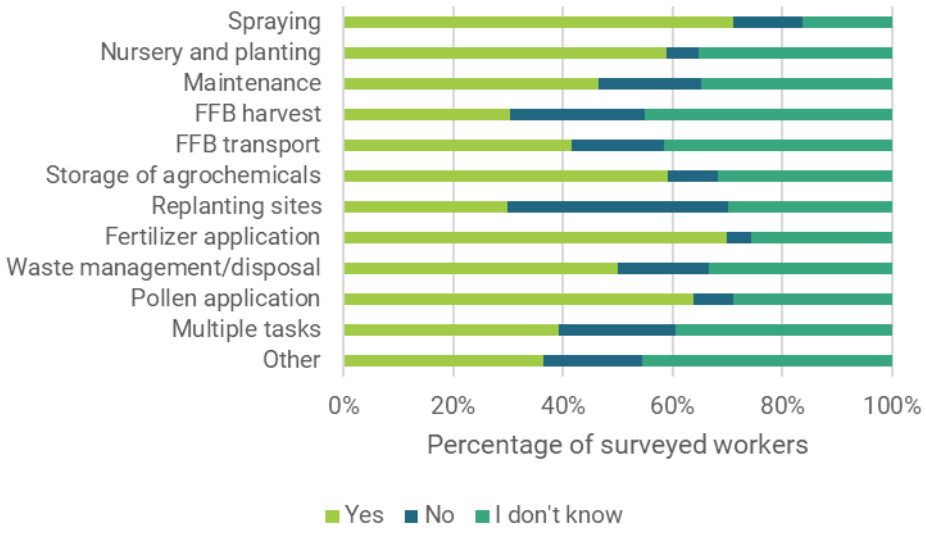
Figure 28 Types of skin irritation experienced by surveyed workers, by work task



Question: What type of skin irritation? n = 739

Workers who reported experiencing symptoms were asked if they believed these symptoms were caused by their exposure to agrochemicals on the plantation. Overall, 47% attributed their symptoms to agrochemical exposure, while 34% did not know. In each of the three countries, the majority of workers (50% in Colombia, 44% in Ghana, and 52% in Indonesia) believed their symptoms were due to agrochemical exposure. When broken down by gender, the majority of both men and women (52% and 46%, respectively) said their symptoms were caused by agrochemical exposure. Disaggregated by length of service, workers who had been employed for less than one year were most likely to believe their symptoms were caused by agrochemical exposure (60%), while over 35% of workers employed for 15 years or more were unsure. Additionally, about 75% of workers employed in spraying and fertilizer application reported that their symptoms were caused by agrochemical exposure (Figure 29). While a higher proportion of workers on RSPO-certified plantations believed their symptoms were due to agrochemical exposure (57% vs. 46%), a greater number of these workers were unsure whether their symptoms were caused by such exposure compared to those in non-certified plantations (27% vs. 25%).

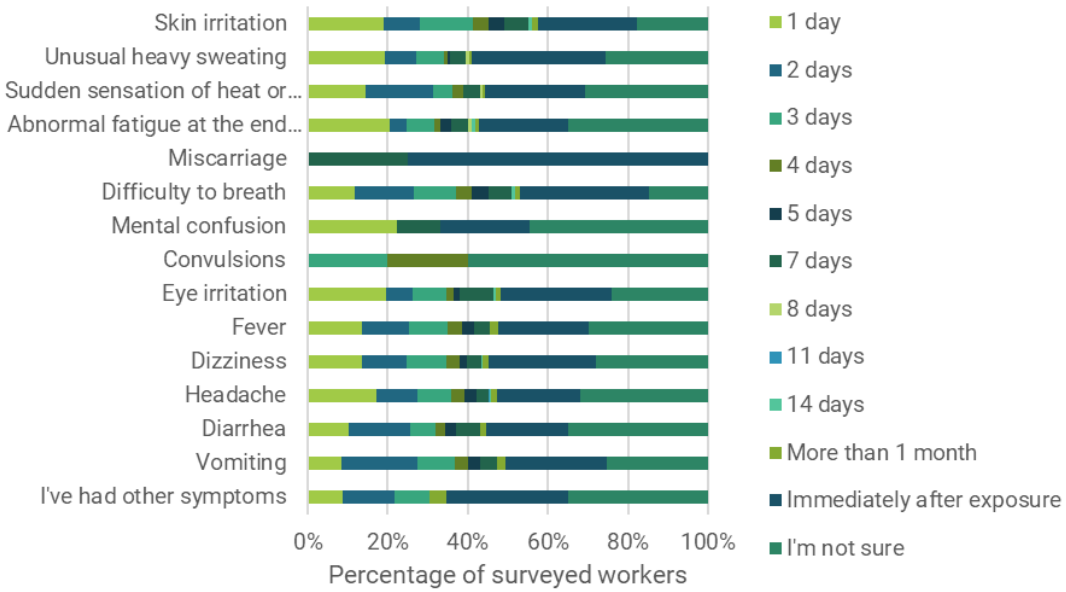
Figure 29 Workers' responses on the causes of their symptoms, disaggregated by work task



Question: Do you think these symptoms are caused by your exposure to the agrochemicals used in the plantation? n = 855

Workers who reported experiencing symptoms were asked about the onset time relative to their exposure. Most workers (25%) were unsure when their symptoms developed, while 23% reported that the symptoms appeared immediately after exposure. The majority of workers who experienced symptoms like headaches, dizziness, diarrhoea, fever, eye irritation, convulsions, mental confusion, abnormal fatigue, or sudden sensations of heat or cold were uncertain about the timing of their symptoms. By contrast, those who reported symptoms such as vomiting, difficulty breathing, unusually heavy sweating, skin irritation, and miscarriage generally indicated that these symptoms developed immediately after exposure (Figure 30).

Figure 30 Days after exposure when symptoms developed

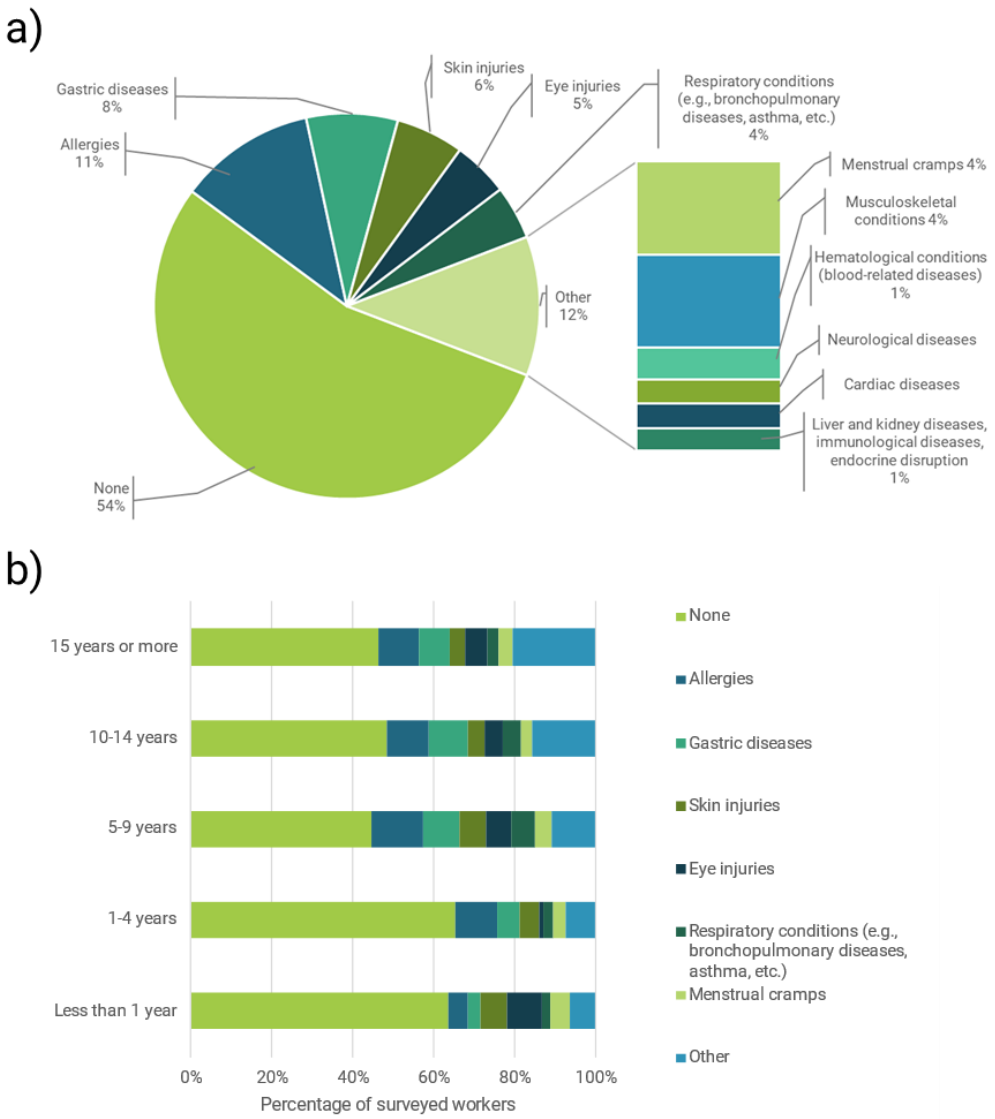


Question: How many days after your exposure to agrochemicals did you develop these symptoms? n = 648

The surveyed workers were also asked about the health conditions they were experiencing at the time of the survey. Over half reported not experiencing any health conditions, with allergies (11%) and gastric diseases (8%) being the second and third most common issues (Figure 31a). In all three countries, the majority of workers reported not experiencing any health conditions: 55% in

Colombia, 74% in Ghana, and 41% in Indonesia. The second most cited conditions varied by country, with allergies being reported by 11% of workers in Colombia and 16% in Indonesia, while skin injuries were most common in Ghana (7%). Moreover, the majority of men and women reported not experiencing any diseases, with skin allergies being the second most commonly cited health condition for each group (10% and 12%, respectively). It is noteworthy that the percentage of surveyed workers reporting no health conditions decreased with the length of service. Specifically, over 60% of workers employed for less than a year indicated they had no health conditions. By contrast, fewer than 45% of those employed for 15 years or more reported experiencing no health issues, suggesting a possible onset of conditions related to cumulative exposure over time (Figure 31b).

