

Poisoned Fruits of Labor

The exposure of migrant workers in agricultural to harmful agrochemicals in Chiang Mai and Mae Sot

A research report by MAP Foundation



Poisoned Fruits of Labor:

The exposure of migrant workers in agricultural to harmful agrochemicals in Chiang Mai and Mae Sot

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Produced by: MAP Foundation, June 2022

This publication has been funded by the Australian Government through the Department of Foreign Affairs and Trade. The views expressed in this publication are the author's alone and are not necessarily the views of the Australian Government.

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Summary

Agriculture is dangerous work. Each year an estimated 170,000 agricultural workers around the world die and over 1 million are injured in work-related injuries involving agricultural machinery or made ill by pesticide poisoning. (ILO, 2018) As of 2018, around 436,188 documented migrants were employed in Thailand's agricultural sector. (Junghus, C., 2019) Yet, there are many more migrants working in agriculture with either "irregular" migration status, without any documents, or with temporary or informal types of documentation.

With environmental and economic pressures on production, Thailand's agricultural sector is using more pesticides, herbicides and fertilizers to increase yields, including some varieties which are facing imminent bans. Since migrant workers generally endure poor working conditions, it can be assumed that migrants working in the agriculture sector are at an increased risk of exposure to pesticides and other agrochemicals. Occupational health and safety measures which can help reduce health risks from pesticide exposure are generally disregarded, increasing migrant workers' vulnerability to related health problems.

As an organization with a focus on Occupational Safety and Health and migrant rights, MAP Foundation conducted research to better understand migrants' vulnerability of exposure to agrochemicals. The research consisted of a survey of 115 migrants with 4 follow-up focus group discussions. The research aimed to assess how migrants working in agriculture handle and apply agrochemicals at work; the precautions they take, including use of proper protective gear; where they get information on handling and applying chemicals; the support they receive from employers to promote their safety at work; the resulting exposure to such chemicals, related health effects, and access to treatment.

The research revealed that men reported applying pesticides more frequently than women; that, generally, workers only wore some personal protective equipment (PPE) but not always proper equipment and not consistently; and that many migrants, especially women, were exposed through secondary means such as pesticide drift, while personal behaviors, such as eating, drinking or smoking while in the field without using proper WASH practices, were direct forms of exposure prominent among men who sprayed pesticides. Generally, migrants were poorly informed on occupational health and safety precautions, lacked the means to purchase their own equipment, and therefore needed support in accessing and using proper PPE. According to migrants, employers were more concerned with the well-being of their crops than their workers, at the same time, some migrants had a cavalier attitude towards working with agrochemicals.

Many migrant workers do not know the dangers of using agrochemicals, but are acutely aware of the effects. Around one-quarter of the workers reported experiencing symptoms which were most likely related to prolonged or acute exposure to agrochemicals. Generally, though, they did not seek out or receive a relevant diagnosis or treatment. This was for various reasons related to their being a migrant, including language barriers, documentation status, related health coverage or lack thereof, opportunity costs of going to a health facility such as transportation costs and loss of a paid work day, and because of the capacity of the health facility which was usually a clinic not a hospital, and therefore lacked proper equipment.

The research has raised a number of questions - If there is greater awareness of the dangers of harmful agrochemicals, will practices in usage change? How can migrant workers be better informed about and access proper PPE? With only limited coverage under social protections such as Social Security and Workmen's Compensation and only temporary status in Thailand, what will happen to migrants who suffer long-term health conditions as a result of exposure to these chemicals, including children? Will there be any chance for migrants to receive compensation? If so, from who? What about treatment? As an already marginalized group, the aim of this research is to raise the visibility of migrants within the discussion surrounding the human effects of exposure to agrochemicals and find possible solutions to their needs.

BACKGROUND

Migrants and Social Protections

As Thailand's age demographic shifts towards an aging society and its labor force evolves, the agriculture industry has increasingly turned to migrant workers to meet labor demands. In 2014, there were 158,157 registered foreign migrants working in Thailand's agricultural sector. (Pensupar, K., 2015) That number increased by over two and a half times in four years. By 2018, out of the 11.4 million people possibly employed in Thailand's agricultural sector, around 436,188 were documented migrants, of which 57% were men. (Junghus, C., 2019) Yet, there are many more migrants working in agriculture with either "irregular" migration status without any documents, or with temporary or informal forms of documentation.

With environmental and economic pressures on production, Thailand's agricultural sector is also using more pesticides, herbicides and fertilizers to increase yields. In a period of 10 years during the decade of 2000-10, the Office of Agricultural Economics (OAE) reported a four-fold increase in pesticide use. As of 2015, it was reported that 172,975 tons of pesticide active ingredients were imported by Thailand, the vast majority of which were herbicides and insecticides. (Phuong, N. T., 2016) With farms applying more chemicals than ever and an increasing number of migrants working in agriculture, potentially, many migrant workers are regularly being exposed to toxic agrochemicals.

Generally, migrants are supposed to be protected under the same labor laws as Thai workers. However, a large number of migrant workers are employed in agriculture, ocean fishing and domestic work – work which is excluded from a certain number of labor protection standards under the Labour Protections Act, and instead governed by Ministerial Regulations. (Kongtip, P., 2015) For example, agriculture workers who are not hired continuously year round but are hired for seasonal or daily work are excluded from basic labor protections such as a minimum wage or limits on working hours, and are excluded from protections under the Social Security Act, the Workmen's Compensation Act and the Occupational Safety, Health and Environment Act (OSHEA). These exemptions reflect the fact that the Thai Government has not ratified ILO Convention 184 on Agricultural Workers, which essentially aims to promote equal rights and protections for agricultural workers as those in other sectors of employment.

In practice, generally, employers and government officials treat migrant workers differently than Thai national workers by not administering their full labor rights. This manifests as a result of lack of enforcement by officials, non-compliance of employers, limited knowledge of migrants, and negative attitudes towards migrants. (Lee, K., et al., 2011) Undocumented migrant workers are even less likely to access services or receive redress, and more likely to simply be deported. Consequently, employers generally neglect migrant agricultural workers' health and safety needs. Without any specific initiatives promoting migrant worker's occupational health and safety, and low rates of workplace inspection, migrant workers in agriculture are especially vulnerable to related hazards. Over the years, MAP Foundation has found that migrant workers, in general, have a difficult time accessing Workmen's Compensation and Social Security benefits. (MAP Foundation, 2015) So, if a migrant is poisoned by pesticides, it is unlikely that he or she will receive adequate treatment or have enough time off to fully recover.

Agrochemical Regulation and Related Health Effects in Thailand

Insecticides, herbicides, and fungicides are regulated under the Hazardous Substance Act of 1992 (HSA). The act regulates hazardous materials bought, produced and sold in Thailand with guidelines restricting or even banning the sale of certain components. Most recently, the three components paraquat, glyphosate and chlorpyrifos are facing a potential ban, with advocates calling for their immediate and total ban. The HSA primarily regulates pesticides until the point of sale. Only a few of the many acts regulating hazardous substances, including pesticides, have guidance or restrictions on farm-level usage. Although the Enhancement and Conservation of National Environmental Quality Act (1992), Food Act (1979), and Agricultural Standard Act (2008) regulate pesticides post-application, referring to environmental contamination and the maximum residue limits for food safety - neither of these

acts regulates the actual application of pesticides. As a result, pesticides such as organophosphate and carbamate are extensively used in Thailand, with little or no oversight on their quality, sale, end use or disposal. (Kaewboonchoo, et al. 2015) Annual sampling of consumer produce grown in Thailand and sold in markets and stores, conducted by the Thailand Pesticide Alert Network (Thai-PAN), recently found 41% of the samples were contaminated with chemical pesticides. (Thai PBS World, 2019)

Pesticide exposure tests among agricultural workers conducted by the Bureau of Occupational and Environmental Diseases of the Thai Ministry of Public Health between 2012 and 2014 indicated that one-third of workers tested presented with unsafe levels of certain hazardous chemicals (i.e. organophosphate and carbamate) from pesticide exposure. (Thetkathuek, A., et al., 2017) A study was done in Sukhothai Province on acute poisoning among Thai farmers, where farmers self-reported symptoms. “Among 420 rice farmers, 53 percent reported neuromuscular symptoms, 34 percent respiratory symptoms, and 10 percent digestive system symptoms. Over a period of one year, 68 percent of the farmers reported experiencing either these symptoms or effects on the eyes, skin, or nails. Of 380 chili farmers surveyed, 38 percent reported dizziness, 31 percent headache, 27 percent nausea and vomiting, and 27 percent fever in relation to pesticide use.” (Kaewboonchoo, O., et al., 2015) A study on chronic disease was also done in the Provinces of Chainat and Singburi, where an environmental linkage of long-term exposure to certain pesticides and herbicides (organophosphates, carbamate, organochlorines and paraquat) was made to Parkinson’s disease. (Kaewboonchoo, O., et al., 2015)

Part of the problem is identifying the symptoms of pesticide poisoning in the first place. Thailand’s Occupational Safety and Health (OSH) services are underdeveloped. As a result, there is a lack of health personnel specialized in occupational health, and generally, doctors and health personnel in primary care units cannot recognize occupational illnesses. (Siriruttanapruk, S., 2006) There have been initiatives to improve recognition and treatment of occupational health related illnesses by the Ministry of Health, but the availability and location of such services are limited, as is the ability to communicate with migrants.

