Illegal Pesticide Trade in The Mekong Countries: Case Studies from Cambodia and Lao PDR

CEDAC, SAEDA and PANAP

2013

ABOUT SAEDA

The Sustainable Agriculture and Environment Development Association (SAEDA), formerly SAF (Sustainable Agriculture Forum), works to support vulnerable communities by promoting sustainable agriculture, increase capacity and awareness to safeguard the environment. SAEDA's projects focus on three main areas of intervention: Sustainable Agriculture, Chemical Pesticide Risk Reduction, and Biodiversity Conservation.

SAEDA envisions a future for Lao communities with sustainable livelihoods, food security and nutrition based on environmentally sound agricultural development. As part of its mission SAEDA works to promote sustainable agriculture and environmental conservation through capacity building and income generation using participatory approaches that empower its constituency of farmers, women, youth, and ethnic minorities.

Website: www. https://saedalao.wordpress.com/

ABOUT CEDAC

The Cambodian Center for Study and Development in Agriculture (CEDAC) envisions a Cambodia society where small farming households enjoy good living conditions and strong mutual cooperation, with the right and power to determine their own destinies, as well as play an important role in supplying healthy food for the whole society.

For more than 16 years, Centre d'Etude et de Développement Agricole Cambodgien / Cambodian Center for Study and Development in Agriculture (CEDAC) has been working to build the capacity and knowledge of rural farmers in ecologically-sound agriculture. Founded in August 1997, with initial support from the French NGO GRET, today CEDAC stands as the preeminent Cambodian organization in the fields of agricultural and rural development, and is especially recognized for its farmer-led extension services, agricultural innovation trainings, support for farmer organizations and publications.

Website: www.cedac.org.kh/

ABOUT PAN AP

Pesticide Action Network Asia and the Pacific (PAN AP) is one of the 5 regional centres of Pesticide Action Network (PAN), a global network dedicated primarily towards the elimination of harm caused to humans and the environment by pesticides and towards promoting biodiversity-based ecological agriculture.

PAN AP's vision is of a society that is truly democratic and culturally diverse, based on the principles of food sovereignty, gender justice and environmental sustainability. PAN AP has developed strong partnerships with peasants, agricultural workers, indigenous peoples, fisherfolks, rural women movements and other small food producers in the Asia Pacific region. Guided by the strong leadership of these grassroots groups, PAN AP has become a strong advocacy network with a firm Asian perspective.Our mission lies in strengthening people's movements to advance and assert food sovereignty,promote biodiversity based ecological agriculture and the empowerment of rural women; protect people and the environment from highly hazardous pesticides; defend the rice heritage of Asia and resist the threats of corporate agriculture and neo-liberal globalisation.

Currently PAN AP comprises 108 network partner organisations in the Asia-Pacific region and links with other civil society and grassroots organisations, regionally and globally.

Website: www.panap.net

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ILLEGAL PESTICIDE TRADE IN THE MEKONG COUNTRIES: Case Studies from Cambodia and Lao PDR

Agriculture is a major source of livelihood and income for a majority of the people and also a major component of the national economies in Cambodia and Lao PDR. With the introduction of modern crop varieties and farmers' efforts to improve yields and incomes, pesticide use has been increasing in both countries; expansion of commercial plantation crops in recent years has further strengthened this trend. The governments see pesticide use as part of their agricultural development plans and strategies to raise national incomes and reduce rural poverty.

However, neither Cambodia nor Lao PDR manufacture pesticides. So while, to some extent, pesticides are officially imported, most, including some highly hazardous pesticides (HHPs) banned in both Cambodia and Lao PDR, are illegally brought in, mainly from neighboring pesticide-manufacturing countries, across porous borders. These illegal pesticides are freely sold in the local markets by retailers most of whom have no license nor knowledge of the products, and used inappropriately and without precautions and protective measures by farmers who are unaware of their ill-effects, resulting in health problems and environmental contamination.