Figure 31 Health conditions currently experienced by the surveyed workers



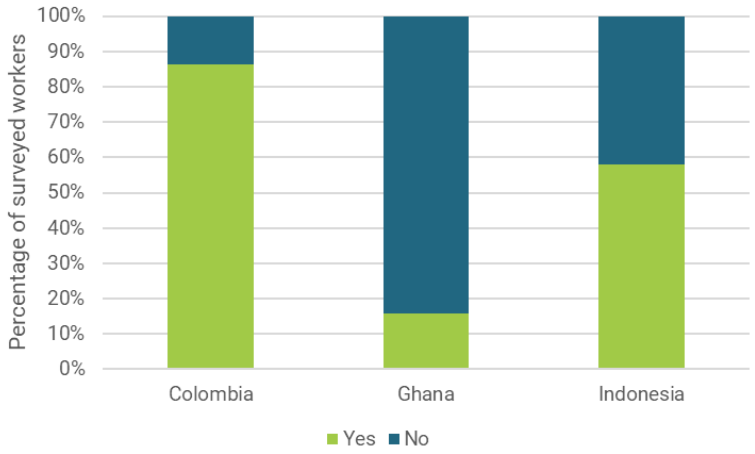
Question: Do you currently experience any of the following (select all that apply):

In acknowledgement of the possibility that health conditions may arise with prolonged exposure to agrochemicals, the ILO recommends regular medical screening of workers exposed to these substances. Medical screening involves pre-assignment and periodic medical exams, as well as examinations following incidents or symptoms of poisoning, and upon resumption or termination of work involving chemical exposure. It should be conducted by an approved medical practitioner and include early detection techniques for health effects. Employers must arrange screening to

assess health risks, diagnose work-related diseases, and ensure proper use of PPE. For specific hazards, medical tests should detect exposure levels and account for biological differences. When applicable, biological monitoring can identify workers needing detailed medical exams. Medical screening is required by law or recommended by occupational health services, especially for workers exposed to hazardous chemicals.[170]

Against this background, workers were asked whether they had obtained a medical certificate of fitness before starting work at the plantation. Nearly 85% of Colombian workers indicated that they had obtained such a certificate, whereas almost 85% of Ghanaian workers reported that they had not (Figure 32). According to a Ghanaian trade union leader who informed this research, *"the cost involved in getting the certificate might be the reason why employees hardly go for [the medical certificate of fitness]."* Disaggregated by employment type (i.e., direct or outsourced), 69% of outsourced workers reported not obtaining a medical certificate of fitness before starting their job at the plantation, compared to 43% of direct workers. Additionally, when broken down by RSPO certification status, 70% of workers at certified plantations reported receiving a medical certificate of fitness before starting, compared to 40% of workers at non-RSPO-certified plantations.

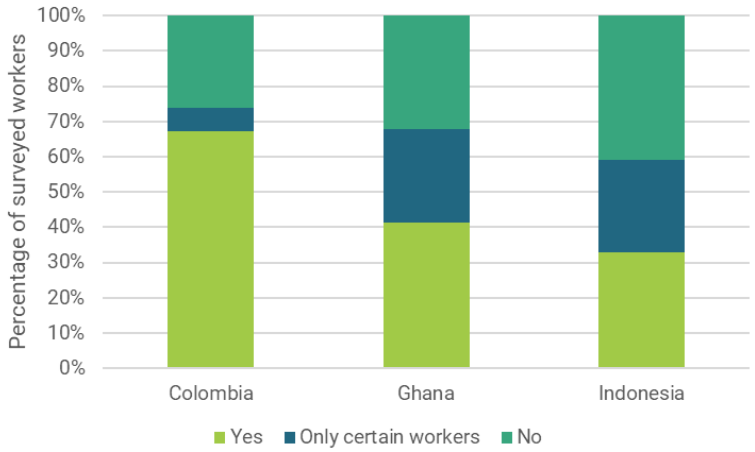
Figure 32 Workers' responses on obtaining a medical certificate of fitness before starting work at the plantation



Question: Did you have to get a medical certificate of fitness prior to beginning your work at the plantation?

Moreover, the workers were asked whether their employers conducted regular medical screening of workers. In Colombia, almost 70% of the respondents said their employer conducted these screenings. By contrast, in Indonesia, over 40% of the respondents said their employer did not conduct such screenings. Both in Ghana and Indonesia, about 20% of the respondents said their employer only screened certain workers (Figure 33). Among those who reported that only specific workers underwent regular medical screening, 47% identified workers involved in pesticide spraying, while 39% cited workers engaged in fertilizer application. Other workers mentioned included those involved in pollen application, nursery work, and milling (a work task not included in this study, as it takes place in factories and not on the plantation). Notably, none of the respondents mentioned workers involved in agrochemical storage, although some responses referred to "workers who work with agrochemicals." Disaggregated by RSPO certification status, 55% of workers employed at RSPO-certified plantations reported that their employer conducted regular medical screenings, compared to 39% of workers at non-certified plantations.

Figure 33 Workers' responses on the company's conduct of regular medical screening



Question: Does the company where you work conduct regular medical screening of workers?

The lack of regular medical screening for workers exposed to pesticides raises serious concerns about their health. For example, workers exposed to carbosulfan (an insecticide used in Indonesia, see Appendix 2) face significant health risks, particularly with cumulative effects and potential interactions with other agrochemicals. Prolonged exposure, as observed in animal models in clinical trials, can lead to cholinergic toxicity, resulting in muscle spasms and respiratory distress, as well as oxidative stress that may cause cellular damage, especially in the liver. Additionally, carbosulfan can suppress immune function, increasing susceptibility to infections, while persistent inflammation may contribute to chronic health issues.[171] Addressing these risks through effective protective measures and regular health monitoring is crucial for upholding oil palm plantation workers' right to a healthy and safe workplace.

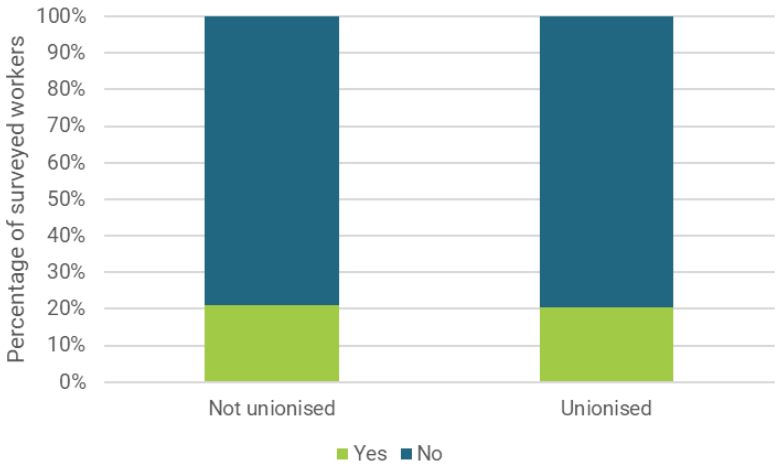
3.7 Management of OSH diseases

There was consensus among the key informants that were interviewed for this research that establishing a link between a disease and its origin was difficult, more so when diseases are of occupational origin. This is illustrated in the words of a Dutch OSH doctor specialising in commercial plantations with many years of experience in Colombia: *"Occupational health services and family doctors often do not coordinate effectively. As a result, when individuals develop health problems and consult their family doctors, there is typically no discussion about their past work history. This lack of communication means that connections between occupational exposure and later health issues are often overlooked. Doctors should make it a habit to inquire about patients' previous work history as part of their assessments, but this practice is not currently widespread."* In line with these concerns, the ILO recommends that, to facilitate the diagnosis of occupational diseases, results of medical records and exposure monitoring should be made available to prepare appropriate health statistics and epidemiological studies, provided anonymity is maintained, as this can aid in the accurate diagnosis and effective control of occupational diseases.[172]

However, as explained in section 3.6, workers often do not undergo medical screening and, when they do, the results of these tests are often not shared with them. In the words of a female worker from Indonesia employed in spraying: "*Every six months, I undergo medical checks at a clinic, including blood tests, but I am not informed of the results. When the lab results indicate problems, I am transferred to different work, although I should continue working but be treated until I recover.*" Against this background, the surveyed workers were asked if they knew the process required for a disease to be diagnosed as occupational. Nearly 80% of the respondents reported not knowing the procedure. Disaggregated by country, 84% of Colombian, 86% of Ghanaian, and 70% of Indonesian informants were unaware of the process for diagnosing an occupational disease. Although low, the proportion of informants employed on RSPO-certified plantations familiar with the process was

higher than that of their counterparts on non-certified plantations (25% vs. 19%). Surprisingly, non-unionised workers were slightly more knowledgeable about the procedure than their unionised counterparts (Figure 34). Additionally, fewer subcontracted workers knew the process compared to those employed directly by the company (15% and 21%, respectively).

Figure 34 Workers' responses on knowledge of the process for diagnosing occupational diseases, disaggregated by union membership

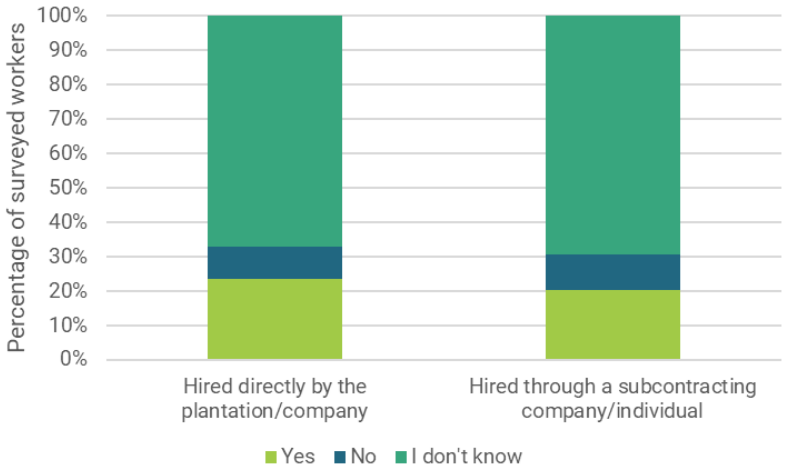


Question: Do you know the process you have to follow for a disease to be diagnosed as occupational?

Another reason provided by the key experts for the low rate of diagnosis of occupational diseases had to do with the predominant focus on occupational accidents. An Indonesian researcher specialising in OSH in the palm oil sector explained: "The government, especially *the Ministry of Labour, is very focused on reducing or eliminating the number of accidents. They have a programme called "Zero Accidents," and companies are deeply involved in this initiative, even awarding prizes to those with zero accidents. This emphasis on preventing accidents has significantly overshadowed the reporting of occupational diseases, their diagnosis, and the tracking of these diseases over time."*

Against this background, workers were asked whether their plantation reported to the Ministry of Labour, Ministry of Health, or other relevant authorities about occupational diseases and accidents at the plantation. Most workers in all three countries did not know whether their employer reported to the relevant authorities (61% in Colombia, 76% in Ghana, and 64% in Indonesia), with 25% of the Colombian, 11% of the Ghanian, and 38% of the Indonesian surveyed workers indicating that their employer reported occupational diseases and accidents to the relevant authorities. When broken down by employment type, direct workers appeared slightly more knowledgeable of their employers' practices, compared to outsourced workers (Figure 35). Workers on non-RSPO-certified plantations appeared to be more aware of their employers' reporting to relevant authorities compared to workers on RSPO-certified plantations. Of the respondents from non-certified plantations, 25% indicated that their employers reported to authorities, and 10% said they did not. In comparison, 21% of respondents from certified plantations said their employers reported, and 9% stated that their employers did not.

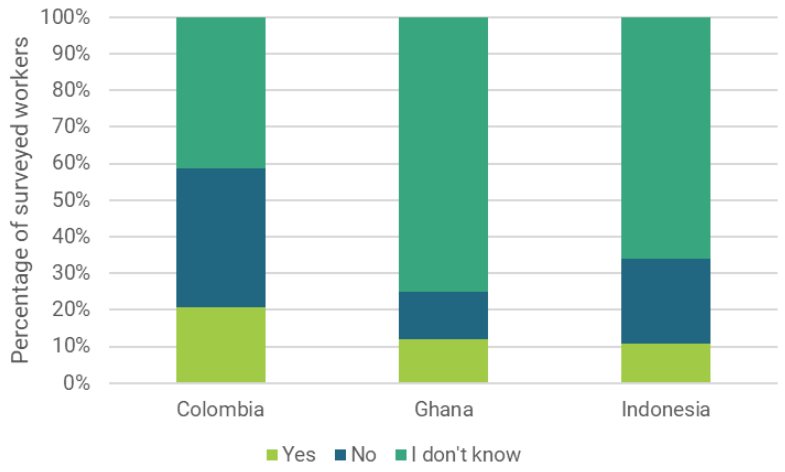
Figure 35 Workers' awareness of their employers' reports of occupational diseases and accidents to the relevant authorities (direct vs. outsourced)



Question: Does the plantation where you work report to the Ministry of Labour, Ministry of Health, or other relevant authorities about occupational diseases and accidents at the plantation?