Prevention is the other gap. Under the Department of Labor Protection Notification there is a “Guidance on Occupational Safety, Health and Environment for Informal Workers, 2013,” which requires self-promotion of OSH among workers in the informal sector, but has no clear means of enforcement. This is readily evident in the agriculture sector, especially among Thai owners who employ migrant workers. One study shows that the majority of migrant workers in agriculture (84 per cent) did not receive any training on OSH or personal protective equipment (PPE) during their employment. (Kachaiyaphum et al., 2010; Namwong et al., 2011)

Considering the need for worker and consumer safety, the amount of information and training migrant workers in agriculture receive on proper application of pesticides is woefully inadequate. This affects the health of both workers and consumers. Previous studies have pointed to low levels of training and poor use of PPE as key contributing factors of over-exposure to pesticides. (Kachaiyaphum et al., 2010; Namwong et al., 2011) In fact, there is very little information provided in migrants’ language on any stages of the application process – from mixing, application or disposal. Studies have shown that there are numerous inaccurate beliefs and practices among Thai farmers regarding pesticide application which result in over-application, which could be a core part of the problem. (Kaewboonchoo, O., et al., 2015) The immigration status of migrant workers in agriculture is another obstacle to attaining safer workplaces. Due to their tenuous status, migrant workers might be reluctant to bring up potential hazards or health and safety concerns for fear of upsetting their employer, which could result in loss of work, retaliation, or deportation. The ability to collectively bargain for safer and healthier working conditions is also not feasible, in part because migrant workers are prohibited from establishing their own labor unions, and because there are no unions in the agriculture industry in Thailand.

THE RESEARCH

Methodology and Objectives

MAP Foundation (MAP), with support from CCFD Terre Solidaire, conducted this research to build the evidence-base on the vulnerability of migrant workers' exposure to harmful pesticides in agriculture, and to advocate for their health and labor rights. This information is intended to help raise migrants' awareness of health dangers from pesticide exposure, and reduce their risks. It is also aimed to inform other groups already promoting safety in agriculture through reduced use of pesticides, and build linkages to these groups. In fact, we hope that consumer groups, labor groups, including farmers, and environmental organizations focused on the abolition of hazardous pesticides, will see the linkages, and will incorporate the health of migrant workers into their advocacy platforms accordingly.

MAP conducted this research in two phases. First, a survey was done during June 2017, when MAP staff and volunteers interviewed 115 migrant workers employed in agriculture in various locations in both Chiang Mai and Tak Provinces. The sub-districts reached include: Chiang Mai Province - Mae Rim, Mae Taeng, Pong Yang and Fang; and Tak Province - Ban Wang Pha, Huai Kalok, Mae Charao, Mae Pa, Mae Tao Mai, and Phop Phra. The survey included questions on: demographics, pesticide use and application, accessibility to information, personal protection equipment (PPE) usage, workplace hygiene, water sourcing, pesticide exposure, symptoms related to exposure, treatment / health seeking behaviors, and special precautions for pregnant women and children. The survey was translated from English into Shan and Burmese, and conducted verbally with participants by volunteers. The interviewees were selected on the basis of being migrants from Myanmar who work directly in agriculture, and according to their availability. The majority of respondents were men 63% (n=73), while 35% (n=40) were women, with an additional 2% (n=2) who did not indicate their sex. There was a disproportionate number of men because originally part of the criterion was to interview those who spray pesticides. This was corrected, but did not result in an even number of male and female respondents. Results of the survey were collated and analyzed, and an initial findings report was written in 2018.

In early 2019, two sets of focus group discussions (FGD) were conducted in the same two provinces (four in all) - one with men and one with women migrants working in agriculture in the same locations of the two provinces where the surveys were done. In Mae Sot area of Tak, ten men and seven women from different sub-districts were brought together for two FGDs in Burmese language, while in Pong Yang area of Chiang Mai, five men and five women from surrounding areas were brought together for FGDs in Shan language. The FGDs were intended to provide qualitative information to the survey results and to corroborate survey information.

The FGD questions had the following general categories: what tasks agricultural workers do in the field, the environmental conditions under which they apply agrochemicals, the safety precautions they take, their exposure to these chemicals, the symptoms they have experienced while they have worked in agriculture, and how they treat them. There was also a section on mother and child health in relation to prevention and exposure to agrochemicals. The following is an analysis of the results.

Division of Labor by Sex

Pesticide use is a primary aspect of agricultural work. Those who apply pesticides generally earn more. There is a general division of labor, with men more likely to apply pesticides than women. In fact, 96% of men indicated that they apply pesticides and only 41% of women. With this division of labor, there is also a gender pay gap, with many women reporting earning only 150 Baht per day while men earn 200 Baht per day for spraying, if they have their own backpack sprayer, and 170 Baht if they have no equipment. Women reported that they were more likely to perform other tasks such as planting, weeding and trimming, but men were more likely to work with pesticides (see table 1). When not spraying, the men do other work, such as applying fertilizer by hand, weeding and trimming. A high proportion of both men and women reported applying fertilizer, although a greater proportion of women reported applying fertilizer than men. Men also reported spraying plant hormones. Division of labor seems to be more or less the decision of the employer, and migrants are usually contracted for one task all day as determined by the employer.



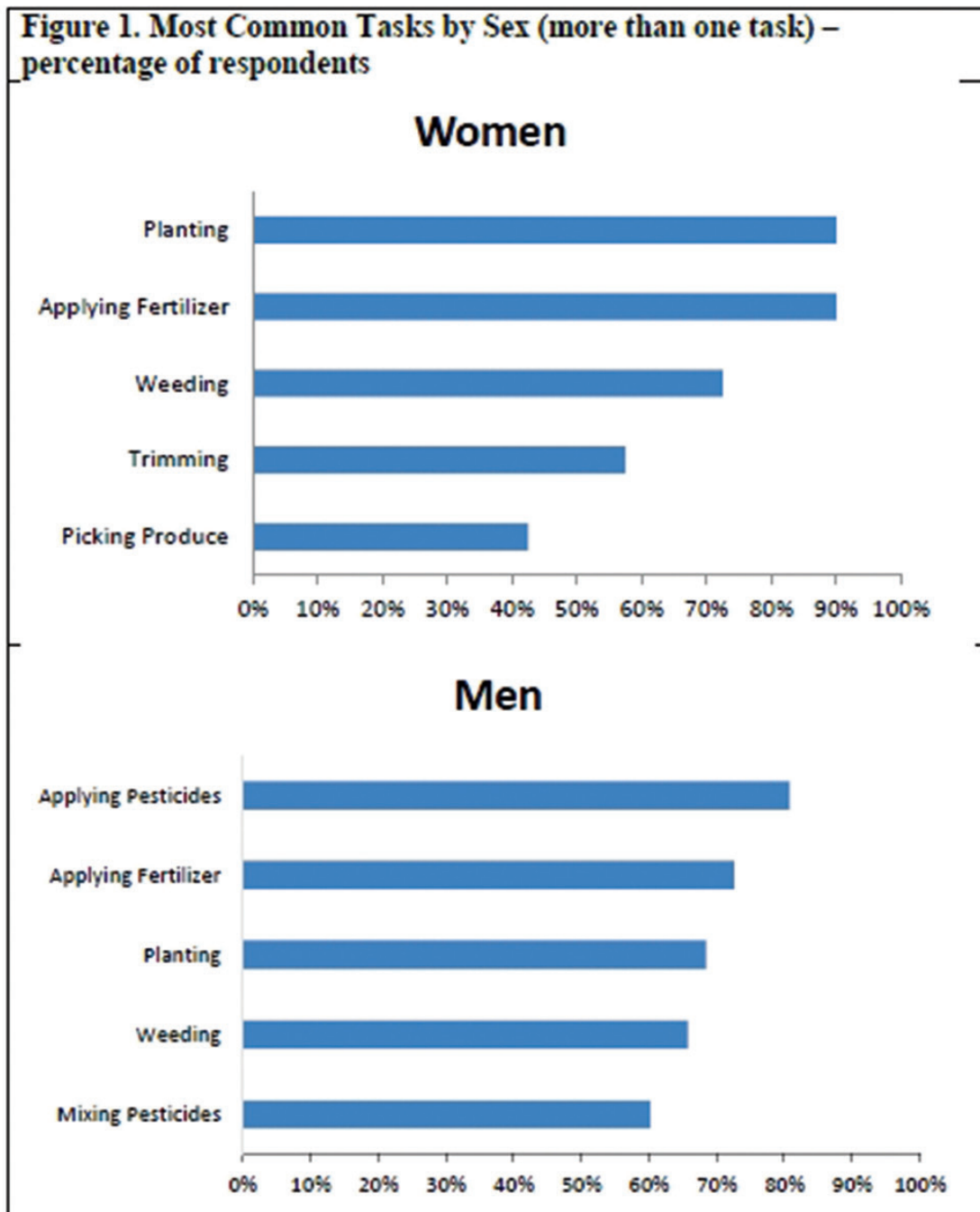
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Table 1. Relative frequency of workers that apply pesticides dissagragated by sex

	Apply Pesticides	Don't Apply Pesticides	Total = n
Men	70 (96%)	3 (4%)	73
Women	18 (44%)	23 (56%)	41
Total	88 (77%)*	26 (23%)	114 (100%)*

***3 of the respondents that apply pesticides did not indicate whether they have work permits or not and for one respondent it could not be established if they applied pesticides or not.**

When asked if they had worked with pesticides, roughly 44% (n=18) of the women reported having applied pesticides and 37% (n=15) reported mixing pesticides. In Mae Sot, the women indicated that they may help spray when there are insects present. Far more men, 96% (n=70), said that they had applied pesticides, and 60% (n=44) had mixed pesticides. Workers who mix and apply pesticides have a greater likelihood of pesticide exposure from splashes and spills which burn the skin and absorb rapidly when in contact. Although women may apply and mix pesticides less often than men, they are still at risk of pesticide exposure through other activities such as pesticide drift during spraying, assisting with spraying, or re-entering the field prematurely after a spraying to do other work. Sometimes, women assist with spraying pesticides as part of a team by pulling the hose in the field when there is a pump apparatus. If not involved in spraying, women will stay in the house and try to avoid exposure.



Top: The relative frequency of the most common tasks reported of women (n=41). Bottom: The relative frequency of the most commonly reported tasks of men (n=73).

Demographics of Pesticide Applicators and Non-Applicators

Approximately one-quarter (22%) of migrant agricultural workers surveyed did not have any proper documents. The rest had temporary status under one or more of the wide array of types of documentation available. Registration types indicated include: “pink cards” and certificates of identification (19%), highlander cards (17%) mostly among Shan workers, informal village headman cards (8%), and the 10 year card (3%) which is for “stateless” people - while only 6% had a temporary passport. (Note: Section 64 was not yet in effect at the time of the survey, and some respondents did not give information on registration status.) Only 22% had work permits. Around 80% of those with work permits (n=19) also sprayed in some capacity, with one-third using backpack sprayers.