These practices, particularly the use of illegal HHPs, have raised concerns among civil society organizations as well as the governments. As a result, some efforts have been made to regulate cross-border trade and the sale and use of pesticides in these countries but these efforts have not seen much success because of lack of enforcement. Even confiscation of banned pesticides is a problem as the countries lack the technological means to safely dispose of or destroy the hazardous chemicals.

The two studies here – "Illegal pesticides in Cambodia" (2011) and "Illegal pesticide trade in Mekong countries: Case of Lao PDR" (2011 to 2013) highlight these and other related issues. They focus on problems of pesticide regulation, trade in banned and illegal pesticides, use of inappropriate labels on products, health and environmental effects of these pesticides, etc. The studies share several broad similarities, which are also common to many other developing countries in South-East Asia. They were conducted in two areas in Cambodia, bordering Vietnam and Thailand, and three areas in Lao PDR, bordering Thailand, Myanmar, China and Vietnam from 2011 to 2013.

The studies are part of a project, "Community Pesticide Monitoring", under a broader collaborative program "Towards a non-toxic environment in South-East Asia" between Pesticide Action Network Asia and the Pacific and the Cambodian Center for Study and Development in Agriculture (for the Cambodian study) and Sustainable Agricultural and Environment Development Association (in the case of Lao PDR). This program seeks to raise public awareness of pesticide risks and empower communities to tackle pesticide problems through community-based pesticide action monitoring, education and advocacy. Using this approach, it also seeks to promote biodiversity-based ecological agriculture to minimize or eliminate the use of chemical pesticides.

Problems of pesticide regulation

Both Cambodia and Lao PDR have enacted laws to regulate cross-border and domestic pesticide trade , distribution and use. Both countries have banned or restricted the use of many hazardous pesticides (mainly WHO Class 1a and 1b). And rules in both countries require that pesticide products be labeled in local languages (Khmer in Cambodia and Lao PDR so that farmers can understand the nature of the products and how to use them to minimize exposure.

The studies, though, showed that most of these rules are flouted. Pesticides are brought into the countries across the borders, without being checked, by companies, middlemen (pesticide suppliers), retail traders and, in smaller quantities, even by farmers living in the border areas. "For most part, import and sales of pesticides took place outside government regulations", says the Lao PDR study. "Most retail shop-owners lacked a license to sell pesticides and were unaware of the banned pesticides". Banned pesticides such as paraquat and methomyl (and many others) were easily available in the markets and commonly used in both the countries. Most of the banned and restricted pesticide products in use were not registered and so also

the companies that sold them. For example, 75-77 percent of the companies who sold pesticides in the two survey areas in Cambodia and in Vientiane Capital in Lao PDR were not registered.

Most of the pesticide products also had labels in foreign languages -- Vietnamese and Thai in the case of Cambodia, and Thai and Chinese in the case of Lao PDR. The fact that 85 percent of the pesticide products in Xiengkhouang province, one of the study areas in Lao PDR bordering China, had Chinese labels and 82 percent of the products in the two survey areas in Cambodia had Vietnamese and Thai labels indicates the extent of the problem. Farmers therefore could not read the instructions on how to use the pesticides; none of the farmers, for example, in the Cambodian study could read "pesticide use instructions", though most of the farmers had used banned and restricted pesticides such as methamidophos, methomyl, paraquat, zinc phosphide and dichlorvos. (That the use of local languages has been steadily increasing of late is an encouraging sign.)

Apparently, law enforcement and implementation is a problem. There was a lack of infrastructure and manpower for checking pesticides at the border and inspection of shops and markets. Customs officers and many government officials were "not familiar with the regulations and had no training" in the proper use of pesticides and not much knowledge of the banned products. Down the line, retailers and farmers too were "unaware" of the banned pesticides and their health hazards. Farmers thus faced the risk of exposure to harmful chemicals and health problems.