By the same token, one of the main issues of the palm oil sector highlighted by the key informants interviewed for this research was the insufficient inspections by the competent authorities in palm oil-producing countries. In the words of an Indonesian OSH doctor at an oil palm plantation not included in this study: *"I must emphasise again: although regulations may cover the handling of these substances, their storage, dosing, disposal, application, waste management, and packaging—all of which are addressed by the regulations—there is a lack of proper inspection, oversight, and control. Additionally, the absence of proper training for the workers means that companies often do the bare minimum."* Against this background, the workers were asked whether there were regular inspections by the Ministry of Labour or other relevant authorities at the plantations where they worked. Almost 40% of the workers in Colombia said there were no regular inspections, while almost 75% of the Ghanaian workers and 65% of the Indonesian workers said they did not know whether there were regular inspections by the relevant authorities (Figure 36).

Figure 36 Workers' reports on regular inspections by the Ministry of Labour or other relevant authorities at their plantation

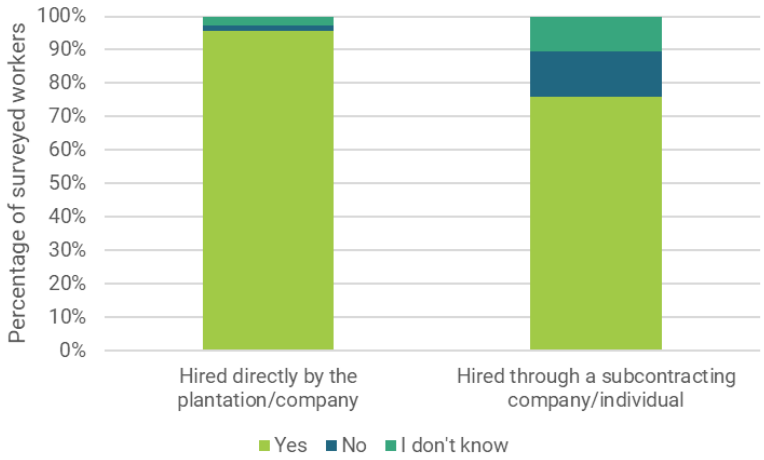


Question: Are there regular inspections by the Ministry of Labour or other relevant authorities at the plantation where you work?

The workers were also asked whether they were covered by their countries' social security schemes. Overall, the majority of respondents indicated that they had coverage. Disaggregated by

country, 95% of Colombian informants, 93% of Ghanaian workers, and 93% of Indonesian informants reported being covered by their social security schemes. When broken down by employment type, 14% of outsourced workers stated they were not covered, compared to just 1% of direct workers (Figure 37). In terms of RSPO certification status, 94% of workers on both certified and non-certified plantations said they were covered. However, nearly 4% of workers at non-certified plantations reported lacking coverage, compared to 1% of respondents on RSPO-certified plantations.

Figure 37 Workers' coverage under social security schemes, by employment type (direct vs. outsourced)



Question: Are you currently covered by the social security schemes?

4

Conclusions

The following conclusions are based on the results of the survey.

4.1 Regulatory challenges

The regulatory frameworks governing the use of agrochemicals and OSH in commercial oil palm plantations in Colombia, Ghana, and Indonesia exhibit both strengths and significant challenges. Each country has ratified key international conventions aimed at ensuring safe and sustainable agricultural practices, including the Rotterdam and Stockholm Conventions, which regulate hazardous chemicals and persistent organic pollutants. However, adherence to more specific OSH-related conventions varies. Ghana stands out with its ratification of the Safety and Health in Agriculture Convention (C184), while Colombia has ratified the Chemicals Convention (C170). Unfortunately, neither Colombia nor Indonesia have ratified C184, and none of the three countries have ratified the Occupational Safety and Health Convention (C155) or the Occupational Cancer Convention (C139).

Despite these international commitments, the implementation of OSH standards reveals several gaps. In Colombia, although a robust regulatory framework exists, compliance is often weak due to inadequate state oversight and a shortage of specialised labour inspectors. The country struggles to harmonise its extensive regulations, complicating their application and enforcement. Furthermore, there are insufficient measures to mitigate the environmental and health risks posed by hazardous chemicals, leading to informal practices in managing contaminated substances and containers.

Ghana's legislation on agrochemicals and OSH also shows significant gaps that hinder effective implementation. While the Environmental Protection Agency (EPA) is responsible for pesticide registration and lifecycle management, the absence of a national OSH policy remains a critical issue. Although the Labour Act provides general guidelines for worker safety, it lacks specific mandates tailored to commercial plantations. The enforcement of existing regulations is further hampered by a shortage of inspectors, particularly in the informal sector, where awareness of OSH principles is low. Additionally, the legislation fails to impose sanctions on businesses for environmental impacts, potentially causing conflicts with surrounding communities. Challenges persist in applying safety measures and regulatory oversight, with unregistered pesticides and inadequate training for pesticide users exacerbating risks to workers' health and safety.

While Indonesia's legislative framework for agrochemicals and workplace safety is extensive, the country struggles to collect comprehensive data on occupational accidents and diseases. Government statistics primarily reflect the formal sector, leaving informal workers and those not registered by their employers unaccounted for. The significant gap between the number of labour inspectors and the total number of enterprises hampers effective supervision and enforcement of OSH regulations. Many companies, especially SMEs, perceive OSH measures as a financial burden, which leads to poor compliance and awareness.

Voluntary sustainability standards, such as RSPO certification, have been introduced to promote responsible production practices in the palm oil industry. However, these standards face criticism for limited effectiveness, insufficient monitoring, and ineffective audits. Challenges like inadequate

safety equipment, poor housing conditions, and stringent performance demands further exacerbate difficulties faced by workers in the sector.

Beyond the regulatory frameworks in Colombia, Ghana, and Indonesia, downstream buyers of palm oil also significantly influence OSH practices of their suppliers, though inconsistently. The palm oil buyers included in this study generally lack dedicated OSH policies for their suppliers, often embedding worker safety commitments within broader human rights or sustainability frameworks. This diminishes their focus on OSH, as many reference ILO standards but frequently overlook specific OSH-related issues, particularly regarding agrochemical exposure. Few companies impose limits on agrochemical use or ensure suppliers take adequate protective measures. When such measures are required, they often neglect gender-specific protections for female workers, leaving significant gaps in addressing worker safety across the supply chain.

4.2 Preventive OSH measures

The survey reveals mixed results regarding the quality of OSH training across the surveyed countries. In Colombia, 61% of workers rated their training as good, reflecting a relatively positive perception of the training programmes. Ghana and Indonesia followed closely, with 54% of workers in each country rating their training positively. Notably, Ghana had a higher percentage of workers (28%) rating the training as "very good," suggesting that OSH training may be more robust in certain areas. Conversely, Indonesia recorded a lower "very good" rating, indicating potential gaps in training effectiveness.

When breaking down the data by work task, those involved in maintenance tasks reported the highest-quality training, with 87% rating it as good or very good. In contrast, workers in waste management expressed lower satisfaction with their OSH training, with only 48% rating it positively. This discrepancy suggests that the specific needs and risks associated with different work tasks may not be adequately addressed in training programmes.

The presence of OSH teams, crucial for maintaining safe working conditions, varies significantly across the surveyed countries. A strong majority of Colombian workers (88%) reported the presence of an OSH team at their plantation, indicating a well-established focus on OSH. Ghana also reported a relatively high presence of OSH teams (75%), while Indonesia lagged behind, with only 45% of workers confirming the existence of such teams. Furthermore, 32% of Indonesian workers were unsure if an OSH team existed at their workplace, highlighting a potential lack of communication or transparency regarding safety structures or compliance by the plantations.

The data indicates that unionised workers are slightly more aware of the presence of OSH teams compared to their non-unionised counterparts (70% vs. 65%). This may be due to unionised workers having better access to information about workplace safety measures or being more involved in advocating for their implementation. Both direct and subcontracted workers generally reported the presence of OSH teams, suggesting recognition of these teams across different employment types.

Perceptions of health and safety risks associated with work tasks vary widely. In Colombia, most workers expressed concern that their tasks compromised their health and safety, signalling a high level of awareness or experience with occupational hazards. In Indonesia, 75% of workers believed their tasks could compromise their safety and health, highlighting similar concerns. By contrast, over 45% of Ghanaian workers did not feel their tasks compromised their health and safety, which might reflect either a lower level of perceived risk or better preventive measures in place.

When analysing specific work tasks, workers in replanting sites and FFB transport were less likely to feel their tasks posed a risk to their health and safety. Interestingly, a significant share of workers in waste management and FFB transport reported being unsure about the risks, indicating a lack of adequate information or training regarding potential hazards related to agrochemical exposure.

The survey results show that overtime is not commonly reported among workers, with over 70% indicating they did not work overtime. The lowest rates of overtime were reported in Colombia (89%) and Indonesia (84%), while a notable share of Ghanaian workers (68%) reported doing overtime. This suggests that in Ghana, workers may be exposed to longer working hours, potentially increasing their risk of exposure to hazardous chemicals. Direct workers reported a higher incidence of overtime (32%) compared to outsourced workers, indicating that employment type might influence the likelihood of longer hours. The low awareness of overtime among outsourced workers (with 5% unaware of their overtime status) may reflect a lack of communication or transparency in work scheduling.

4.3 Exposure to agrochemicals

The survey results reveal crucial information about worker awareness and exposure to agrochemicals, highlighting a gap between expected and reported levels of awareness. Given that all surveyed workers are engaged in roles involving either direct or indirect contact with agrochemicals, it was anticipated that they would all be aware of their exposure. However, the data indicates discrepancies in this expectation.

Overall, 55% of workers reported contact with agrochemicals, with country variations: 69% in Colombia, 58% in Indonesia, and 41% in Ghana. While exposure is a common factor across the board, the level of awareness about this exposure varies. Notably, 40% of Indonesian workers and 20% of Colombian workers reported not being informed about the agrochemicals they use, despite their direct involvement with these chemicals. This discrepancy indicates a significant gap in information dissemination and training.

The survey highlights serious concerns about the management of hazardous agrochemicals, particularly those banned or restricted in Europe but still used in the focus countries. The persistence of these chemicals exposes workers to substances deemed too dangerous for use in the EU, revealing a significant misalignment between local practices and international safety benchmarks, as well as national legislation. For instance, tebuconazole, a fungicide reported in use in Colombia, has been banned there since 1990. Additionally, paraquat, classified as moderately hazardous, has been banned in the EU since 2007 due to its exposure risks. In Indonesia, its use is restricted as a limited pesticide under Appendix III of Regulation 43 of 2019 due to risks associated with ocular and dermal damage, inhalation toxicity, and chronic poisoning.