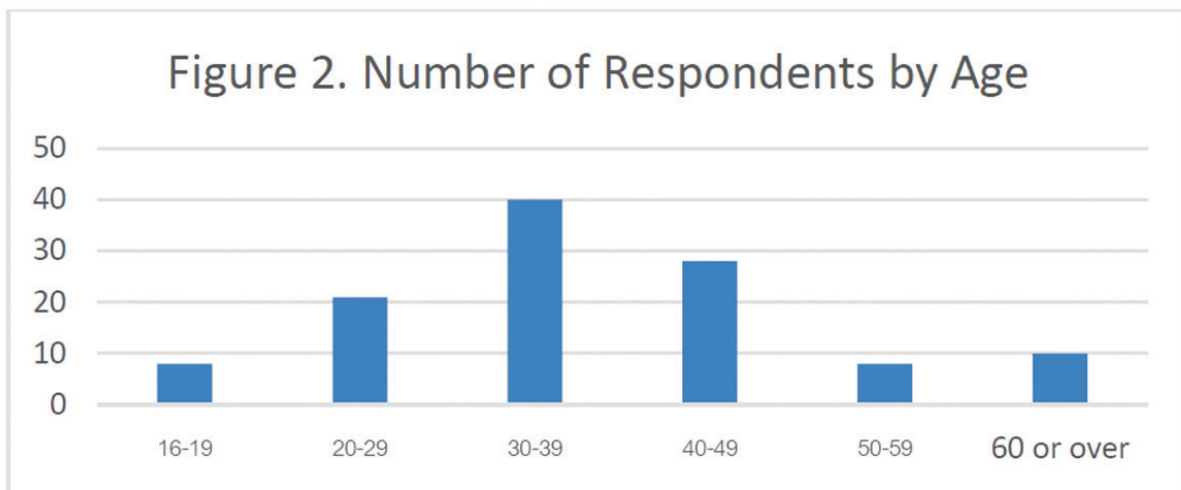
Table 2. Frequency of pesticide applicators disaggregated by documentation status

	Apply Pesticides	Don't Apply Pesticides	Total
Have Work Permit	22	2	24 (22%)
No Work Permit	63	24	87 (78%)
Total	85 (77%)	26 (23%)	111 (100%)

Not all respondents answered this question.

Pesticide applicators were slightly more likely to report that they had previously worked in agriculture than non-applicators. However, some of the men who worked as sprayers in Mae Sot called themselves “general laborers,” as they alternate between agriculture and construction, and generally prefer working in construction. Other migrants, though, have only done agriculture the whole time they have been in Thailand, and are likely to have stayed in one location most of that time.

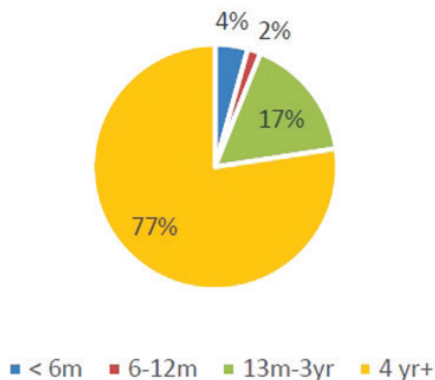
The ages of those surveyed averaged between 36 and 39 years old with pesticide applicators mainly being older men, and women who did not spray pesticides being on the younger end. The youngest respondents working in agriculture were age 16 and a small but significant number (n=13 or 11%) of respondents were age 55 or over, with the oldest being 68 years of age.



There was little difference in the length of time spent in Thailand between those who applied pesticide and those who did not (77% of respondents had been in Thailand over 4 years). The majority of pesticide applicators (75%) and non-applicators (85%) had been in Thailand for more than 4 years. Relatively few of the applicators (6%) and non-applicators (8%) have been in Thailand for less than 1 year. In fact, of those who have been in Thailand over 4 years, some migrant respondents indicated they have been present for 6, 10, 12 and up to 20 years. Those in Chiang Mai Province were primarily of Shan or hilltribe ethnicities from various parts of Shan State. In Mae Sot area, migrant workers came from various areas of the central parts of Myanmar, ranging from those of Karen ethnicity who originate from adjacent Karen State, to those of Burman ethnicity coming from Bago and Magway Divisions. The longer term migrants in Chiang Mai were more likely to originate from Southern Shan State, which is where there has been on-going conflict, and similarly, long term residents along the border in Mae Sot area are of Karen ethnicity and may also have fled conflict at home. The regularity of Shan workers in Chiang Mai Province returning home depended, with those present less than ten years returning every 2-3 years, while longer term residents only returned once or twice in 10 years. The group near the border in Mae Sot area has been in Thailand less time than the Shan group generally, ranging from

one and a half years to 4 to 7 years in total. However, a group of women and their families of Karen ethnicity have been in the Mae Sot area from between 2 to 7 years and 14 to 20 years. This group averaged two children each, the youngest being 3 months and the oldest 20 years old. All have only done agriculture the whole time.

Figure 3. Respondents' Length of Time in Thailand



Most migrants in agriculture have short-term work, rotating between seasonal crops, meaning that they work different crops for the three different seasons, including fallow periods. Some workers are hired daily when it comes time to harvest a crop. Migrants mentioned being hired to work on vegetable crops including: onions, red onions, cucumbers, chilies, green beans, cabbage, and cilantro, while others have worked on staple crops such as: corn, beans, cassava, rice, potatoes, and sugar cane. Corn and beans rotate, some crops like cassava and sugar cane are planted every two years depending on the market price. In parts of Chiang Mai, there were also flowers and strawberries as part of the seasonal mix of crops, while in Fang it is primarily orange orchards which are all-year round.

Personal Protective Equipment (PPE)

Basic knowledge on proper use of personal protective equipment (PPE) is a primary element of occupational safety and health practices. In agriculture, the use of pesticides requires at least a minimal understanding of the related hazards and how to protect oneself. Unfortunately, migrant workers do not seem to be well informed, they do take some measures to protect themselves, but generally face limitations on their ability to access proper PPE.



Warning symbols on agrochemical containers (pesticides, herbicides, hormones, fertilizers...) generally indicate what sort of PPE to use with a caption in Thai. Some containers that were shown to the interviewers included a graphic indicating that gloves and a face shield should be used “when mixing,” another showing gloves and a mask for “when using,” and a black “x” that says “danger.” According to interviews and the survey, some of the men who apply pesticides know what the symbols mean, however, there are some men who do not know what these mean or are not aware of such information.

Pesticide producers frequently insist that their products are safe to use if applicators properly read and follow the instructions included in the label; however, this is more difficult for migrant workers as they face fundamental language barriers. If migrant agricultural workers cannot read or understand the labels, they cannot follow the safety and first aid instructions. The workers understand some Thai. When they buy the chemicals at the shop, the shop keeper explains how to use the chemicals, but the workers admitted that they do not fully understand. They are made to rely on their Thai- employers to provide safety instructions to them. Migrant workers said that the employer decides what to spray and when - the workers do not necessarily know what they are spraying or what it does. They are instructed how to spray – high or low, but are not given any information on safety.

In Mae Sot, the employer orders the pesticides and other chemicals and therefore the workers may not ever see the containers. Workers in some locations have seen symbols on the containers showing which safety equipment to use, but the workers do not have such equipment. The workers know the chemicals are harmful, yet the employer does not provide such equipment. They have to buy any PPE on their own, but they say the cost is prohibitive.

The men interviewed at both locations know about PPE generally, but indicated they had never really seen, been taught how to use, or ever worn proper PPE. Migrant workers, both men and women, will imitate what other migrants are doing for protection. Only a few have ever actually received any instruction, and even then, it is only cursory information. For example, workers in Fang orange orchards initially received instructions on protection from the employer a while ago, but it was vague, in Thai and never updated. In Pong Yang, the employer reportedly told the workers to protect themselves, but did not explain the health effects of the chemicals they are exposed to.

“No one taught us about safety or protection equipment. We just followed what others were doing.” – Migrant woman in Mae Sot area.

In the FAO’s “Guidelines for Working with Pesticides in Tropical Climates,” it is recommended that every pesticide applicator should at least wear long sleeves, long pants, and boots as basic protective equipment while handling pesticides. (FAO, 1990) For most migrants working in agriculture though, Personal Protective Equipment (PPE) beyond this simple clothing is basic and unreliable. In fact, most migrants wear clothing while spraying or working in the fields to provide protection primarily from the sun, such as facemasks (ski masks), hats with visors, and long sleeves. Of the 115 people interviewed, only 4 reported not wearing long sleeves and 6 reported not wearing long pants. Only 1 person reported they did not wear any PPE at all.

The survey results showed differences in PPE use between pesticide applicators and non-applicators. Not surprisingly, we found that pesticide applicators generally use more PPE and wear PPE at a higher rate than migrant agricultural workers who did not apply pesticides, which by extension means men are more likely to wear PPE than women because more men spray than women. To protect from pesticides, herbicides and other chemicals when spraying, migrants identified using basic PPE, such as hats, gloves, rubber boots and a cloth or cloth mask to cover the mouth. Most migrants working in agricultural indicated that they know that gloves and boots help prevent chemicals from seeping into the skin. When mixing chemicals, male respondents reported using a cloth mask, long sleeves and a hat (if outside).



Hats act as PPE if workers are applying pesticides onto crops that reach over their heads. Most workers reported wearing hats with visors while working, but more to protect against the sun and not necessarily as PPE. Very few people (2%), however, said that they wore glasses or other eye protection while working, which is of concern because safety glasses, especially goggles, can help prevent pesticide from reaching the eyes when there is back-spray or if there is a splash while mixing or pouring. In Chiang Mai, migrants working with flowers reported wrapping plastic like an apron around their body when spraying, and when the plants are high, some reported wearing safety glasses (not goggles).