Export crops and pesticide use -- a paradox

Meanwhile, agricultural development plans and strategies to increase production and export revenues from plantation crops are adding to the problems in Lao PDR. Plantation crops use more herbicides to control weeds, and the expansion of plantation crops such as rubber, sugar cane and particularly hybrid corn in Lao PDR has increased the use of toxic pesticides brought from neighboring countries, especially China, notes the Lao PDR study. As the government encouraged farmers to grow hybrid corn, a "hot" and export commodity, it has led to "a surge in pesticide use". "The long porous borders with pesticide-manufacturing countries and the farmers' increasing dependence on toxic pesticides thus pose a challenge to implementing the new pesticide rules" (introduced in 2010), the study points out.

In 2012, therefore, the Department of Agriculture, in association with UN Food and Agriculture Organization, initiated a nation-wide effort to strengthen the regulatory framework, train pesticide inspectors, carry out inspections of pesticide shops (distribution centers) in provincial capitals and raise awareness among retailers by providing them with basic information on pesticides. To reduce pesticide use, training was also conducted in Integrated Pest Management. And, with an eye on the growing international market for chemical-free food products, the government also sought to promote sustainable agriculture. If implemented well, these efforts could help curb the trade in toxic pesticides and reduce their use.

Exposure risks and health problems

Health problems related to pesticides are common in both countries. In Cambodia, these "appeared to be widespread" with 70 percent of the farmers in the surveyed areas developing headaches, dizziness tiredness and other symptoms while spraying pesticides or soon after. Farmers in Lao PDR reported, besides common symptoms such as rashes and headaches, a few deaths following the use of pesticides. Environmental problems, mainly contamination of water in Cambodia and of traditional foods such as wild mushrooms in Lao PDR, were also reported. Significantly, several people in Lao PDR had been hospitalized after eating pesticide-contaminated mushrooms collected from forests close to corn fields.

Because of lack of training, unsafe disposal of used pesticide containers was another source of contamination of natural resources. In Cambodia, farmers reported that they threw empty pesticide containers and washed pesticide sprayers in farms and in water courses and canals; as a result, there was a decline in aquatic resources in the neighborhood lakes and rivers, according to some farmers. In Lao PDR also, farmers threw pesticide containers in farms, rivers or near their houses, contaminating the soil, water and food sources and creating health risks for communities.

Thus, in both countries, rural communities faced a "double exposure" risk -- from poor pesticide use practices and unsafe disposal of used containers. This underscores the important role of good training. Farmers who had some training reported "being careful" in following instructions to minimize exposure.

Conclusions and recommendations

The two studies make some interesting suggestions for better implementation of pesticide regulations within countries and to curtail illegal trade in hazardous pesticides in the region.

- Manufacturing countries should enact mechanisms to prevent export of hazardous pesticides to countries, that have banned them.
- To check imports of illegal pesticides, infrastructure and manpower to monitor pesticide products at border check-points, shops and markets should be strengthened.
- Given the long porous borders with pesticide-manufacturing countries, measures such as banning HHPs and stricter monitoring are not enough to stop imports of illegal pesticides. Experience shows that bans have worked only when neighboring or other manufacturing countries from where the pesticides came stopped their production (as has been the case with some HHPs). The Lao PDR study therefore calls for strong regional cooperation in "preventing unwanted imports and curtailing the proliferation of HHPs" in the region. Further, when banned pesticides are confiscated in a country which lacks the means to dispose of them safely, the onus should be on producing countries to "accept the return of such banned pesticides". Countries in the regions need to discuss and develop these measures under the framework of The Strategic Approach to International Chemicals Management (SAICM), which is a global policy framework to foster the sound management of chemicals, suggests the study.
- Finally, beyond all these, governments and international agencies should strongly promote ecological and sustainable agriculture and help farmers move away from the use of hazardous pesticides. This will curtail trade in illegal pesticides in the region and also promote "healthy rural livelihoods".
- To facilitate this process governments should exchange information on banned pesticides in their countries and the manufacturing countries should put regulations in place that forbid pesticide distributors to export pesticides to countries that have banned them.

- In addition, pesticide manufacturing exporting countries should establish protocols to accept returned pesticides and hazardous chemicals from the countries where these chemicals are banned. Such an initiative should be part of a regional effort to curtail the illegal trade of pesticides.