Despite these restrictions, paraquat continues to be used on Indonesian oil palm plantations, raising serious concerns about worker safety and regulatory oversight. The conditions under which paraquat should be used—specifically, that it only be applied by properly trained workers with appropriate protections—are rarely met.[173] This situation is further exacerbated by the fact that the countries responsible for most of the manufacturing and export of paraquat—namely China, Switzerland, and the UK—have banned its use domestically, as has the EU. While the EU's internal regulations are increasingly protective of the environment, it remains the largest pesticide exporter, with European companies investing heavily in Indonesia, which was the third-largest global importer of paraquat from Europe in 2019.[174] This misalignment underscores the urgent need for stricter regulatory enforcement and improved safety measures to align with international standards.

Additionally, the survey results reveal significant concerns regarding the timing of re-entry into fields treated with pesticides, a critical aspect for mitigating exposure risks. Pesticide residues can remain on plant surfaces and in the soil, leading to significant exposure through skin or clothing contact if proper intervals are not observed. Toxic pesticides, such as organophosphorus compounds and carbamates, are particularly hazardous and can lead to severe health issues if workers are not adequately protected.

The data shows a troubling lack of compliance with restricted entry intervals in some regions. In Indonesia, 21% of workers reported that pesticides were applied while they worked, and 23%

entered the fields immediately after application, indicating a serious lapse in adhering to recommended restricted entry intervals. By contrast, 44% of Colombian workers and 61% of Ghanaian workers reported waiting more than 12 hours before re-entering treated fields, suggesting better compliance with safety protocols in these countries. However, ongoing issues were highlighted by the fact that 20% of workers involved in fertilizer application and 17% of workers in various tasks entered fields shortly after pesticide application. This points to a perilous situation where workers who are in direct contact with agrochemicals (fertilizer applicators) are also exposed to recently applied pesticides.

4.4 Management of OSH risks

The survey highlights significant variations in the provision and maintenance of PPE across different regions. While 95% of workers overall reported receiving PPE from their employers, 10% of workers in spraying and waste management/disposal reported not receiving it, indicating a gap in provision for these high-risk tasks. Additionally, 50% of Indonesian workers noted that damaged PPE was not replaced, with similar issues reported by 30% of direct workers and 15% of subcontractors. The ILO mandates that PPE should be provided, maintained, and replaced at no cost to workers, emphasising that failure to do so increases exposure risks.

The issue of PPE costs to workers is concerning. While most workers did not have to pay for PPE or acquire it independently, 22% of Indonesian workers reported that they had to purchase or obtain PPE outside the plantation. This situation reflects a failure to adhere to ILO standards, which dictate that PPE should be provided at no cost. Furthermore, the lack of proper washing facilities exacerbates this issue, with 56% of subcontracted workers and 55% of direct workers reporting no access to washing facilities. The absence of these facilities prevents effective cleaning of PPE, potentially leading to contamination risks for both workers and their families.

Access to personal hygiene facilities is also concerning. A considerable number of workers reported a lack of basic sanitation facilities, with 55% of Colombian workers, 51% of Ghanaian workers, and 56% of Indonesian workers indicating that such facilities were unavailable at their workplaces. This absence hinders workers' ability to maintain personal hygiene and manage exposure to hazardous chemicals. The ILO recommends that these facilities be accessible and segregated by gender, a standard that is not met in many of the surveyed plantations.

Information regarding safety practices varies significantly among workers. Although nearly two-thirds reported being informed about the daily use of agrochemicals, this was less consistent in Indonesia (54%) compared to Colombia (68%) and Ghana (67%). Additionally, 55% of Colombian workers had access to safety labels and CSDS, whereas only 31% of Ghanaian and 39% of Indonesian workers did. This lack of accessible safety information highlights a need for improved communication and compliance with ILO standards, which mandate clear and available safety documentation.

Disparities in smoking policies are also evident. While 70% of Colombian and 92% of Ghanaian workers reported that smoking was prohibited on plantations, 26% of Indonesian workers said they could smoke anytime, and 24% could smoke when not in contact with chemicals. This variation highlights the necessity for stricter enforcement of smoking bans near hazardous areas, along with increased awareness-raising and training about the dangers of smoking in environments with agrochemicals to prevent accidental exposure and ensure safety.

Although over 80% of workers reported being able to perform their tasks with full PPE, 24% of Colombian and 25% of Indonesian workers faced difficulties, compared to just 4% of Ghanaian workers. When disaggregated by work task, workers involved in pollen application and FFB harvesting reported difficulties. These findings suggest that current PPE designs may not adequately meet the diverse needs of all worker groups, potentially increasing exposure risks and highlighting the need for improved design and fit of PPE.

4.5 Storage of agrochemicals

Survey results indicate that while 70% of Colombian workers reported having access to a well-ventilated and restricted area for agrochemical mixing, only 64% of Indonesian and 62% of Ghanaian workers could confirm the existence of such facilities. This discrepancy highlights significant gaps in workers' awareness regarding the availability of designated mixing areas, which may stem from inadequate communication by employers or the potential absence of these facilities.

Concerning the disposal of empty agrochemical containers, 75% of Colombian workers reported that these containers were disposed of in designated restricted areas. By contrast, only 63% of Ghanaian workers and 56% of Indonesian workers were aware of such practices. The considerable uncertainty surrounding disposal methods, particularly among direct workers and those engaged in tasks like fresh fruit bunch (FFB) harvesting and waste management, suggests deficiencies in both the implementation of disposal systems and the communication of these protocols to workers.

4.6 Health effects of agrochemicals

The survey results indicate that a significant number of workers reported no symptoms, with headaches and dizziness being the next most common health issues across all regions. While some regional differences exist in the frequency of these symptoms, the overall consistency suggests a common exposure impact among workers. In this context, the prevalence of headaches and dizziness underscores the urgent need for effective health monitoring and tailored preventive measures to mitigate these specific effects. Additionally, the high proportion of workers reporting no symptoms may indicate potential gaps in symptom recognition or reporting, particularly in environments with inadequate PPE, insufficient washing facilities, and direct or indirect exposure to hazardous agrochemicals.

Workers also reported various types of skin irritation related to agrochemical exposure, with blistering most common in Colombia, burning in Ghana, and ulceration in Indonesia. Notably, gender-specific patterns emerged: women frequently reported ulceration, while men experienced more blistering. While many workers attributed their symptoms to agrochemical exposure, a significant portion remained uncertain about the cause. This uncertainty was particularly prevalent among those with longer tenures and those in specific roles, such as spraying and fertilizer application. Immediate symptoms like vomiting and breathing difficulties were typically linked to recent exposure, whereas headaches and dizziness often led to ambiguity regarding the timing of exposure.

The survey findings depict a complex landscape concerning the health conditions of workers across the three countries. A significant majority of respondents reported not experiencing health issues—55% in Colombia, 74% in Ghana, and 41% in Indonesia—yet notable variations in the types of conditions reported exist. Allergies and gastric diseases emerged as the most common ailments, with skin injuries particularly highlighted by Ghanaian workers. This suggests that while acute health issues may be relatively low, specific concerns warrant attention, especially in relation to the working environment and potential exposure to allergens or irritants.

Interestingly, the data indicates that the likelihood of reporting no health conditions diminishes with increasing years of service, suggesting a possible correlation between long-term employment and the onset of health issues. Specifically, workers employed for less than a year reported a higher percentage of good health, while those with 15 years or more demonstrated a significant decline in reported wellness. This pattern underscores the importance of continuous health monitoring and preventive measures, particularly for long-serving workers who may be at greater risk due to cumulative exposure to occupational hazards. Addressing these issues is crucial for fostering a healthier workforce and ensuring compliance with occupational health and safety standards.

Moreover, the findings reveal significant gaps in medical screening practices. In Colombia, nearly 85% of workers reported obtaining a medical certificate of fitness before employment, in stark contrast to about 85% of Ghanaian workers who did not receive such certification. Additionally, rates of regular medical screenings varied significantly: nearly 70% in Colombia compared to less than 60% in Ghana and Indonesia. This discrepancy suggests that barriers to obtaining medical certifications and conducting regular health assessments may be adversely affecting worker health. Barriers could include costs, access to healthcare, and inconsistent enforcement of medical screening protocols. Enhancing adherence to screening requirements and improving access to health services are crucial for better identifying and addressing health issues related to agrochemical exposure.

4.7 Management of OSH diseases

The findings highlight important challenges in diagnosing and managing occupational diseases within the palm oil sector. A recurring issue across regions is the difficulty in establishing a clear link between these diseases and their origins. Poor coordination between occupational health services and general healthcare providers exacerbates this issue, leading to potential underreporting and misdiagnosis of work-related health conditions.

Data reveal substantial disparities in medical screening practices, with relatively high compliance in Colombia contrasted with inadequate practices in Indonesia and Ghana. The inconsistent application of screenings, often limited to specific high-risk groups, neglects the broader workforce and fails to ensure comprehensive occupational health coverage. This selective approach risks overlooking occupational diseases and indicates a systemic failure to prioritise worker health and safety.

Transparency is another critical issue. Workers frequently reported that even when medical screenings were conducted, results were not shared with them, which constitutes a breach of their rights to access health information. According to the WHO, accessibility is a core component of the human right to health, encompassing the need for information accessibility among other dimensions.[175] This lack of transparency prevents workers from taking proactive steps to address potential health issues, undermining the effectiveness of occupational health initiatives.

Regarding social security scheme coverage, most workers across all regions reported being covered, with 95% in Colombia, 93% in Ghana, and 93% in Indonesia. However, a notable gap exists between direct and outsourced workers, as 14% of outsourced workers indicated they were not covered, compared to just 1% of direct workers. This disparity highlights the vulnerability of outsourced workers, who often lack full social security benefits, leaving them inadequately protected in case of incapacitating occupational diseases or accidents.

Lastly, workers reported a concerning lack of regular inspections by relevant authorities, particularly in Indonesia and Ghana, which aligns with findings in the literature. The absence of stringent oversight and enforcement mechanisms contributes to ongoing negligence in health and safety practices on plantations. This lack of regulation not only places workers at greater risk but also perpetuates poor health outcomes within the industry and hinders the collection of robust, longitudinal data that could help establish links between agrochemical exposure and occupational diseases.

4.8 Gendered exposure risks

The results indicate gendered differences in the experience and perception of exposure risks and the use of PPE on oil palm plantations. The finding that 24% of women workers struggle to complete their workload while wearing full PPE, compared to only 13% of men, suggests that PPE may not be adequately designed for women, possibly due to differences in body shape or specific work tasks. This disparity points to the need for more inclusive PPE design and fit, as ill-fitting or uncomfortable gear can reduce its effectiveness and compromise worker safety.

Moreover, the relatively higher percentage of women (20%) who reported being allowed to smoke anywhere on the plantation, compared to 2% of men, may indicate less effective training or a lack of enforcement of safety protocols for women, raising concerns about their overall working conditions and protection against agrochemical hazards.

Health outcomes also reveal gendered patterns, with women experiencing more ulceration (20%) compared to men. These differences in symptom types may reflect variations in exposure or vulnerability based on gender, underlining the need for targeted health monitoring and interventions for each group. While over half of the surveyed workers reported not experiencing any health conditions, gender-disaggregated data showed that skin allergies were the second most commonly cited health condition for men (10%) and women (12%), indicating a shared risk.