Regarding reported behaviors of actual usage of proper PPE, there were gender differences in usage of various types of PPE. These differences were most likely related to differences in the perception of risk from pesticide exposure due to the tasks performed. For example, most men reported wearing boots (94% of male respondents). Non-applicators or those who did not apply pesticides, mostly women, were more likely to report wearing sandals while working (around 15%), although three male pesticide applicators indicated that they wore sandals while working. Wearing sandals while working in agriculture raises the risk of exposure by absorbing pesticides through the feet, even if not applying pesticides, and especially if a person walks through a recently sprayed field.

The majority of both men and women workers reported wearing cloth masks made of cotton or disposable surgical masks while they worked. The problem is that neither of these really provide effective protection against pesticides, and may actually be harmful because they absorb the chemicals and keep them close to the nose and mouth. Some women in Chiang Mai area who spray say they do not use a mask because “they can’t breathe.” Those who have worn a mask said that, when it is hot wearing a mask is uncomfortable, and that it fills with sweat and causes a skin rash. Some reportedly wrap a t-shirt or piece of cloth around their face for protection as a makeshift mask. Most respondents who reported using a cloth mask also indicated that they washed it every day.



Gloves protect workers from pesticides absorbing through the skin of their hands. Only a little more than half of both pesticide applicators and non-applicators reported wearing gloves, and less than half reported wearing plasticized/rubber gloves, which offer better protection from pesticides. Cotton gloves may offer some protection, but some OSH experts worry that cloth or cotton gloves may actually absorb the pesticides, keeping the chemicals close to the skin and increasing the risk of pesticide exposure. Neither men nor women wear gloves when spraying / spreading fertilizer or hormones because it is not seen as being dangerous.



Table 3. Reported relative frequencies of PPE worn by migrant workers

Worker Characteristics	Boots	Hat	Cloth Mask	Gloves	Plasticized Gloves	Sandals (negative indicator)
All Respondents (n=114)⁺	101 (88%)	99 (86%)	83 (73%)	64 (56%)	49 (43%)	9 (8%)
Sex (n=112)[*]						
Women (n=40)	31 (78%)	33 (82%)	29 (73%)	26 (65%)	23 (58%)	6 (15%)
Men (n=72)	68 (94%)	64 (89%)	53 (74%)	36 (50%)	25 (35%)	3 (4%)
Pesticide applicator status (n=113)[*]						
Applicators (n=87)	82 (94%)	79 (91%)	67 (77%)	49 (56%)	38 (44%)	3 (3%)
Non-applicators (n=26)	18 (69%)	20 (77%)	15 (58%)	14 (54%)	10 (38%)	6 (23%)

Note:

+ One person stopped responding to the remainder of the survey

*One person stopped responding to the remainder of the survey and two people did not indicate their sex on the survey

* One person stopped responding to the remainder of the survey and one person it could not be established whether they apply pesticides or not

In the survey, the workers answered questions about PPE use during their whole workday without differentiating tasks and changes to PPE. So, it is possible that cotton gloves are only used for certain tasks, but it is not clear if these tasks are related to pesticide use or not. In Chiang Mai, some migrants reported using two types of rubber gloves: sometimes, thin disposable latex sanitary gloves, which they reused, and sometimes the thicker, plasticized, reusable orange gloves (which are advertised as used for gardening, dish washing or house cleaning). Reportedly, the problems migrants experience with wearing rubber gloves is that they retain heat and sweat, and when chemicals touch them, it makes the gloves feel hot.

Although non-applicators tend to wear less PPE because they do not work directly with pesticides - such as wearing sandals (flip-flops) - they are still at risk of exposure. Entering or working in a recently sprayed field would require even non-applicators to don PPE to reduce their potential exposure regardless of whether they handle pesticides or not. However, migrant non-applicators, who are mostly women, may be underestimating the need for protective equipment depending on their understanding and practices involving re-entry of fields after spraying and exposure to pesticide drift.

Safety Behaviors

While using protective equipment is necessary working in the fields, there are other behaviors which may also expose workers to harmful agrochemicals. The research examined some of these behaviors in relation to safety precautions workers take while working in the field regarding hand washing, and eating, drinking or smoking. When these behaviors are done in the fields, it puts the worker at risk of exposure because he or she might accidentally ingest dangerous chemicals via food, beverages or cigarettes which become contaminated through contact with chemical residue. Pesticide container re-use, clothes washing and water disposal were also behaviors assessed as indirect channels of contamination in the environment.

Both male and female workers reported high rates of drinking water while at work (65%). The water either comes from a nearby stream or river, or sometimes they collect rainwater or have bottled water. Ironically, tap water (from a pipe and local water source) is usually not clean. Around one-third (33%) of both male and female respondents also reported eating while in the fields. Respondents indicated that they will use a spoon if they have one, otherwise, they will use their hands. Around 90% of both male and female agricultural workers surveyed, meaning both pesticide-applicators and non-applicators, reported that they “washed” their hands before eating, drinking or smoking. It is not clear how often they are able to use soap though. In focus group discussions, a group of male migrant workers in Mae Sot said that when they are in the fields, they will just wipe their hands or wash only with water, no soap, before eating, smoking or eating beetle nut. Generally they know there are chemicals on their hands, but they feel that they are being pressured to work by the employer.

“Migrants have to complete the task assigned in the period allotted or they will get fired.” – Male migrant worker in Mae Sot.

This means they do not feel there is enough time to take proper safety precautions, like washing their hands properly. This does not have to be the case though. It was noted that at the shop where pesticides are sold, soap is also sold. In fact, some brands of pesticides give complimentary soap free as a promotion. But migrants said the employer is the one who buys the pesticides, and then either keeps the soap and uses it, or sells it back to the workers.

Those who applied agrochemicals, mostly men, were more likely to report eating, drinking or smoking (EDS) while working in the fields than those who did not apply these chemicals, meaning they are highly susceptible to poisoning through ingestion. Almost 40% of men also reported smoking while in the fields, whereas there were only a few women who smoked. Workers may also be exposed to

chemicals while consuming food, beverage, or cigarettes in the field through pesticide drift (which is when the wind carries pesticide while being applied) or through volatilization (which is when pesticides evaporate and turn into a gas). Women were more likely to report abstaining from eating, drinking or smoking (38%) while at work than men (25%).

Table 4. Relative frequency of respondents reporting eating, drinking or smoking (EDS) in the fields, washing hands prior to EDS

Migrant Worker	Eat at Work	Drink at Work	Smoke at Work	Wash Hands before EDS	Abstain from EDS
Women (n=40)	14 (35%)	25 (63%)	2 (5%)	36 (90%)	15 (38%)
Men (n=71)	23 (32%)	47 (66%)	28 (39%)	64 (91%)	18 (25%)

Once done working, migrant workers reported showering and washing their work clothes immediately afterwards. Usually, the woman of the household washes the clothes at least every couple of days. Sometimes the clothes are soaked. The woman will then, most likely, use her hands to wash, and work clothes which have absorbed chemicals are generally mixed with other clothes (children’s clothes most likely separated). She then pours the water out on the ground or where convenient, usually close by. If there is a man-made pond, they will wash right next to it and dump the water on the ground. Piped (tap) water is the same. If near a stream or an irrigation ditch, unfortunately, when they pour the water out on the ground, the water is likely to roll back into the water source.

Reusing old pesticide containers creates another possible exposure route. Depending on what is being stored and how it is used, pesticide residue can leach into whatever is held inside the container and possibly lead to ingestion or dermal absorption of pesticides into the blood stream. Only 15% (n=17) of the migrant workers interviewed reported reusing pesticide containers, and both men and women reported reusing pesticide containers at similar rates. Of the workers that reported they reuse pesticide containers, the most frequently reported use for old containers, and most concerning, was for storing water. They used the barrel to collect water for washing, showering and even drinking. Others said they drank from reused pesticide containers or stored food in the containers. All of these uses are highly concerning because they may obviously result in ingestion of pesticide residue. In discussions, migrants mentioned that they commonly just rinse containers once with water, no detergent, before repurposing them. They have never been informed of the danger. While there are some employers who take responsibility for the containers and reuse them for mixing and containing pesticides, it seems that most migrant workers are not aware of health risks related to pesticide container reuse, and this leaves them vulnerable to misuse.

Pesticide Application

“We know it is dangerous to our health, but we have to use (spray) chemicals. It is part of the job.” - Male migrant worker in Mae Sot.

Work in agriculture used to pay only 60-70 Baht a day; now the wage is up to 170 to 200 THB a day, but, generally, is still below the minimum wage, which is 310 Baht per day. Approximately half of the pesticide applicators surveyed reported that they earned more than workers who do not apply pesticides, which means there is generally an economic incentive to do this dangerous task. Those who get paid more for spraying earn between 30-50 Baht more per day, putting the wage for sprayers at between 200 and 250 Baht. If a worker borrows spraying equipment from the employer, like a backpack sprayer, the worker has to pay a rental fee of 30 THB a day. If the worker mixes the chemicals improperly and the plant dies, the worker has to pay to replace the plants.



The amount of time pesticide applicators say they spend applying pesticides varies widely. Some applicators only apply pesticides for 30 minutes a day, mostly on share cropping arrangements, while other applicators spend up to 11 hours applying pesticides on large plantations. Migrant workers most frequently reported applying pesticides for 8 hours a day, but the average was slightly less at 6.6 hours.

In Mae Sot, some of the men spray 3-4 days a week. They reported that it is usual to spray all day until 5pm, and in some cases, they have sprayed until 1 or 2 a.m. as necessary to finish! In one month, they could spray between 15 and 20 days. These migrant workers reported spraying fertilizer, pesticide, and herbicide... whatever the employer wants. In Chiang Mai (Pong Yang), migrants seemed to have more autonomy regarding decisions to spray and reported spraying 1-2 times a week, depending on the season. In the cold season they would spray once every 1-3 days, in the hot season every 7-10 days.