- A mechanism to curtail illegal trade of pesticides should be in place and the Strategic Approach on International Chemicals Management (SAICM) offers a platform to advance this initiative.

- Ultimately, governments and international agencies should support policies to encourage farmers to transition away from toxic chemicals and promote sustainable agricultural practices that provide safety and a dignified livelihood to rural communities.

CASE OF LAO PDR

Vientiane Capital and provinces of Loyang Namtha and Xiengkhouang

Pesticides on the left counter sold with other stuff, Vientiane Capital, Lao PDR

Reports on the increasing use of pesticides in Lao PDR (van der Wulp 2006; Lao-FAO IPM and FAO Pesticide Risk Reduction Programme 2009, 2011; FAO IPM Vegetable Regional Programme 2010) have raised the alarm about the use of highly hazardous pesticides (HHPs) by farmers wearing little or no protection. Some of these pesticides, i.e., paraquat and methomyl, have been banned in the country. Lao does not produce active ingredients or pesticide formulations. Nearly all pesticides sold and used in Lao originate from Thailand and China, and to some extent from Vietnam. Lao, as with most non-industrialized countries, lacks the technology to dispose of pesticides safely. Thus, enforcing pesticide regulations, for example by confiscating illegal pesticides, becomes a challenge in the absence of adequate technology to dispose of hazardous products. Regional cooperation among countries is needed, especially from the pesticide manufacturing countries in order to protect communities from toxic chemicals and to enforce national laws. Pesticide manufacturing countries should take measures to both 1) prevent exports of pesticides to countries which have banned them, and 2) accept returned chemicals from countries where they have been confiscated by government authorities. The Strategic Approach on International Chemicals Management (SAICM) offers an adequate framework to advance an international policy mechanism to curtail the illegal flow of pesticides. Furthermore, international donors and development agencies should support government policies that promote sustainable agriculture, free of hazardous chemicals, which reduces the incentive for illegal trade.

Introduction

On 2011 PAN AP, in collaboration with the Sustainable Agriculture and Environment Development Association (SAEDA), and with support from the Lao Department of Agriculture (DOA), and the Ministry of Natural Resources and the Environment (MoNRE), conducted a survey to characterize the movement and use of pesticides in Lao PDR, particularly of banned substances. Interviews of retail shop owners, farmers, and government officials in Vientiane Capital and the border provinces of Louang Namtha, and Xiengkhouang were conducted (Table 1). Vientiane Capital borders Thailand on the west, separated by the Mekong River. Louang Namtha borders Myanmar and China on the north, and Xiengkhouang borders Vietnam on the east side. Most of the pesticide applications had taken place between March and June, during the main planting season, therefore pesticide stocks in stores were low in July when the survey took place. This study confirmed previous reports that most pesticides found in Lao originate from Thailand and China, and are sold under Thai and Chinese labels (Louanglath, Tiapangnavong, van der Wulp, 2008; Lao -FAO IPM and FAO Pesticide Risk Reduction Programme 2009, 2011). Recently banned pesticides, such as the herbicide paraquat and the insecticide methomyl, were still easily available.

Paraquat was found in Vientiane Capital and Louang Namtha and Xiengkhouang provinces, commonly with a Thai label and Syngenta's logo.Paraquat with a Chinese label was found in the northern province of Louang Namtha. It should be noted that China's decision to phase out paraquat by 2016 may help curtail its availability in Lao, especially in the northern provinces.

Methomyl with a Thai label and DuPont's logo (Lannate) was easily available in Vientiane Capital and Xiengkhouang. In 2012 two -rounds of nationwide inspections of pesticides conducted by FAO and DOA found that paraquat and methomyl were still sold. The insecticide endosulfan, banned in Lao, was not found in this survey, however, SAEDA recorded the active ingredient from an empty bottle with a Chinese label, that was brought by a farmer to a workshop on pesticide-awareness raising in Namor district, Oudmxai province in July 2013 (B. Pathilath, personal communication, 2013).All pesticides recorded in Vientiane Capital (Tables 2 & 3) and 86% of the pesticides found in Xiengkhouang province shops (Table 6), including the ones found in farms (Table 7), had Thai labels.