The gendered impacts of agrochemical exposure further underscore the importance of considering gender-specific factors in health assessments. Women may be more vulnerable to reproductive diseases caused by certain agrochemicals commonly used in the surveyed plantations, including Glufosinate Ammonium, Chlorpyrifos, and Borax. Additionally, exposure to agrochemicals such as Benomyl and Carbendazim is particularly concerning, as these substances are known to potentially harm unborn children. This highlights the critical need for gender-sensitive health assessments to better understand the risks faced by different worker groups.

4.9 RSPO status of plantations

The analysis reveals considerable differences in OSH practices between RSPO-certified and non-certified plantations. While RSPO certification continues to positively influence employer responsibilities in PPE provision, a notable 9% of certified plantation workers reported having to pay for PPE, slightly higher than the 8% among non-certified workers, highlighting a need for stricter RSPO oversight. Non-certified plantations also show a higher proportion of workers able to complete tasks using full PPE (84% vs. 81% on certified plantations) and report better PPE replacement rates (88% vs. 78%) and quality (59% vs. 55%).

The availability of PPE washing facilities remains inadequate, with 45% of certified plantation workers and 38% of non-certified plantation workers reporting no access to such facilities. A majority of workers on certified plantations (71%) also report taking PPE home, marginally higher than the 68% of non-certified plantation workers. This practice, combined with limited washing facilities, risks cross-contamination and points to a gap in RSPO's enforcement of hygiene protocols.

Regarding personal hygiene facilities, 51% of workers on certified plantations reported insufficient access, a higher proportion than the 38% on non-certified plantations, underscoring the need for RSPO's strengthened oversight to meet health protection standards. Although most workers rated the quality of OSH training as 'good' (62% on certified plantations and 61% on non-certified plantations), a considerable difference in training access was observed: 67% of certified plantation workers received training compared to only 23% on non-certified plantations.

Non-certified plantations reported better access to first-aid kits, with 60% rating them as 'good' compared to 42% on certified plantations. Furthermore, 10% of certified plantation workers reported a lack of first-aid kits, compared to less than 1% of non-certified plantation workers. The data also reveals a difference in access to OSH teams, with 67% of certified plantation workers reporting the presence of an OSH team, compared to 47% on non-certified plantations.

Workers on certified plantations reported higher rates of overtime (31% compared to 17% on non-certified plantations) and pesticide exposure (55% on certified plantations vs. 56% on non-certified plantations). Notably, 39% of certified plantation workers reported waiting more than 12 hours to re-enter fields post-pesticide application, compared to 7% at non-certified plantations. However, immediate re-entry remains an issue, with 9% of certified and 6% of non-certified workers entering fields immediately post-application or while pesticides are being applied.

Access to agrochemical information improved, with 62% of certified plantation workers receiving daily updates compared to 44% on non-certified plantations. However, more non-certified plantations provided CSDS and pesticide labels (35% vs. 31%), while a greater proportion of certified plantation workers were unsure of CSDS availability (42% vs. 39%). Smoking bans were more widely enforced on certified plantations (64%), though 24% of certified workers were unsure about these policies, compared to 18% on non-certified plantations.

Moreover, 54% of certified plantation workers reported access to designated mixing areas for agrochemicals compared to 38% on non-certified plantations, reflecting RSPO certification's role in promoting safer agrochemical practices. However, ongoing inspections are necessary to maintain these standards, further reinforcing the need for enhanced RSPO oversight in maintaining consistent health and safety protections across certified plantations.

Additionally, certified plantations demonstrate improved disposal practices, with 61% of workers reporting that agrochemical containers are disposed of in designated areas, compared to 44% on non-certified plantations. Continuous monitoring and reinforcement of both mixing and disposal protocols are essential to mitigate environmental contamination and maintain RSPO's commitment to environmental safety standards.

The reported prevalence of health symptoms among certified plantation workers—particularly headaches (18%) and skin irritations (11%)—highlights the ongoing need for enhanced health monitoring. Increased worker awareness of agrochemical risks (57% on certified plantations vs. 46% on non-certified) suggests progress in hazard recognition but underscores the necessity for robust health measures to reduce exposure.

The provision of medical screenings on RSPO-certified plantations reflects positive compliance, with 70% of workers receiving pre-employment fitness certificates and 55% participating in regular screenings, compared to 40% and 39%, respectively, on non-certified plantations. Ensuring consistent health assessments, particularly on certified plantations, is essential to align with RSPO and ILO health standards. However, awareness of employer obligations for reporting occupational diseases remains lower among certified plantation workers (21%) than their non-certified counterparts (25%). This highlights a potential gap in communication regarding occupational disease reporting, suggesting that RSPO could facilitate a better understanding of employers' reporting obligations and practices among workers, ultimately strengthening confidence in RSPO standards.

Lastly, social security coverage on RSPO-certified plantations is marginally higher, with only 1% of workers on certified plantations reporting no coverage compared to 4% on non-certified plantations. This near-universal coverage underscores RSPO's commitment to ILO guidelines, though further efforts are needed to ensure equitable protection for all workers.

While RSPO certification promotes certain improvements in OSH standards, many of these issues have been previously documented on certified plantations, particularly in Indonesia. Reports from certified plantation workers have highlighted recurring issues such as low awareness of OSH policies, poor communication on health and safety responsibilities, and insufficient understanding of chemical risks. Additionally, workers have consistently reported concerns over the quality, suitability, and accessibility of PPE.[176] These recurring issues suggest that existing certification processes may not sufficiently address critical worker safety concerns or enforce comprehensive compliance across certified sites. Strengthening RSPO oversight and enhancing worker engagement in OSH practices will be crucial to addressing these longstanding concerns effectively.

5

Recommendations

5.1 National governments

National governments are recommended to:

- Ratify ILO conventions such as C155 (all countries), C184 (Colombia and Indonesia), C170 (Ghana and Indonesia), C139 (all countries), and C148 (Colombia and Indonesia) and follow the corresponding recommendations to incorporate these instruments into national laws.
- Incorporate regional agrochemical governance instruments (i.e., Manual Técnico Andino – Resolution 2075; ASEAN Regional Guidelines for Sustainable Agriculture) into national legislation.
- Promote the use of Integrated Pest Management (IPM) practices in commercial plantations to reduce reliance on harmful agrochemicals. Provide resources and support for transitioning to more sustainable pest management approaches that prioritise worker safety and environmental health.
- Establish guidelines for manufacturers to ensure PPE is both functional and comfortable, reducing barriers to effective use.
- Strengthen labour inspection following the ILO's recommendations for this purpose. In this context, national governments should use resources more efficiently, ensuring the inspector-to-worker ratio corresponds with financial allocations, especially during shortages. Moreover, labour inspectors should adopt a three-fold role as supervisors, advisors, and enforcement agents, focusing on guidance. Publicising inspection best practices and establishing a clear plan for inspection frequency and prevention strategies are necessary for improvement.
- Develop tailored training programmes for outreach staff that promote a prevention-oriented approach. These programmes should integrate both general OSH modules and specialised modules targeting agrochemical exposure.
- Provide tools for management systems, such as centralised chemical data sheets and ongoing training on relevant policies
- Develop and implement robust health monitoring systems to track workers' symptoms and health conditions. Raise awareness of reporting obligations for occupational diseases to ensure accurate data collection and response.
- Foster social dialogue and sector-specific approaches to OSH and mitigation of agrochemical exposure risks.

Moreover, the EU should enact a comprehensive ban on the export of all pesticides that are prohibited or severely restricted within its member states. It is unacceptable for the EU to profit from the sale of dangerous chemicals that it deems too hazardous for its own citizens.

5.2 RSPO

The RSPO is recommended to:

- Strengthen monitoring mechanisms to ensure compliance with RSPO standards, particularly regarding employer responsibilities for PPE provision and PPE washing facilities.

- Ensure that its P&C review task force places a strong emphasis on labour issues, with expanded guidelines on occupational safety and health, especially regarding agrochemical exposure.
- Promote the development and provision of gender-inclusive PPE that accommodates the diverse body shapes and work tasks of all workers.
- To align more closely with global best practices, each principle and criterion in the P&C should clearly reference relevant international labour standards, facilitating palm oil companies' adherence to responsible practices.
- Likewise, in the context of its current revision of P&C, RSPO should encourage that in the national interpretation of these principles and criteria, indicators be better harmonised with national labour laws to enhance compliance and provide clearer guidelines for local operators.
- Ensure that all workers, particularly on certified plantations, have access to CSDS for all agrochemicals used. This could involve regular training sessions on how to interpret and use these data sheets effectively in daily operations.
- Encourage plantation-level trade unions to integrate RSPO P&C labour standards into their collective bargaining agreements, using these standards as a checklist during negotiations.
- Facilitate partnerships with PPE manufacturers to develop suitable, high-quality, and comfortable protective equipment, ensuring workers' safety and well-being in various environmental conditions.
- Advocate for policies that guarantee comprehensive social security coverage for all workers, regardless of their employment status on certified or non-certified plantations. This should include access to health care and benefits related to occupational diseases.
- Meaningfully involve workers in decision-making processes related to health and safety practices on plantations. Establish mechanisms for regular consultation and feedback from workers, ensuring their voices are heard and considered in policy development.
- Address the criticism regarding the limited inclusion of workers by creating platforms that enable meaningful participation, ultimately leading to more effective and relevant OSH measures. In this context, the RSPO could add at least one independent trade union representative to its Board of Governors. This direct voice of workers would complement existing NGO board members and strengthen governance in addressing labour rights.

5.3 Downstream buyers

Downstream buyers of palm oil are recommended to:

- Develop and enforce strict sustainability and health standards that suppliers must adhere to regarding the safe use of agrochemicals. This includes requiring suppliers to demonstrate compliance with occupational health and safety regulations.
- Implement regular audits of suppliers to assess their adherence to safety standards and regulations. Ensure that these audits include evaluations of worker health and safety practices related to agrochemical exposure.
- Partner with suppliers to establish training programmes for workers on the safe handling of agrochemicals. This should include training on PPE, safe application techniques, and emergency response procedures.
- Promote suppliers' use of IPM practices to reduce reliance on harmful agrochemicals. Provide resources and support for transitioning to more sustainable pest management approaches that prioritise worker safety and environmental health.
- Engage in multi-stakeholder initiatives that focus on improving labour rights and health outcomes in palm oil production. Collaborate with trade unions, NGOs, and other stakeholders to address systemic issues affecting workers.
- Use their leverage to incentivise suppliers to adopt safer practices and improve working conditions. This may involve conditional purchasing agreements that link supplier contracts to compliance with health and safety standards in the context of agrochemical exposure.

- Work with industry associations and governments to advocate for stronger regulations on agrochemical use in palm oil production. Encourage policies that protect workers and promote sustainable agricultural practices.
- Demand transparency from suppliers regarding their use of agrochemicals, including disclosure of specific substances used and their potential health impacts. This information should be accessible to workers and relevant stakeholders.
- Advocate for and support initiatives that monitor the health of plantation workers, particularly those exposed to agrochemicals. Encourage suppliers to implement health surveillance programmes and provide access to medical care for affected workers.