Weather conditions can influence the absorption rate of certain pesticides, and it is generally advised against applying pesticides in high winds or hot temperatures, both for the effectiveness of the pesticides and for the safety of the worker applying them. Windy weather, specifically, increases the likelihood of pesticide spray drifting – making it more difficult to coat the plants, while also possibly resulting in the chemicals landing on nearby workers or blowing-back onto the person spraying. Hot weather can increase the volatilization of pesticides making a liquid pesticide evaporate into vapors that may be easily inhaled. Sweating from hot/humid weather, or moisture from rain, could make the workers' skin wet, which increases the absorption of certain types of pesticides. It is also advised to avoid spraying in the rain because some pesticide formulations need to be reapplied if it rains during or soon after the application.

Around half of the pesticide applicators in the survey said they did not avoid any particular type of weather when spraying. Humid, rainy, and hot weather were the conditions most avoided, although at low rates. Reasons workers avoided applying pesticides during wet/rainy weather included, “if it is wet, the pesticide will not work”, “it causes pain” and “when it is wet, it causes poisoning”. The workers that avoided other types of weather said that they did so due to concerns about the effectiveness of the pesticides, possible damage to the crop, concern that they would be poisoned, and past experiences with symptoms (such as feeling too hot, pain and dizziness) after applying pesticides in that type of weather. It was surprising how few workers avoided windy weather because of the obvious disadvantages regarding the safety of the worker spraying in the wind and the effectiveness on the crop. This may indicate that the migrant agricultural workers are not receiving crucial information about proper pesticide application in regards to weather considerations, or, they might not have the flexibility or control over decision making to choose to delay or cancel planned applications if inclement weather should arise.



The time of day can also impact the temperature and relative humidity, which can, in-turn, affect the volatilization of recently applied pesticides and increase applicators' susceptibility to pesticide exposure. Conditions such as dehydration and heat stroke can also make pesticide poisoning symptoms more severe. Generally, there is no specific time to spray, but the most common times workers reported applying pesticides were during early morning, late morning and evening. Most respondents applying pesticides for 6-8 hours indicated that they applied pesticides throughout the day, but stopped during the early afternoon when the sun is at its peak and the heat is greatest.

Table 5. Weather migrant workers reported avoiding when applying pesticides, and time of day pesticide applicators most frequently reported applying pesticides

Application Timing	Relative Frequency
Weather Avoidance (n=53)	
Wet/rainy	26 (49 %)
Hot	10 (19%)
Windy	3 (6%)
Do not avoid any weather	16 (30%)
Application Time of Day (n=86)	
Early Morning	49 (57%)
Late Morning	43 (50%)
Afternoon	12 (14%)
Evening	45 (52%)

In Pong Yang, Chiang Mai, migrant workers have more autonomy in their work schedules and can decide on their own about when to spray. For instance, they will assess heat conditions before deciding to spray. They also prefer to spray in the morning when there is no wind, and in the hot season they spray only in the morning. If there is wind, they adjust the spraying to the direction it is blowing. If they are caught in the spray by a gust, they will stop and wash off. After they spray, they do not do any other activities in the field. As far as going back into the field to work, they reported sometimes waiting one day after spraying and then “rinsing” the field before going back in, while others reported waiting until the pesticide was dry after 1-2 hours, depending on the situation.

In Mae Sot, the employer decides what to spray and when. There is generally no concern or consideration for the wind or other conditions, such as rain or heat. Commonly, the migrant workers do not know what they are spraying and some do not know what it does. Women and other family members will stay in the house to avoid the spray, but many houses are adjacent the field, and sometimes the wind blows it in. One person reported currently living in the fields with his parents along with a child 2 years of age. They live in a typical thatch bungalow. The wind blows chemicals in when the wind blows. The other workers interviewed live in camps and commute to work.

In Chiang Mai, on smaller fields, they may use a mechanical pump or backpack pump and reportedly spray at a downwards angle; in Mae Sot they are instructed how to spray – high or low, and use either a backpack or mechanical pump. Pesticides have to spray high, so more chance of drift from wind. Generally, the angle sprayed depends on what they are spraying. Herbicides and certain fertilizers are sprayed low, pesticides and another type of fertilizer or hormones are sprayed high. Sugar cane is reportedly the worst because it is so high that it traps the spray, which then drips back down on the workers. Fruit tree orchards were also mentioned as being exposed to particularly dangerous chemicals.

The industrial sized pump apparatus for large fields is setup like this: the agrochemical (pesticide, herbicide, fertilizer, etc) is in a barrel with a hose in it that runs to a pump, which then shoots it through a longer hose with a nozzle. It takes 2-4 people, usually women, to pull the hose and untangle it, with the man in front spraying. Whoever is in front is receiving a spray directly from the hose and is getting the most exposure, while those standing behind also receive a lighter spray.

“The employer is only concerned that the chemicals reach the plants.” - Migrant men working on agriculture in Mae Sot area.

In Mae Sot, the women assist with spraying pesticides, herbicides and fertilizers. They help pull the tube for spraying with a distance of about 1-2 meters between them and the sprayer. If the hose is longer or thicker, more than two women will help pull. The women will help with spraying all day and only stop for lunch. The smell is very strong and they feel that the chemicals are dangerous, but they do not know what chemicals are used.

The workers do not know the names of the pesticides – only the picture on the container. Only three of the pesticide applicators surveyed could partially name the pesticides they worked with; none of the survey respondents could fully name the pesticides they use. Generally, they understood the function of the chemicals (for killing insects, fungus, weeds, or snails) but could not name the brand or chemical. The majority of pesticide applicators reported acquiring the pesticides they worked with from their employers. Far fewer pesticide applicators purchased the pesticides themselves or else received them from friends or co-workers.

Generally, when migrants were initially hired to spray chemicals, the employers taught them about pesticides and their use. After that, they were left alone and had to learn on their own. In Chiang Mai, the workers understand some Thai. When they buy the chemicals at the shop, the shop keeper explains

about how to use the chemicals, but the workers do not fully understand. They then have to observe the effect it has to adjust the strength of the mixture.

Fertilizers and herbicides are applied during hot season when the land is fallow. Once the plants are growing, they use insecticides, and then spray hormones when the plants are blossoming. The type of pesticide used depends on the type of insect and its development stage. In Mae Sot, the employer usually decides what type of pesticide to use, when and how much.

Women in Mae Sot are unaware of the name of the brand of chemicals used. They do generally understand the use though – pesticide, herbicide, fungicide... The men in Mae Sot identified one local brand which they are particularly weary of, but they only knew it by the picture on the container. It burns on contact, and once the hand has come into contact with this chemical, touching other parts of the body will also leave a burning sensation. If it was the compound glyphosate (red horse brand), then it is an organophosphate and may cause non-Hodgkin lymphoma. In Pong Yang, Chiang Mai, in areas where flowers and vegetables are grown, the migrant workers could remember one herbicide’s name – Gramoxone, which is an herbicide produced by Syngenta (a Swiss company) with the active ingredient paraquat which is highly toxic. The import of paraquat along with glyphosate and chlorpyrifos are all slated to be banned in Thailand.

“Employer only thinks of the benefit to his crop, not to the workers.” – Female migrant worker in Mae Sot

Applicators reported using pesticides, including herbicides, and hormones primarily in liquid form, and fertilizers and herbicides primarily in powdered form. Each form poses different exposure routes and hazards depending on the method of application. Backpack sprayers were the most common application method for liquid agrochemicals, followed by tractors / motorized apparatus. Powdered forms were used less frequently and mainly applied with a spreading tool; only one person reported applying powdered fertilizer manually by hand.

Table 6. Source of agrichemical and application method by form

Behavior	Frequency*
Source of Pesticides (n=87)	
Employer	69 (79%)
Purchase on own	9 (10%)
Receive from friends/co-workers	6 (7%)
Application Method (n=87)	
Powder spread using hands	1 (1%)
Powder using spreading tool	23 (26%)
Liquid using backpack sprayer	50 (57%)
Liquid pesticide with tractor	32 (37%)

*There is overlap between categories, thus only meant to illustrate frequency.

When migrant workers in Mae Sot mix chemicals, they will put the chemicals into a 200 liter, blue plastic barrel. They usually mix 2 to 3 constituents, commonly including insecticides. The employer gives instructions on mixing regarding amounts and proportions. Sometimes the employer demonstrates, sometimes just gives orders. In Mae Sot, the men said they use their teeth to open the pesticides container - a hazardous display of machismo.

Mixing is done either in an open air room with a roof to protect from sun, or else in the field with lots of ventilation. As they are outside, there is no issues with ventilation, on the other hand, there is also no planning or consideration for wind. If already in the field, they will mix near a water source, will use whatever container is available, and will wash and rinse it in the field. In many fields, they have a pump to provide water uphill or in other locations without a water source.



No protective equipment is provided or worn – no gloves, mask or goggles; they wash their hands in the local stream or water channel afterwards, but usually not with soap. The color and smell absorbs into their skin. A couple of the men in Mae Sot admitted that when they first arrived and started working, they stuck their arm in the barrel and used their bare hands to mix chemicals. Now they use a bamboo rod or any stick they can find.

As mentioned earlier, once finished spraying, in some cases the employer is reported to take the barrels and clean them for re-use. In other cases, left to their own devices, the migrants will rinse the container and empty the water generally without regard or caution and then repurpose the container.

Symptoms Possibly Related to Pesticide Exposure

Most of the workers interviewed reported that they had suffered symptoms similar to pesticide poisoning while at work. The research did not conduct blood tests though, so it cannot be confirmed that the symptoms were caused directly by pesticides. While there are many other possible causes of these symptoms, there is also a strong, suggestive correlation that these are related to pesticide exposure. Moreover, other studies have corroborated similar symptoms among agriculture workers as being linked to exposure to pesticides. (Kaewboonchoo, O., et al., 2015; Mrema, E.J., et al., 2017)

The symptoms reportedly experienced most frequently by migrant agricultural workers from the survey included: dizziness/lightheadedness (60%), headaches (48%), stinging eyes (37%), blurry vision

(34%), cough (35%), exhaustion (32%), nausea (30%), and difficulty in breathing / tight chest and painful to take deep breathes (29%). Some of these symptoms are associated with pesticide exposure, but could be due to other conditions or a combination of the two. Other causes could include illness, heat exhaustion / sunstroke, dehydration, allergies, exposure to extreme changes in weather, or other pre-existing medical conditions. Other symptoms mentioned to a lesser frequency included vomiting (15%), burning throat and nose (18%), skin burns (15%), seizures (12%) and confusion (11%), all of which are more specific to pesticide exposure.