In Xiengkhouang, two brands of glyphosate had Chinese labels and three herbicide brands, including atrazine, had Vietnamese labels. In Louang Namtha province, 65% of the pesticides found in shops (Table 4), and most found in farms (Table 5), had Chinese labels. Pesticides with Lao labels were not found in the surveyed areas. Over 50% of the pesticides found in Vientiane Capital were insecticides, over 70% of the pesticides found in Louang Namtha province and over 50% of the pesticides found in Xiengkhouang province were herbicides. Shopkeepers and farmers reported that 15-30 litre containers of glyphosate with Chinese label were in high demand in the rubber, sugar cane plantations of Louang Namtha and hybrid corn plantations of Xiengkhouang province. Paraquat, atrazine, and 2,4-D herbicide formulations were also common.

Pesticides and other agricultural products in a Vientiane Capital shop

Methomyl and paraquat, both banned in Lao, are easily available

Some highly hazardous organophosphate (OP) insecticides were found, such as dicrotophos (WHO class Ib)[1], widely available with Thai label especially around the Mekong area. Also, dichlorvos (Ib), found with Thai label in Vientiane Capital and Chinese label in Louang Namtha province. OP insecticides Class Ia (extremely hazardous) were absent: for instance, methyl parathion (Ia), and mevinphos (Ia), that were readily available less than a decade ago, were not found. This is attributed to the fact that Thailand banned both and China banned methyl parathion, although mevinphos is still registered by one company in China (PEAC, personal communication, 2013). Other OP Class Ib insecticides, such as monocrotophos, and methamidophos, that were common in the past (Van der Borght et al., 2004), were no longer available.

Monocrotophos and methamidophos have been banned in Thailand and China, and, consequently production and export to Lao also have stopped. The most common insecticides recorded in this survey were cypermethrin (II) and dicrotophos (Ib), especially around the Mekong area, and to a lesser extent in Xiengkhouang province. Pesticides appeared to move easily into Lao across its long porous borders, particularly from Thailand and China as indicated by the pesticide labels around the Thai (Mekong River) and Chinese borders respectively.

The international checkpoints and the smaller traditional checkpoints were busy with daily trade. However, from observations and conversations with pesticide shop owners and farmers, it appeared that pesticide inflow across the Mekong River from Thailand took place in great part through district checkpoints and by means of small personal boats. Some shop retailers in Lao indicated that they purchased pesticides directly from Thai shops and sold them to other Lao shop owners as far as Xiengkhouang, where pesticides arrived by bus.

Several farmers along the Mekong River reported purchasing pesticides in Thai stores, which they transported back in their own boats. Farmers residing inland tended to buy pesticides in local Lao shops.

[1] WHO classification refers to technical grade active ingredients in pesticides and is based on acute oral and dermal toxicity (to the rat). The WHO intends the final classification be based on the amount of active ingredient in a formulation rather than on the technical product. However, under conditions of use in developing countries exposure can far exceed those envisage by label use rates and the calculations provided by WHO. Also, on illegally traded pesticide products, the label content may not be accurate. Therefore, PAN proceeds on a precautionary basis that the active ingredient is inherently hazardous.

Illegal pesticide trade through Lao's long porous borders

Lao's long porous borders and the ease of movement of pesticides with little control, make enforcement of pesticide regulations and bans a formidable challenge. In the last decade, pesticide bans became effective only when the neighboring manufacturing countries stopped their production, such as occurred with methyl parathion, mo no crot opho s, a n d methamidophos, no longer found in the Mekong countries after its production ended in Thailand and China. Therefore, strong regional cooperation is needed, especially from the neighboring countries that manufacture pesticides, to prevent unwanted imports particularly of banned ones and to curtail the proliferation of HHPs in Lao and other countries in the region. While it may be difficult to prevent sales of banned pesticides to individuals from Lao purchasing a few bottles in stores across the border, it may be feasible for shops in neighboring manufacturing countries to exclude banned pesticides from wholesale orders placed by distributing shops from Lao. Such policy should be discussed and further developed by countries in the region.