5.4 Plantation owners

Commercial oil palm plantation owners are recommended to:

- Adopt IPM strategies that focus on using biological control methods, cultural practices, and resistant crop varieties to manage pests effectively.
- Conduct a comprehensive review of all agrochemicals used on the plantation and immediately eliminate any substances that are restricted or banned internationally. Stay updated on the latest regulations and ensure compliance with international safety standards.
- Identify and phase out the use of agrochemicals known for their acute toxicity, even if they are not banned. Prioritise safer alternatives that pose lower risks to worker health and the environment.
- Explore and invest in safer agrochemical alternatives that are effective in pest control but have lower toxicity profiles. Collaborate with research institutions to identify and implement innovative pest management solutions.
- Foster an environment of open communication regarding the use of agrochemicals. Inform workers about the types of chemicals used, their potential risks, and safety measures in place to protect them.
- Implement comprehensive training programmes focused on agrochemical safety, PPE usage, and hygiene practices. Ensure that training is tailored to the specific needs of workers, particularly women, who may face different exposure risks.
- Invest in infrastructure to provide adequate washing facilities for PPE and hygiene amenities on all plantations. Ensure these facilities are easily accessible to prevent cross-contamination and promote worker health.
- Strengthen communication channels regarding safety policies, such as smoking bans near agrochemical storage areas and CSDS. Ensure all workers are informed about these policies and understand their importance for health and safety.
- In close collaboration with trade unions, continuously review and improve agrochemical use practices, health protocols, and training programmes. Stay informed about emerging research, technologies, and regulations related to palm oil production and worker safety.

5.5 IPOWU members (trade unions)

- Initiate campaigns to raise awareness among workers about the risks associated with agrochemical exposure, particularly focusing on gender-specific vulnerabilities. This can empower workers to take proactive measures to protect their health.
- Partner with health and safety experts, researchers, and NGOs to develop and implement effective safety protocols tailored to the unique conditions of oil palm plantations. This collaboration can enhance the credibility and effectiveness of union-led initiatives.
- Lobby for stronger regulations and enforcement related to agrochemical use in the palm oil industry. Unions should advocate for policies that prioritise worker health and safety, including stricter limits on hazardous substances.

- Enhance communication between workers, union representatives, and management to facilitate open discussions about agrochemical safety concerns. Create platforms for workers to voice their experiences and suggest improvements.
- Utilise the findings from this participatory research project to inform union strategies and initiatives. Use the instruments developed for this research (i.e., digital survey tools, indicators, and manuals) to set up a periodic monitoring system that tracks progress and setbacks in agrochemical safety. Regularly evaluate the effectiveness of the monitoring system, making adjustments as needed to address emerging issues and improve worker safety outcomes.
- Collaborate with other unions, both locally and internationally, to share best practices, strategies, and resources related to agrochemical safety. This solidarity can amplify collective bargaining power.

Appendix 1 ILO Recommendations

Recommendations are essential components of international labour standards, developed by the ILO. Unlike conventions, recommendations are non-binding guidelines that provide detailed instructions on implementing the principles outlined in conventions. They can either accompany a convention, offering more comprehensive guidance on its application or exist independently. Recommendations are adopted at the annual International Labour Conference and are submitted to national authorities for consideration. While they do not carry the legal obligation of conventions, recommendations play a crucial role in shaping national labour policies and practices by providing valuable frameworks for action.[177]

Recommendation No. 129 – Communications within the Undertaking Recommendation, 1967

Recommendation No. 129 focuses on the crucial role of effective communication between management and workers in an organisation. While this recommendation does not directly address agrochemical usage, its principles of effective communication and information exchange within an organisation can indirectly contribute to safer, more responsible, and environmentally sound management of agrochemicals.[178]

Against this background, Recommendation No. 129 advocates for the creation of a mutually understanding and confident climate through rapid and comprehensive information exchange about organisational and worker-related social aspects. The recommendation promotes genuine, regular two-way communication between different levels of management and workers, including trade union representatives, emphasising the use of diverse communication channels like meetings, bulletins, and various media forms. It covers a wide array of communication content, ranging from employment conditions and job descriptions to training opportunities, working conditions, safety regulations, and the overall state of the organisation.[179]

Recommendation No. 133 – Labour Inspection (Agriculture) Recommendation, 1969

Recommendation No. 133 provides additional guidance on implementing Convention No. 129, known as the Labour Inspection (Agriculture) Convention, adopted in 1969. This convention aims to establish an effective system of labour inspection in the agricultural sector by ensuring proper working conditions, occupational safety, and health for agricultural workers. The convention emphasises the importance of protecting the rights and well-being of agricultural workers through systematic and tailored inspection practices.[180]

The recommendation advises enhancing the role of labour inspectors in agriculture through concrete measures. These include collaboration with technical services to improve agricultural conditions, focusing on worker training, social services, co-operatives, and compulsory school attendance. It also emphasises that labour inspectors should possess relevant qualifications and receive guidelines from central authorities for uniform inspections. Additionally, the recommendation encourages nighttime inspections when necessary and suggests collaboration with committees for hygiene and safety. To manage health and safety threats, labour inspectors should be proactively involved in the preventive control of new plants, materials, substances, and processing methods. Finally, it recommends education campaigns using rural promoters, publications, film shows, and educational programs to inform stakeholders about legal provisions, safety, and health in agriculture.[181]

Recommendation No. 147 – Occupational Cancer Recommendation, 1974

Recommendation No. 147 advocates replacing carcinogenic substances in the workplace with less harmful alternatives, minimising worker exposure to these substances in terms of numbers,

duration, and intensity. It also mandates regular updates to safety measures based on new research and expert consultations. Employers are responsible for employing safer work processes, minimising exposure to carcinogens, and ensuring safety during the transport and storage of such substances. Workers are required to adhere to safety procedures and use protective equipment.[182]

Moreover, the recommendation calls for periodic reviews and regulation of carcinogenic substances, allowing exemptions under strict conditions. It emphasises the importance of pre-assignment and periodic health examinations for workers, ensuring continued medical care post-exposure, and mandates these services to be accessible and free. Employers are urged to provide alternative employment if continued exposure is harmful. The establishment of a record-keeping and information exchange system is encouraged, along with the promotion of occupational cancer risk studies. Educational materials for employers and workers are to be developed, and national implementation of these guidelines through laws or regulations is required.[183]

Recommendation No. 156 – Working Environment (Air Pollution, Noise and Vibration) Recommendation, 1977

Recommendation No. 156 provides additional guidance on the implementation of the Convention No. 148, known as the Working Environment (Air Pollution, Noise and Vibration) Convention adopted in 1977 (see 2.2.5).[184] For this research's purpose, the focus will be specifically on air pollution.

The recommendation specifies that preventive and protective measures are the responsibility of the employers. These include regular monitoring and inspection of the working environment, replacement of harmful substances with safer ones, and providing personal protective equipment. Employers are also required to reduce the workers' exposure to these substances by rescheduling their work organisation or reducing their working time without changes in wages.[185]

Moreover, the competent authority oversees setting standards for emission levels and ensuring their compliance. The recommendation also provides employers with tools to supervise the health of workers, mainly through regular and free medical examinations and biological tests to monitor the workers' degree of exposure to harmful substances and air pollution. Employees should be able to access their results at any time. If medical reports highlight hazards, the employer is required to offer a suitable alternative employment for the workers, while maintaining their previous wage. Finally, the recommendation promotes training, information and research in this field, with strong support from workers' representatives.[186]

Recommendation No. 177 – Chemicals Recommendation, 1990

Recommendation No. 177 provides additional guidance on the implementation of the Convention No. 170, known as the Chemicals Convention, adopted in 1990 (see 2.2.3).[187]

The recommendation is divided into several parts, among which:

- Classification and related measures

This section outlines the criteria for classifying chemicals based on various characteristics. These include toxic properties, physical characteristics, corrosive and irritant properties, allergenic and sensitising effects, carcinogenic effects, teratogenic and mutagenic effects, and effects on the reproductive system. The competent authority is urged to maintain a consolidated list of chemicals used at work with relevant hazard information. Additionally, labelling and marking requirements for hazardous chemicals are detailed, covering information on labels, legibility, durability, size, uniformity, and easily understandable presentation for workers. The recommendation also outlines criteria for CSDS, ensuring essential information is included while allowing for the omission of confidential ingredient details, which can be disclosed to competent authorities and concerned parties for worker safety and health protection upon request.[188]

- **Responsibilities of employers**

Employers are mandated to monitor and limit workers' exposure to hazardous chemicals, keeping records accessible to workers and the competent authority. Operational controls must be in place and uniformly applied in all establishments of multinational enterprises, ensuring safety in chemical use, storage, and transport. Specific safety criteria are established by the competent authority to minimise risks, including those related to diseases, injuries, fires, and explosions. Employers are also tasked with arranging medical surveillance for workers exposed to chemicals, maintaining confidentiality of medical records while providing access to workers, and implementing first aid and emergency procedures in compliance with competent authority requirements.[189]

- **Co-operation**

This section underlines the importance of collaboration between employers, workers, and their representatives in implementing safety measures. Workers are expected to use safety devices correctly and report risks, while publicity materials for hazardous chemicals must highlight their dangers. Additionally, suppliers should provide employers with information on potential hazards for specific chemical uses at work.[190]

- **Rights of workers**

Workers and their representatives have the right to access CSDS and information to protect against risks from hazardous chemicals. They can request and participate in investigations of potential risks, with confidential information use restrictions. Workers have the right to report hazards, remove themselves from imminent danger, seek alternative work in certain health conditions, and receive compensation for resulting loss of employment or health issues. Pregnant or lactating women have the right to alternative work and later return to their previous jobs. Workers are entitled to clear information, instruction, and training on chemical risks and safety measures in a language and format they understand.[191]

Recommendation No. 192 – Safety and Health in Agriculture Recommendation, 2001

Recommendation No. 192 provides additional guidance on the implementation of the Convention No. 184, known as the Safety and Health in Agriculture Convention adopted in 2001 (see 2.2.1).[192] For this research's purpose, the focus will be specifically put on chemicals use and management.

The recommendation highlights the importance of managing and using chemicals safely in agriculture, highlighting the need for a national occupational safety and health surveillance system. This system should assess risks and implement control measures for various hazards, including hazardous chemicals, biological agents, and extreme environmental conditions. It mandates the provision of personal protective equipment, training for safe chemical use, emergency procedures, and special measures for vulnerable groups like pregnant women and young workers. Additionally, it calls for the development of guidelines and educational programs to promote safety and health in agricultural practices, tailored to local conditions and technologies.[193]

Appendix 2 Types of agrochemicals used in surveyed plantations

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
Herbicide	Glufosinate Ammonium	Yes	No	Yes	Moderately hazardous.** GHS Category 1A and 1B – Known or presumed human reproductive toxicant according to the European Chemicals Agency under EC/1272/2008 Annex VI (015-155-00-X) + self-classification.[194] Potential health effects of ammonium glufosinate on humans may include skin and eye irritation, especially with prolonged or repeated exposure. Careful application is necessary to avoid harming non-target plants, and it is toxic to aquatic organisms, making it important to prevent contamination of water bodies. When handling and applying ammonium glufosinate, individuals should wear protective clothing to reduce exposure risks. Recommended protection includes coveralls, neoprene or PVC gloves, rubber boots, a cap, unbreakable safety glasses, and a mask designed specifically for pesticide use. Following these precautions minimises the risks of skin contact and inhalation.[195]
Herbicide	Diquat	Yes	No	No	Moderately hazardous.** Restricted in Indonesia (Annex III). Diquat causes irritation to the skin, eyes, and respiratory tract. Ingestion may lead to gastrointestinal discomfort, and in severe cases, can result in kidney and liver damage, central nervous system effects, and even death. Long-term exposure is associated with various health issues, including cataracts, skin conditions, and potential neurological effects. Diquat is highly toxic to aquatic organisms, such as fish and invertebrates, while generally posing lower toxicity risks to birds and mammals. However, it can still be hazardous to these species if ingested in large amounts or over extended periods. When handling diquat, it is essential to wear protective clothing, including chemical-resistant gloves, long-sleeved shirts, long pants, eye protection, and respiratory protection. Washing hands and face thoroughly after handling and before eating or drinking is also crucial to minimize exposure.[196]
Herbicide	Paraquat	No	No	Yes	Moderately hazardous.** Banned in the EU since 2007, Judgment of the Court of First Instance in Case T-229/04. Restricted in Indonesia (Annex III). Paraquat exposure, especially through skin contact, poses severe poisoning risks, particularly if prolonged, involving concentrated forms, or occurring on wounded skin. Inhalation can also lead to poisoning and lung damage. Severity is influenced by the quantity, route, and duration of exposure, as well as the individual's health. Paraquat damages the mouth, stomach, and intestines on contact, distributing widely in the body and causing toxic effects, especially