Men and women are affected by pesticide exposure differently, but women are considered at greater risk from the health effects. Migrant men and women surveyed reported experiencing symptoms at similar rates even though men were more likely to apply pesticides than women. Skin, eye, respiratory, nerve, and muscular/vascular symptoms were reported at similar rates for both men and women. Men were slightly more likely to report gastrointestinal symptoms than women at a 7% greater frequency (perhaps because of their habits of eating beetle nut without washing hands properly). Men were more likely to report muscle weakness and diarrhea while women were more likely to report cough, fatigue, headaches, confusion and tremors. It is concerning that women reported experiencing confusion and tremors at a higher proportion, as women only made up 34% of all survey participants, but made up 50% of the workers who reported experiencing tremors and 46% of workers experiencing confusion. As men are more likely to apply pesticides, it is surprising to find that women reported more symptoms similar to those of pesticide exposure than men, and insinuates that exposure goes beyond simply being in close proximity to spraying. (Numerous studies noted by Mrema, E.J., et al. state that women's exposure to pesticides has been underestimated, and, therefore, women experience symptoms from pesticide exposure at significant rates which go undetected.)

“Some of the pesticides are really strong. You can shower for five days and the smell doesn't go away.” – Male migrant workers in Mae Sot

Symptoms experienced by women in Chiang Mai include itchy skin, nausea and shortness of breath. Itchy skin they treat by soaking in hot salty water, which was a recommendation from another worker. Some reported being sick with fever and aches unable to work for four days, but it was most likely heat stroke. The women also reported swollen eyes and sometimes feeling dizzy. Other symptoms include numbness in fingers, especially during cold season, and a numbness on their side when sleeping which could also be from cold or hard sleeping surface. The women said they have a reaction to the smell of two certain brands, and that there are other brands they could name which worried them which happened to include organophosphates and paraquat.

Symptoms reportedly experienced right after spraying by the male respondents in Chiang Mai sometimes included vomiting, dizziness, and difficulty in breathing. Other physical effects of direct exposure include headaches, chest pains, weakness and shivers. When chemicals get into an open wound, they say it burns. Most symptoms have an onset before going to bed. At night, their eyes burn, turn red and water. They mentioned that when they felt numbness in the hands they would soak them in salt water. Other symptoms experienced at night include locked muscles, aches and pain in their bones and muscles. They reportedly drink milk, eat a poached egg or take Shan herbal remedies to ease symptoms.

The longest lasting effect is burning eyes or blurry vision. If the spray gets in their eyes, the men will immediately rinse with the water that is available. If they have a cucumber, they will put slices on the eyes to soothe them. If it is really bad, they will go to the local health clinic / hospital (“satani-anamai”), but they have never been to a doctor. They said they are afraid if they test, they might find a nasty surprise. On the other hand, if they go and no serious problems are found, then they would feel it was a waste of time as they would only get paracetamol.

The workers in Pong Yang, Chiang Mai, did not report any serious incidents – only long term exposure. However, the workers do not have any information on poisoning by agrochemicals, and therefore may not understand what the symptoms are. After being exposed to some of these chemicals for so long though, some of the workers have developed a visceral reaction and are unable to use certain chemicals any longer. They get a sensation like being car sick just from the smell. They identified a brand with a dog on the label as being particularly potent. Migrant workers say this brand burns on contact, and they get headaches and feel dizzy from the smell. If they work with this brand they say they will feel like they have a hangover all day and night.

An older woman in Pong Yang said she had sprayed for ten years, but had health problems and stopped spraying by doctor's orders. Around fourteen years ago, while she was still spraying, she had an exposure incident. She went to the clinic and had a health check, but did not get a blood test. She was given a shot, returned home and went into shock - she seized up as if with epilepsy. She used herbs to relieve the symptoms. "I felt hot on the inside but my skin was cold to the touch." During those days, she used to spray a lot, was exposed to spills and got wet from the spray. Then she had a second seizure episode. The doctor tested her blood at Nakhorn Ping Hospital and found she had been poisoned. After that incident, she stopped spraying. Although it has been another ten years since she stopped spraying, even now she has a reaction to certain chemicals, primarily insecticides.

Long term conditions noticed by one of the older respondents (42 years old) have included low immunity and aches in joints. One other participant has had persistent health problems for one year, including blurry eyes, numbness in hands and feet, and he suffers from chest pains. This person has never been treated at the hospital, but he has health insurance.

Women in Mae Sot say exposure to spraying makes them feel dizzy. They react to the smell with nausea and vomiting. When they get wet from the spray it feels itchy, burns and sometimes rashes develop which turn into sores. When it gets hot, they take off their long sleeve shirts, but then the chemicals land on the skin. When this happens with fertilizer, the feeling is burning, itchy and hot; when it happens with pesticides, they develop a rash.

The women participants know that PPE is for protecting skin, but they have no real knowledge on the benefits of using a proper mask or what one looks like. They reportedly use only a thin cloth to cover their mouth and nose as a filter, which is light enough to easily breathe through it. When the cloth covering their mouth gets hot or wet, they will take it off.

"We know about the health problems (we face), but we still need to eat every day." – Women migrant workers in Mae Sot.

These women know when the health effects are from pesticide exposure, usually because it is affiliated with an exposure event. For example, there have been wind events in Mae Sot where migrants were reportedly spraying chilies or potatoes and the wind blew pesticide into their faces – including the women who were assisting by pulling the hose. On those occasions these women needed to stop work because of the health effects. Symptoms are often long lasting - up to five days, and recurrent every time they spray. Most commonly they suffer from dizziness and nausea. When they suffer a serious episode, they report that they usually cannot get up or move the first day. By the second and third day they can start to sit up, and by the fourth and fifth day they begin to move around. With these episodes they lose work for up to five days and receive no compensation. Even after experiencing these events, women participants indicated that they still help occasionally when needed in the fields.

Participants mentioned other migrant workers in the community who also reportedly suffer health conditions related to exposure to agrochemicals. The father of one of the younger women in the group has long-term, recurrent symptoms which are exacerbated when he sprays. They said he was on long term treatment, but it was not mentioned what he was taking.

The families that live in the fields have the highest exposure. There is regular spraying of various types of chemicals from herbicides, insecticides, fertilizers, hormones, fungicides, etc., and these families are always exposed. They could attest to this because three of the participants previously lived in the fields, including the one woman whose father has health problems currently.



It would be expected that non-applicators experience less symptoms than those workers who apply pesticides because they are not directly exposed to chemicals as frequently, and because applicators are more likely to eat, drink and smoke while working in the fields. However, reports of skin symptoms and gastrointestinal symptoms, although low, were at similar rates between pesticide applicators and non-applicators. Pesticide applicators made up all 18 cases of muscle weakness, but the rate of feeling “very tired” or exhaustion was even among applicators and non-applicators.

The greatest difference in symptom frequency between non-applicators and pesticide applicators were eye symptoms and respiratory symptoms. Pesticide applicators were more likely to report eye symptoms than non-applicators, while non-applicators were more likely to report respiratory symptoms. Workers who apply pesticides were more likely to report blurry vision and stinging eyes than non-applicators, which is not surprising considering very few reported wearing eye protection while applying or handling pesticides.

The greater frequency of respiratory symptoms among non-applicators, which are mostly all women, is surprising and suggests they might be exposed to spray-drift either by re-entering fields too soon after pesticide application, or through dust from crops related to volatilization (evaporation of the chemicals). In fact, non-applicators, mainly women, report experiencing symptoms such as difficulty breathing,

tremors, vomiting and confusion at higher rates than applicators. It is concerning that non-applicators are reporting tremors and confusion as these can be considered as symptoms of exposure to chlorpyrifos, a neurotoxic organophosphate. (PAN) This means that exposure is not related to direct application, and that more sensitive groups, such as women and children, are being affected.

Table 7. Relative frequency of symptoms as reported by migrants working in agriculture, disaggregated by sex and applicator status

Affected part of body	Symptoms	All Respondents (n=114)	Women (n=40)	Men (n=73)	Non-applicators (n=26)	Applicators (n=88)
Skin	-rashes -burns -blisters	14%	12%	14%	16%	13%
Eyes	-stinging eyes -blurry vision -red/watery eyes	32%	33%	32%	24%	37%
Respiratory	-difficulty breathing -burning nose/throat -coughing	29%	30%	26%	36%	25%
Nervous	-dizzy/lightheaded numbness/tingling -headaches -tremors -confusion	28%	30%	26%	31%	26%
Gastro-intestinal	-nausea -stomach pain -vomiting -diarrhea	17%	13%	20%	19%	17%
Muscular/vascular	-muscle cramps -muscle weakness -fatigue -bruise easily -nosebleeds	13%	11%	14%	10%	14%

Generally, those workers who eat, drink or smoke (EDS) in the fields reported symptoms more frequently than workers who abstained from EDS. There was noticeably higher rates of symptoms among workers with EDS behaviors for eye, nose and throat, muscular, headaches and dizziness. Skin symptoms and gastrointestinal symptoms were at similar rates between EDS workers and non-EDS workers, except for diarrhea, which was higher among EDS workers. Again, EDS usually consists of migrants sitting in or nearby the field where they were just working, exposing them to freshly applied pesticides without proper PPE, and thus also providing higher likelihood of ingesting or inhaling chemical components of these pesticides.

Frequency of symptoms also differed between workers who washed their hands before eating, drinking and smoking (EDS), and those who did not. Those who did not wash their hands before eating, drinking or smoking, generally reported symptoms at a greater frequency than workers who said they did wash their hands. (The sample size for workers that reported not washing their hands was only 10 people, which may distort results.) Skin, respiratory, nerve, gastrointestinal and muscular/vascular symptoms

were all reported more frequently in the group that does not wash their hands. Only eye symptoms were reported at similar frequencies.

The ability to wash hands in the field is limited though, as mentioned previously, due to lack of access to water and soap. Many migrants know to wash their hands before eating if possible. As a result, they may wipe their hands or wash only with water. Some mentioned that they will eat with a spoon if possible. When they make it to the house to eat, they wash with soap and water first. Men generally get more serious symptoms from EDS without proper hand washing, and sometimes have to go to the hospital. In Mae Sot, the respondents reportedly knew of a man nearby who did not wash his hands before eating beetle-nut, and died from ingesting poison - “his intestines rotted and he died.”

Workers who reused pesticide bottles, which was only 17 respondents, reported slightly higher frequencies of skin symptoms, eye symptoms, respiratory symptoms and nerve symptoms than workers who did not re-use pesticide bottles. Gastrointestinal and muscular/vascular symptoms were fairly similar between workers who say they reuse pesticide containers and those who do not. As mentioned previously, there are various ways containers are reused, depending on the size and type. The most concerning is when it involves food or water storage. While an obviously dangerous practice, it is not commonplace, and had only a marginally negative impact on health.

Table 8. Relative frequency of symptoms experienced in relation to certain safety behaviors

Body System	Symptoms	All Respondents (n=114)	EDS (n=79)	Avoid EDS (n=33)	Don't Wash Hands (n=10)	Wash Hands (n=102)	Reuse Container (n=17)	Don't Reuse (n=95)
Skin	-rashes -burns -blisters	14%	14%	12%	30%	12%	18%	13%
Eyes	-stinging eyes -blurry vision -red/watery eyes	34%	40%	18%	37%	34%	39%	33%
Respiratory	-difficulty breathing -burning nose/throat -coughing	29%	31%	20%	43%	26%	31%	27%
Nervous	-dizzy/lightheaded -numbness/tingling -headaches -tremors -confusion	28%	33%	16%	50%	26%	36%	26%
Gastrointestinal	-nausea -stomach pain -vomiting -diarrhea	17%	19%	13%	30%	16%	15%	18%
Muscular/vascular	-muscle cramps -muscle weakness -fatigue -bruise easily -nosebleeds	13%	17%	4%	32%	11%	16%	12%

Health Seeking Behaviors

Migrant workers in agriculture are generally unwilling to visit a healthcare provider unless the condition is severe or can no longer be ignored. Even when they have proper health insurance which would cover the related hospital expenses, migrants generally only go to the hospital in cases of an emergency and for the health exam to obtain a work permit. Unfortunately, local public health clinics are commonly unable to properly treat conditions related to pesticide poisoning and have to refer migrants to a hospital, which is farther away and takes time, making migrants reluctant to enter the public health system at all. Only 25% of respondents said they would go to a public health service provider as a first resort, and more than half of them were from one location (Fang in Chiang Mai); and almost the same amount said they would go to a private clinic or hospital as a first resort. Not quite half of all respondents said they would go to a public hospital as a secondary resort.

Even though participants in Pong Yang, Chiang Mai, had migrant health insurance, and some who had 10 year cards had the Thai “Gold Card” previously known as the 30 baht scheme, they said it was unlikely they would go to the hospital because of language barriers and because they would lose a whole day’s income and expenses for transportation. They were more likely to buy medicine at a pharmacy, such as eye drops or paracetamol, and self-treat.

One group in Mae Sot said that when there is an incident, the employer gets someone experienced to replace the person on the work team, and will take the worker to the health clinic themselves. Another group said that it is rare, if ever, the employer takes them when they need treatment, and that usually it is the “wife” or a friend who goes. Some migrants in Mae Sot area, when they experienced general health problems, would go to the NGO SMRU or the Mae Tao clinic on the Thai side. If they experience more serious problems, they have gone to a clinic on the Myanmar side, which means going to what is known as a “quack” doctor and getting a shot (usually B vitamins, but with uncertain sterilization standards).

Respondents said they do inform doctors when symptoms are related to pesticide exposure (what is uncertain is whether the doctors ever ask migrant workers about pesticide exposure without prompting by the patient). At the border, some migrants said they never had their blood tested for toxicity, only for malaria. In Chiang Mai, a couple have had blood toxicity tests. The problem is, when medicines do not work, instead of going back to the same doctor and having more tests, they simply move to another facility and get treated for their symptoms again, and not necessarily for toxicity. In fact, most migrants working with pesticides had never had their blood tested for toxicity, but they want to! “One day we will use our insurance,” some migrants said at Mae Sot. One concern they expressed that holds them back is the fear that they would find out they had something serious, and would not know what to do about it.

Pregnancy Precautions and Children’s Exposure

Many migrants reportedly work in agriculture because the setting is conducive to living together as a family. However, the proximity of living quarters to the fields increases the possibility of children being exposed to toxic pesticides and other agrochemicals, which could, in turn, have long-term health effects. Considering the high potential of exposure, we asked parents, especially mothers, what sort of precautions they have taken to protect their children from pesticide exposure, including when they were pregnant, and what sort of health seeking behaviors they practice to support their children’s development.

In Pong Yang, one woman said when she was pregnant she worked up till the 8th month, and in the 9th month still worked, just not every day. She did things like weeding, planting flowers and cutting. Antenatal care was provided at the local community hospital / health clinic. In Mae Sot, the women said that, generally, once they knew they were pregnant, they did not work in the fields anymore. They stayed at home and did unpaid domestic work. However, some of those who lived in the fields worked up until birth, doing tasks like cleaning corn. In Mae Sot, respondents reported going to the NGO clinic SMRU for antenatal care, which was closer than Mae Tao Clinic.

In Mae Sot, women reported returning to work anywhere from 10 days after birth, up to 3 months, while some waited as long as 6 months depending on whether they had someone to take care of the child at home. If they returned back to work soon after giving birth while taking care of the child, they would do work that does not expose them directly to pesticides or chemicals in the fields. In Pong Yang, the mothers waited around 7-8 months before they started working again, mainly doing weeding. When they have a small child, they wait a day or two after spraying, and let the men rinse the fields before they go back out to work. When mothers work in the field, the young child stays with the father or another family member. They reportedly seal the house or go to another location to avoid drift when there is spraying.

The kids in the Chiang Mai area have pink books, which are provided by the Thai Public Health system for recording a child's development over time. The problem, according to migrants interviewed, is that when the parents go to see the doctor, they do not really understand what the doctor is saying all that well. They can listen and understand at a basic level in Thai, but they cannot read. Unfortunately, due to limited time, the doctors only explain so much, and the parents are expected to read the book on their own like Thai patients. So, unless a health condition is identified at birth, it is uncertain if a Thai doctor would identify health problems related to pesticides if they developed at a later developmental stage in the child.

In Mae Sot, one of the mothers who works in the fields said that her child was born with heart problems and abnormal blood cells. In Pong Yang, there were two children with their respective mothers present during the interview – one was 1 year and 10 months, the other was 2 years and 8 months. The younger one has anemia, and is supposed to take medicine until age three. The older one's mom was very conscientious about taking precautions and does not work in the fields much anymore. Both mothers breastfed their children though.

In Mae Sot, if the kids are under two years of age, they may stay with the mother in the field while she works, possibly even bundled against her. Kids of families living in the fields between the ages of three and ten stay in a thatch house with a brother or sister or relative. The kids who are older than that, especially twelve and up, start working. The ability of kids in this area to attend school depends on the family's circumstances and whether they have enough money.

In the Pong Yang area where the interview was done, there are seven kids in the area. Two older boys, one ten years old and the other twelve, like to play in the fields and in the water source, but have no symptoms associated with chemical exposure. In Mae Sot, kids whose families live in the fields undoubtedly are being exposed. If there is a canal, the kids play in it, regardless of the fact that it may contain run off from the fields or be contaminated with chemicals. During spraying season, kids have skin problems as they usually jump and play in the water at the end of the day. Some kids have reported having a high fever. When this happens and the parents take them to a doctor, they only test the blood for malaria. Parents do not know to explain about possible chemical exposure, so the physician only treats the symptoms empirically.

How Migrant Workers Would Feel Safer

We asked workers who suspected that their symptoms were related to pesticide exposure how they could feel safer. The great majority, 43 of the 53 respondents to our follow up questions, replied that they would wear more personal protective equipment. This is problematic though because, of the 31 respondents who told us they use PPE, only 7 said they were given personal protective equipment by their employers, the other 24 said that they had to purchase equipment themselves. As the majority of migrant agricultural workers earn well below the minimum wage, purchasing their own equipment is a burden, and they will end up buying cheap substitutes or make do with things like a cloth wrapped around their face rather than a proper mask. In follow-up interviews, migrant workers said that they think employers should buy proper PPE for their employees.



Other workers felt they need improved field hygiene practices such as washing hands or bathing after handling pesticides, keeping pesticides away from food, and washing clothes contaminated by pesticides separate from other clothes in order to reduce their exposure to pesticides. However, 25% of survey respondents (28 out of 113) said that they ran out of water at work and 29% had run out at home. This makes bathing or hand washing after handling pesticides or before eating/ preparing food difficult. The water they do have access to may not be clean, or else cleaner sources may be unaffordable. A total of 17 survey respondents use water from ponds or streams to wash with, which, if located in or around the fields, may be contaminated with pesticides.

Increased safety includes reading and following the instructions and precautions on pesticide labels. But this is also a challenge because survey respondents said that pesticide labels are mostly in Thai and some are in English, but only 27% (out of n=111) of the migrant workers surveyed read Thai or English. Most workers rely on the employer, a foreman, or another worker to instruct them on the use of these agrochemicals.

Four of the respondents, who apply fertilizer but not pesticides, thought they had been poisoned by pesticide drift, and told us that next time they would run away from spraying and avoid recently sprayed fields. Other than this small group, it seems that workers who do not apply pesticides may not understand the risks of being exposed indirectly by re-entering the fields too early or getting caught in pesticide drift. There needs to be greater awareness of how to protect oneself from exposure for both applicators and non-applicators.