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
					in the lungs, liver, and kidneys. The substance accumulates in lung cells, likely via active transport mechanisms, making licensed applicators particularly vulnerable.[197] Signs of exposure include mouth and throat pain, gastrointestinal symptoms (nausea, vomiting, abdominal pain, bloody diarrhoea), which can lead to dehydration, electrolyte imbalances, and low blood pressure. Ingesting small to medium amounts may lead to heart issues and lung scarring, while larger amounts can cause acute kidney failure, confusion, coma, rapid heart rate, liver failure, severe lung scarring, muscle weakness, pulmonary oedema, respiratory failure, seizures, and possibly death. Survivors may suffer from chronic issues, including long-term lung damage, kidney and heart failure, and oesophageal strictures due to scarring. Large doses are generally fatal.[198] Chronic paraquat exposure is associated with cancer, reproductive damage, and organ toxicity, particularly in the kidneys and liver. Neurotoxic effects are especially concerning, as they are linked to Parkinson's disease. Risk factors increase with cumulative exposure, genetic predispositions, and exposure to other chemicals. Studies indicate that living near paraquat use is associated with increased Parkinson's risk, raising alarms amid concerns of a Parkinson's disease pandemic. Additionally, paraquat negatively affects wildlife and poses health risks for nearby communities.[199]
Herbicide	2,4-D	Yes	No	Yes	Moderately hazardous.** Acute Toxicity 4 (H302: harmful if swallowed; H318: causes serious eye damage; H317: may cause an allergic skin reaction; H411: Toxic to aquatic life with long-lasting effects) according to the European Chemicals Agency under Regulation (EC) No 1272/2008 Annex VI Table 3.1; Index No 607-040-00-3.[200] Application should be carried out by direct spraying on weeds, either manually or using tractor-mounted spraying equipment. Toxicity classification indicates potential harm to aquatic organisms. Environmental protection measures include not using the same spraying equipment for other pesticides in susceptible crops or for livestock bathing.[201]
Herbicide	Triclopyr	No	Yes	Yes	Moderately hazardous.** Caution is warranted due to its toxicity categorisation. Human exposure should be minimised, and appropriate protective clothing, such as gloves and long-sleeved clothing, should be worn during handling and application[202]
Herbicide	Glyphosate	Yes	Yes	Yes	Slightly hazardous.** Probably carcinogenic to humans (Group 2A) according to the International Agency for Research on Cancer.[203] Exposure to glyphosate, particularly in large amounts or over extended periods, may pose health risks, including irritation of the eyes, skin, and respiratory tract. Long-term or high-dose exposure has been debated and

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
					researched for its potential carcinogenicity and other health effects. Glyphosate can also negatively impact non-target plant species and aquatic organisms if it contaminates water bodies. While its impact on animals and insects like bees is generally low, it can still affect food sources and habitats for various wildlife species. To minimise exposure risks when handling and applying glyphosate, it is important to wear suitable personal protective equipment, including long-sleeved shirts and pants, chemical-resistant gloves, protective eyewear, a mask or respirator if inhalation risk is present, and shoes and socks.[204]
Herbicide	Aminopyralid	Yes	No	No	Unlikely to present acute hazard in normal use.** Application should be carried out by direct spraying on weeds, either manually or using tractor-mounted spraying equipment. Toxicity classification indicates potential harm to aquatic organisms. Environmental protection measures include not using the same spraying equipment for other pesticides in susceptible crops or for livestock bathing.[205]
Herbicide	Metsulfuron methyl	No	No	Yes	Unlikely to present acute hazard in normal use.** It is crucial to avoid skin contact and inhalation of spray mist. Adequate protective clothing, including gloves and goggles, is recommended during handling and application.[206]
Herbicide	Fluroxypyr	No	No	Yes	Unlikely to present acute hazard in normal use.** Fluroxypyr poses potential toxicity risks to aquatic organisms.[207]
Herbicide	Acetic Acid	Yes	No	No	Acetic acid, generally has low to moderate oral toxicity for most species and does not persist in soil or water. However, its highly corrosive nature presents a contact risk. It is important to note that a lack of hazard alerts does not imply that acetic acid is free from potential impacts on human health, biodiversity, or the environment; it may simply reflect limited data available for a thorough assessment. Prudent safety precautions are advised when handling acetic acid in agricultural settings.[208]
Herbicide	MSMA (Monosodium methanearsonate)	Yes	No	No	
Herbicide	Clethodim	Yes	No	No	Exposure to this herbicide may cause irritation to the skin, eyes, and respiratory tract, with ingestion or prolonged exposure potentially leading to more severe health complications. The effects on non-target organisms, particularly beneficial insects, aquatic life, birds, and mammals, vary depending on concentration and duration of exposure. It poses risks to

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
					aquatic environments and non-target plant species. To mitigate these risks, it is essential to wear long-sleeved shirts, long pants, chemical-resistant gloves, goggles or a face shield, and a respirator if necessary. These precautions help reduce skin contact and inhalation hazards.[209]
Insecticide	Beta-cyfluthrin	No	No	Yes	Slightly hazardous.** Acute Toxicity 2, H330 – Fatal if swallowed and Fatal if inhaled, Based on Regulation (EC) No 1272/2008 (CLP Regulation), Annex VI, Part 2.[210] Appropriate precautions and protective measures, including the use of personal protective equipment such as gloves and suitable clothing, are essential during handling and application. It is crucial to avoid contact with alkaline-reactive products. To mitigate environmental impact, Betacyfluthrin should be applied through directed foliar spraying, diluted in water. It is not toxic to crop plants when used within recommended doses; however, precautions must be taken to prevent contamination of water bodies, and empty containers should be thoroughly rinsed and disposed of appropriately.[211]
Insecticide	Carbosulfan	No	No	Yes	Moderately hazardous.** Fatal if inhaled, toxic if swallowed, very toxic to aquatic life, very toxic aquatic life with long-lasting effects and may cause an allergic skin reaction, according to ATP01 approved by the European Union;[212] Recommended but not yet included in Annex III of the Rotterdam Convention. Considering its chemical properties, it is generally not anticipated to leach into groundwater and typically does not exhibit prolonged persistence in soil or water systems. While moderately toxic to mammals and identified as a skin sensitiser and cholinesterase inhibitor, it demonstrates a high level of ecotoxicity across various species, including birds, fish, bees, and earthworms.[213]
Insecticide	Dimethoate	No	No	Yes	Moderately hazardous.** Included in the PAN Highly Hazardous Pesticides List for its environmental toxicity (highly toxic to bees). Strict precautions and usage recommendations, including the use of personal protective equipment such as gloves and goggles during handling and application, must be followed. The reentry period for treated areas is 4 hours. To reduce environmental impact, applications should be avoided during rainy conditions, and precautions should be taken to protect terrestrial and aquatic fauna outside the treatment area.[214]
Insecticide	Cypermethrin	No	Yes	Yes	Moderately hazardous.** Included in the PAN Highly Hazardous Pesticides List for its environmental toxicity (highly toxic to bees). The re-entry period after treatment is set at 4

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
					hours. Mitigation measures include avoiding contact with skin, eyes, and clothing during handling and application, using appropriate protective equipment.[215]
Insecticide	Deltamethrin	No	No	Yes	Moderately hazardous.** UN Hazard Class: 6.1; UN Pack Group: II: Toxic if swallowed or if inhaled; Causes mild skin irritation; Causes eye irritation; Causes damage to central nervous system; May cause respiratory irritation; Very toxic to aquatic life with long-lasting effects.[216] deltamethrin can pose risks if improperly handled. Exposure may cause skin and eye irritation, and in severe cases, it can affect the nervous system. Non-human impacts include toxicity to aquatic life and potential harm to beneficial insects, like bees. To mitigate these risks, appropriate protective clothing such as gloves, long-sleeved shirts, and eye protection is recommended during application.[217]
Insecticide	Fipronil	No	No	Yes	Moderately hazardous.** Included in the PAN Highly Hazardous Pesticides List for its environmental toxicity (highly toxic to bees). While the compound and its degradation products are relatively immobile, precautionary measures such as wearing protective clothing are recommended during application. Recommended re-entry period after application is 14 days.[218]
Insecticide	Bifenthrin	Yes	No	No	Moderately hazardous.** Included in the PAN Highly Hazardous Pesticides List for its long-term effects and environmental toxicity (GHS + C2 & R2 and highly toxic to bees). In humans, exposure to bifenthrin can lead to potential health risks, including skin and eye irritation, with more severe symptoms occurring with prolonged or excessive exposure. For non-human species, particularly aquatic organisms and bees, bifenthrin poses a significant toxicity risk, potentially resulting in long-term environmental damage. To mitigate these risks, appropriate protective measures are essential when handling bifenthrin. This includes wearing protective clothing such as gloves, long-sleeved shirts, long pants, and eye protection to minimise skin and eye contact.[219]
Insecticide	Lambda-cyhalothrin	No	Yes	Yes	Moderately hazardous.** Included in the PAN Highly Hazardous Pesticides List for its acute toxicity (H330) and environmental toxicity (highly toxic to bees). Lambda-cyhalothrin can pose risks to human health and non-target organisms. In humans, exposure may lead to symptoms such as skin and eye irritation, respiratory issues, and neurological effects in severe cases due to its neurotoxic properties. To mitigate these health risks, appropriate personal protective equipment is crucial, including long-sleeved shirts, long pants, gloves, goggles, and masks to minimise skin and respiratory exposure.

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
					Careful handling and adherence to safety protocols are essential. For non-target organisms, lambda-cyhalothrin is extremely toxic to aquatic life and bees, and harmful to beneficial fauna. It is vital to avoid contamination of water bodies and to apply it when pollinators are not active.[220]
Insecticide	Metaldehyde	No	No	Yes	Moderately hazardous.** In terms of animal health, acute exposure to metaldehyde may manifest in clinical signs such as tremors, seizures, hyperthermia, salivation, restlessness, panting, vomiting, and ataxia. Animals surviving the initial 24 hours of intoxication generally have a favourable prognosis, with no anticipated spontaneous recurrent seizures.[221]
Insecticide	Chlorpyrifos	Yes	No	Yes	Moderately hazardous.** Included in the PAN Highly Hazardous Pesticides List for its long-term effects (GHS + repro (1A ,1B)) and environmental toxicity (highly toxic to bees). Chlorpyrifos poses potential health risks to humans and is classified as moderately hazardous. Exposure can occur through ingestion, inhalation, or contact, leading to adverse effects on the nervous system. Mitigation measures include the use of appropriate protective clothing, such as gloves, goggles, and respirators, during handling and application.[222]
Insecticide	Dicofol	No	No	Yes	Moderately hazardous.** Dicofol containing more than 78% p,p-Dicofol or 1 g/kg of DDT and DDT-related compounds is severely restricted in the EU. Moreover, agreed by the POPs Chemical Review Committee and the Conference of the Parties as meeting the criteria of the Stockholm Convention but not yet formally listed. Prohibited in Colombia under Resolution 10255 of 1993. While dicofol shows adverse effects in experimental animals, including liver tumours in mice, its genotoxicity absence suggests a low carcinogenic risk to humans at expected dietary exposure levels.[223]
Insecticide	Thiocyclam hydrogen oxalate	No	Yes	No	Moderately hazardous.** Safety measures include wearing protective clothing during handling. Environmental protection measures are also essential, such as avoiding contamination of water sources and adhering to safety distances during application to minimise ecological impact. Reentry periods range from 4 to 12 hours, depending on the crop.[224]

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
Insecticide	Imidacloprid	No	No	Yes	Moderately hazardous.** Included in the PAN Highly Hazardous Pesticides List for its environmental toxicity (highly toxic to bees). Imidacloprid poses potential health risks to humans and non-target organisms. Exposure can lead to adverse effects on the nervous system, necessitating protective measures such as wearing appropriate clothing to minimise skin contact. Mitigation strategies include adhering to recommended doses and application intervals to prevent overuse and potential environmental contamination.[225]
Insecticide	Flubendiamide	Yes	No	No	Slightly hazardous.** Included in the PAN Highly Hazardous Pesticides List for its environmental toxicity (very toxic to aquatic organisms and very persistent in water, soil or sediment). Exposure can lead to potential human health risks, especially with prolonged or improper handling. Acute exposure may cause irritation to the skin, eyes, or respiratory tract. Chronic exposure, though less likely in normal agricultural use, could potentially lead to more severe health issues. For non-target organisms, Flubendiamide's specific mode of action generally means lower toxicity to beneficial insects, fish, and birds. However, it can be harmful to aquatic invertebrates and should not be allowed to contaminate water bodies. Mitigation measures are crucial to minimise exposure risks. Personal protective equipment, such as gloves, long-sleeved shirts, long trousers, and eye protection, should be worn during handling and application. Applicators should ensure proper equipment calibration and adhere to label instructions to prevent drift and runoff.[226]
Insecticide	Tebufenozide	No	No	Yes	Unlikely to present acute hazard in normal use.** Precautions include using clean water in terrestrial applications, employing surfactants, and ensuring proper tank cleaning before and after product preparation. Mixtures with other agrochemicals or fertilisers should undergo compatibility testing in small quantities before use. Additionally, appropriate precautions, such as wearing protective clothing and adhering to recommended re-entry periods, should be followed to minimise potential risks.[227]
Fungicide	Thiram	Yes	No	Yes	Moderately hazardous.** Dustable powder formulations containing a combination of benomyl at or above 7%, carbofuran at or above 10% and thiram at or above 15% are listed in Annex III of the Rotterdam Convention. When used along with Carboxin, it poses a significant risk to aquatic organisms, potentially causing long-term adverse effects in aquatic environments.[228]

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
Fungicide	Tebuconazole	Yes	No	No	Moderately hazardous.** Prohibited in Colombia (Resolution 2308 of 1990). Tebuconazole is generally considered to have low acute toxicity to humans. However, it is essential to follow safety precautions. Applicators and workers should wear appropriate personal protective equipment, including long-sleeved shirts, long pants, chemical-resistant gloves, and goggles or a face shield. Respirators may also be necessary in situations with a high potential for exposure. To mitigate environmental impact, it is advisable to avoid applications during adverse weather conditions, such as high winds or rain. It is important to adhere to recommended doses, calibration procedures, and resistance management strategies to ensure effective and responsible use of tebuconazole in oil palm cultivation.[229]
Fungicide	Difenoconazole	Yes	No	No	Moderately hazardous.** Difenoconazole is generally considered to have low toxicity when used according to label instructions. However, exposure to higher concentrations can pose health risks, including skin and eye irritation and potential respiratory issues. It is important to note that long-term exposure or misuse could lead to more serious health effects, though specific data may be limited. Non-human health impacts primarily concern aquatic organisms, where Difenoconazole can be highly toxic, disrupting aquatic ecosystems, particularly if it enters waterways through runoff or improper disposal. The impact on beneficial insects, birds, and other wildlife is less pronounced but should still be considered, especially when applying it in or near sensitive habitats. For personal protection, users should wear appropriate protective clothing when handling and applying. Difenoconazole, typically including long-sleeved shirts, long trousers, chemical-resistant gloves, and eye protection. Adequate ventilation is also important during application, especially in enclosed spaces.[230]
Fungicide	Propiconazole	Yes	No	No	Moderately hazardous.** Long-term effects (GHS + repro (1A ,1B)). For human health, Propiconazole is generally considered to have low acute toxicity. However, prolonged or intense exposure may lead to skin and eye irritation, along with potential respiratory issues. It is important to follow safety guidelines, including wearing appropriate protective clothing such as long-sleeved shirts, long trousers, chemical-resistant gloves, and eye protection. In terms of environmental impact, Propiconazole is extremely toxic to aquatic organisms, necessitating caution to prevent water contamination.[231]

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
Fungicide	Thiabendazole	Yes	No	No	Slightly hazardous.** Long-term effects (EPA prob likel carc and GHS + repro (1A ,1B)). Mitigation measures should be employed to minimise exposure to humans and non-human organisms. Adequate protective clothing, including gloves, long sleeves, and goggles, should be worn during the handling and application of Thiabendazole to mitigate potential health risks. It is critical for users to adhere to the prescribed rates to ensure effective disease control while minimising the risk of adverse effects on the environment and non-target organisms .[232]
Fungicide	Carboxin	Yes	No	No	Slightly hazardous.** When used along with Thiram, it poses a significant risk to aquatic organisms, potentially causing long-term adverse effects in aquatic environments.[233]
Fungicide	Hexaconazole	No	No	Yes	Slightly hazardous.** Strict adherence to safety recommendations is essential during handling and application, including the use of personal protective equipment such as gloves and goggles. The re-entry period to treated areas is set at 8 hours.[234]
Fungicide	Carbendazim	Yes	Yes	No	Unlikely to present acute hazard in normal use.** Long-term effects (GHS + muta (1A, 1B) and GHS + repro (1A ,1B)). Users are cautioned to conduct compatibility tests in small areas before mixing agrochemicals.[235]
Fungicide	Kasugamycin	Yes	No	No	Unlikely to present acute hazard in normal use.** Banned in the EU (2005/303/EC). Standard precautions, such as avoiding contact with skin and eyes and using protective clothing during application, are recommended.[236]
Fungicide	Metiram	Yes	No	No	Unlikely to present acute hazard in normal use.** Long-term effects (EPA prob likel carc and GHS + C2 & R2). Precautions generally advise against mixing metiram with strongly alkaline insecticides and fungicides. During application, wearing appropriate protective clothing is recommended, and users should adhere to safety guidelines, which include thoroughly cleaning equipment after use.[237]
Fungicide	Mancozeb	Yes	Yes	Yes	Unlikely to present acute hazard in normal use.** Safety precautions, including appropriate clothing and equipment, should be followed.[238]
Fungicide	Chlorothalonil	No	No	Yes	Unlikely to present acute hazard in normal use.** Fatal if inhaled, toxic to aquatic life, very toxic to aquatic life with long-lasting effects, causes serious eye damage, is suspected of causing cancer, may cause allergic skin reaction, and may cause respiratory irritation

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
					according to ATP01 of the EU.[239] Likely human carcinogen (formerly group B2) according to EPA[240]
Fungicide	Benomyl	Yes	No	Yes	Unlikely to present acute hazard in normal use.**Muta. 1B H340 May cause genetic defects; Repr. 1B H360FD May damage fertility. May damage the unborn child; Aquatic Acute 1 H400 Very toxic to aquatic life; Aquatic Chronic 1 H410 Very toxic to aquatic life with long-lasting effects according to Regulation (EC) No 1272/2008.[241] Withdrawn from the EU (Directive 91/414/EEC), derogation HU (771/2004) essential use 835/04, 02/928; Dustable powder formulations containing a combination of benomyl at or above 7%, carbofuran at or above 10% and thiram at or above 15% are listed in Annex III of the Rotterdam Convention.
Fertilizer	Zinc phosphide	No	No	Yes	Highly hazardous.** Included in the PAN Highly Hazardous Pesticides List for its acute toxicity. Restricted in Indonesia (Annex III).
Fertilizer	Copper sulfate	No	No	Yes	Moderately hazardous.** The margin between copper deficiency and toxicity is narrow. Therefore, careful application is required to avoid toxicity, particularly with repeated use and in combination with sewage sludge and manure. Due to its low solubility in water, copper toxicity can persist and negatively impact seed germination, root development, and overall plant vigour. Regular monitoring of fields receiving copper fertilizers and manure is advised to mitigate these risks.[242]
Fertilizer	Borax	No	No	Yes	Slightly hazardous.** Causes serious eye irritation according to Regulation (EC) No 1272/2008.[243] Boric acid, borax, and other forms of boron (B2O3) can pose risks to human health through inhalation, dermal, and oral exposure. Limited inhalation data indicate potential harm, including reduced fetal weight. There have been reports of fatalities due to skin exposure and oral ingestion, accompanied by weight loss and reproductive toxicity. Genotoxicity studies suggest that boron-containing compounds are not genotoxic, with no evidence of carcinogenicity found in a two-year mouse study on boric acid.[244]
Fertilizer	TSP (Triple Superphosphate)	No	No	Yes	
Fertilizer	NPK 15-15-6-4	No	No	Yes	
Fertilizer	Urea	No	No	Yes	

Type of chemical substance	ISO common name*	Use in surveyed plantations			Health impacts, hazard classifications, and usage recommendations/restrictions
		Colombia	Ghana	Indonesia	
Fertilizer	Ammonium sulphate	No	No	Yes	
Fertilizer	Magnesium carbonate (Dolomite)	No	No	Yes	
Fertilizer	Ammonium chloride	No	No	Yes	
Fertilizer	Sodium nitrate	No	No	Yes	
Fertilizer	Calcium dihydrogen phosphate	No	No	Yes	
Fertilizer	Potassium chloride	No	No	Yes	
Fertilizer	Potassium sulfate	No	No	Yes	
Fertilizer	Magnesium sulfate	No	No	Yes	
Other	NAA (α-Naphthaleneacetic acid)	Yes	No	No	Moderately hazardous.**
Other	Alkyl-aryl polyglycol ether	Yes	No	Yes	

Question: Which other chemical substances?

*ISO common names refers to the names assigned to chemical substances by the International Organization for Standardization. The names of chemical substances are internationally recognised and standardised to ensure consistency and clarity in communication, especially in areas such as chemical manufacturing, labelling, and regulatory compliance.

Sources: WHO (2019), *The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2019*, Geneva: World Health Organization; Rotterdam Convention (n.d.), "Annex III Chemicals", online: https://www.pic.int/theconvention/chemicals/annexiiichemicals, viewed in January 2024; Action Network International (2021, March), *PAN International List of Highly Hazardous Pesticides*, Hamburg, Germany: PAN Germany.

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