Some of the migrant workers interviewed told us about other workers they knew who left their workplace after having a bad experience with pesticides. They told us that some of these workers changed crops or went to work at a different location after having a poisoning incident. In previous research, MAP has found that a documented migrant worker's registration status can act as a barrier to changing employers because it was difficult to legally change registration to a different employer, or else employers have

withheld registered workers' documents to prevent them from leaving. Migrants in agriculture feel powerless to negotiate with employers because they generally lack education and are not allowed to collectively bargain. Moreover, local, informal redress systems are biased. For example, when migrant workers in Mae Sot area have a complaint, they register it with the village headman; but migrants feel they never get a satisfactory resolution.

Social Security, Workmen's Compensation and OSH

As mentioned at the outset, agriculture work has been categorized as informal work, and therefore been excluded from certain social protections. In March 2019, the Ministry of Labour included workers in the agriculture, fishery, forestry and animal raising sectors under Social Security coverage if they are employed all year round (and migrants must have formal registration). Workmen's Compensation is supposed to cover all workers. The question raised for migrant workers is whether Worker's Compensation will be available for migrants who suffer long-term health-related effects from prolonged exposure to pesticides and other agrochemicals. The ability to access new Occupational Disease Centers, which focus on treatment of patients with health conditions induced by exposure to hazards materials in the work place, and receive proper diagnosis, treatment and rehabilitation, is of primary importance. And if there is harm found to be a result of pesticide exposure, will there be compensation?

Recommendations - Direct Assistance to Migrant Communities

Considering their remoteness and lack of education or access to services, direct interventions with migrant worker communities in agricultural areas are needed to improve: OSH practices, environmental health, WASH practices, and women and children's health. The following are suggested interventions:

- Education on Occupational Safety and Health (OSH) in agriculture, including: benefits and use of proper Personal Protective Equipment (PPE) for applicators and non-applicators, including assessment of potential harm of "alternative" methods such as cloth or surgical masks (do's and don'ts); understanding health hazards of pesticides / agrochemicals by type, including understanding hazard labels; safety in proper mixing, application and disposal of agrochemicals; and modes of indirect exposure such as spray drift, residue and run-off, and how to reduce potential exposure for non-sprayers through strategies of re-entry intervals, wind assessment and safe distances.
- Promotion of WASH (Water, sanitation and hygiene) interventions to migrant communities in agricultural settings to promote: proper hand-washing with soap among workers, and safe eating/ drinking/ smoking behaviors; access to clean water including understanding filtration systems; proper disposal of laundry and other types of waste water; and discouragement of reusing pesticide containers of any form supported by proper disposal.
- Training on collective bargaining and accessing redress in order for migrant workers to demand better working conditions from their employers, receive proper compensation for workplace injury or sickness, and to countervail the general insecurity agriculture workers face as seasonal or temporary workers in the "informal" sector.
- Pre- and post-natal care interventions focused on migrant women in agricultural settings, ranging from awareness raising on the risks of child birth after exposure to certain chemicals, to referral for related pre/post natal health services including long-term care, as necessary.

Recommendations – Thailand Royal Government

Numerous policies and bureaucratic structural barriers are in place which prevent migrant workers in agriculture from receiving their full labor and health rights. Some of the most obvious and essential changes needed include:

- Provide a registration option with more permanent status to agricultural migrant workers who have regular residence, to enable them to be recognized as workers in the formal sector and receive related social protections, regardless of the seasonality or temporariness of their employment status.

- Amend the Occupational Safety, Health and Environment Act to provide coverage for migrants who are employed in agriculture, and make employers legally responsible to promote workplace safety and prevent workplace accidents, including provision of personal protective equipment and measures to decrease exposure through EDS.
- Include all migrant agricultural workers under protections of the Workmen's Compensation Act, regardless of registration status or duration of employment, including coverage under a health insurance scheme which enables them to access proper treatment in the case of work-related injury or disease, especially pesticide exposure incidents and long-term rehabilitation and treatment.
- Increase the OSH training of medical staff at local level health clinics / hospitals to more readily identify health conditions induced or linked to exposure to pesticides or other harmful agrochemicals, with migrant language-friendly materials to assist the diagnosis.
- Increase migrants' access to blood testing for chemical poisoning and related diseases along with provision of medicines that can counteract poison through local level health centers / hospitals in agricultural / rural areas.
- Promote access to proper redress mechanisms for labor disputes and occupational health claims of migrant workers in agriculture, including injury or related diseases / health conditions, regardless of their location or registration status.

Recommendations – Employers

Employers have the most direct influence on work conditions of their migrant employees in agriculture, and therefore, are the ones who must take the most responsibility for ensuring the safety and well-being of migrant workers by doing the following:

- Provide essential and proper personal protective equipment (PPE) to all migrant employees at no cost.
- Train workers on occupational safety and health in migrants' language, including how to use PPE and agrochemicals properly, supported with printed materials in migrant languages and picture graphics.
- Promote improved health and safety practices among pesticide applicators including: improved access to washing facilities with proper detergent / soap; safe EDS areas with break-time permitted; flexibility in working hours to accommodate temperatures, weather and wind; and the ability to choose a safer pesticide or mix at a lower concentration.
- Uphold labor standards by paying proper wages, providing special bonus wages for those who spray chemicals as negotiated with workers, and providing proper social protections.

Recommendations – Consumers and other Relevant Networks

As consumers become more aware of how their food is produced and harvested, they are demanding greater accountability for the impact it has on labor rights and the environment. Various food production industries in Thailand are already under scrutiny. Yet, when it comes to agriculture, the main focus has been the impact of pesticides on the consumer – not on the producers. Since farming in Thailand has shifted towards greater reliance on migrant workers, who are traditionally marginalized, we call on the following:

- Include migrant workers in networks already advocating for changes in agricultural practices, such as banning the use of hazardous pesticides.

- Allow migrant workers to join class-action suits against companies which have been responsible for production and distribution of pesticides that use harmful chemical agents which have been proven to cause health conditions, such as cancer, blood lymphoma, birth defects or congenital conditions in children...
- Promote alternative methods of agriculture which either do not use hazardous agrochemicals or else significantly reduce the amount and frequency used, and which provide the producers greater autonomy on the decisions used in pest control.
- Link monitoring networks for “ethically-sourced” agricultural products to include labor and health rights of migrant workers.
- Support those who grow organic produce by expanding “ethically-sourced” labelling to indicate those farmers who are environmentally friendly, promote consumer health, and uphold the health and well-being of their laborers.



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REFERENCES

Food and Agriculture Organization (FAO) of the United Nations. Guidelines for Working with Pesticides in Tropical Climates. Food and Agriculture Organization of the United Nations. Rome. (1990)

International Labor Organization (ILO) – “Agriculture: A hazardous work”; Occupational Safety and Health (2018)- accessed at: http://www.ilo.org/safework/areasofwork/hazardous-work/WCMS_110188/lang--en/index.htm

Junghus, C., et al., “Chapter 4 - Working conditions for Migrants in Thailand’s Agricultural Sector.” Harkins, B., Thailand Migration Report 2019, United Nations Thematic Working Group on Migration in Thailand, Bangkok. (2019)

Kachaiyaphum et al., 2010; Namwong et al., 2011, as cited in: Junghus, C., et al., “Chapter 4 - Working Conditions for Migrants in Thailand’s Agricultural Sector.” Harkins, B., Thailand Migration Report 2019, United Nations Thematic Working Group on Migration in Thailand, Bangkok. (2019)

Kaewboonchoo, O., et al., “Occupational Health and Safety for Agricultural Workers in Thailand: Gaps and Recommendations, with a Focus on Pesticide Use,” *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*. 25(1) p. 102-120. (16 March 2015) <https://journals.sagepub.com/doi/abs/10.1177/1048291115569028?journalCode=newa>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5812464/>

Kongtip, P., et al. “Informal workers in Thailand: Occupational health and social security disparities.” *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* 25.2 (2015): p.189-211. Lee, K., McGuinness, C., and Kawakami, T., Research on occupational safety and health for migrant workers in five Asia and the Pacific countries: Australia, Republic of Korea, Malaysia, Singapore and Thailand. ILO DWT for East and South-East Asia and the Pacific. (2011)

MAP Foundation. Regular Rights, Second Edition. A Study on the Impact of Regularization of Migrant Workers from Myanmar (Burma) in Thailand. MAP Foundation and Terre Solidaire. (2015)

Mrema, E.J., et al., “Pesticide Exposure and Health Problems Among Female Horticulture Workers in Tanzania,” *Environmental Health Insights*. (22 June 2017)

Pesticide Action Network (PAN) – “Chlorpyrifos,” accessed October 2019, at <https://www.panna.org/resources/chlorpyrifos-facts>

Pensupar, K. and Oo, Y. “Changes in the Agricultural Labor Force of Thailand and the Impact of the Alien Workers on it Economy.” Food and Fertilizer Technology Center for the Asian and Pacific Region (2015).

Phuong, N. T., “Pesticide use in Agricultural Production in Thailand.” Center for Applied Economic Research, Kasetsart University Thailand (2016). http://ap.ffc.agnet.org/ap_db.php?id=727

Siriruttanapruk.S, Integrating Occupational Health Services into Public Health Systems: A Model Developed with Thailand’s Primary Care Units, Bangkok. ILO. (2006)

Thai PBS World, “41 percent of vegetables in Thai markets exceed contamination standards” as accessed 30 June 2019

https://www.thaipbsworld.com/41-percent-of-vegetables-in-thai-markets-exceed-contamination-standards/?fbclid=IwAR1yKaFeRdoFk_JF0L3dEsCSMO3J_pbv78UO5WtnyS6OQsX8v8gMoBkJIII

Thetkathuek. A, et al., 2017, as cited in: Junghus, C., et al., “Chapter 4 - Working Conditions for Migrants in Thailand’s Agricultural Sector.” Harkins, B., Thailand Migration Report 2019, United Nations Thematic Working Group on Migration in Thailand, Bangkok. (2019)

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