Regional cooperation is needed to curtail illegal trade of pesticides

Manufacturing countries where the pesticides originate should establish mechanisms to accept the return of banned products from countries where they have been confiscated by government agencies. SAICM appears to offer a viable framework, under which such mechanism could be developed.

In the northern Louang Namtha province, shop owners of Chinese ethnicity preferred to buy pesticides in Yunnan province, China, while Lao nationals preferred to purchase pesticides in Vientiane Capital, which were transported by bus or truck, and sometimes purchases were made in occasional trips to Thailand.

From the three farmers interviewed along the Lao-China border, one of them reported often buying herbicides in Yunnan during trips to visit relatives. The other two farmers bought pesticides from China at a bi -weekly fair in the Lao-China border area and were reluctant to make trips to acquire pesticides and goods in China because of the levy imposed on trucks crossing the border from China.

Some shops in Xiengkhouang reported placing pesticide orders to shops in Vientiane, which were shipped by bus. Plastic containers, 15-30 litre, of glyphosate with Chinese label were bought in Louang Namtha, and transported in personal trucks or buses. Pesticides with Vietnamese labels were rare. This was attributed to people in Lao not being able to understand the Vietnamese language.

On the other hand, Thai language was easily understood by most people in Lao, and Thai TV channels, carrying pesticide adds, were watched frequently. Some shops in Lao, according to farmers, offered energy drinks with pesticide purchases. A household pesticide had a small dishwater attached as a bonus.

Lao shares borders with pesticide manufacturing countries. Most of the pesticides found originated from Thailand and China

Also, according to government officials, pesticides salespeople from Thailand promoted their products among Lao farmers. For instance, farmers talked of a past scheme where points could be accumulated and exchanged for money when fellow farmers were recruited to use certain chemical products.

Although national data on pesticide imports with/without legal permits and number of retail pesticide shops with/without licenses was not available, this survey indicated that most pesticide imports in Lao lacked import permits and most pesticide retail shops operated without licenses.

In Vientiane Capital, according to the Provincial Agriculture and Forestry Office (PAFO Vientiane, 2011), in 2011 only 15 out of 65 shops had license to sell pesticides.

Thus, taking this to the national level, in 2011 most of the pesticides sold and used in Lao were technically illegal because imports and sales tended to take place largely without a government license.

However, important developments for pesticide enforcement regulations have taken place since then, such as the establishment of a nation-wide inspection scheme with the assistance of FAO.

In early 2012, FAO and DOA trained inspectors from all provinces and two rounds of nation-wide inspections of all pesticide shops in provincial capitals were conducted. Shopkeepers received an information booklet with basic information about pesticides, the list of banned pesticides, and the elements of the pesticide regulation that are most relevant to retailers (van der Wulp, personal communication, 2013).

DOA officials confirmed the survey findings that, along the Mekong River, most of the pesticides used were insecticides to control agricultural pests, and heavier use of herbicides took place in the regions towards China and Vietnam.

The herbicides glyphosate and paraquat were sold and used in larger quantities than other pesticides, especially in the northern province of Louang Namtha and the eastern province of Xiengkhouang where there was high demand in the rubber and hybrid corn plantations respectively.

Support is needed for biodiversity-based ecological agriculture

Government and international agencies should support programs and policies that promote agriculture free of hazardous pesticides, assist farmers to transition from synthetic chemicals into ecological and biodiversesus tainable agr ic ul tur e, an d promote the marketing of safe and nutritious agricultural products . T hes e m easures would assist in advancing healthy rural l iv e l ih oo ds , an d reducing the pressure for illegal trade in pesticides.

Store with miscellaneous items, including eggs, drinks, pesticides and other agricultural products located next to each other

Lao Pesticide Regulations

The Lao government, with FAO's support, has worked to strengthen the regulatory framework for pesticides. As part of this effort, Lao's Ministry of Agriculture and Forestry (MAF) issued new regulations on the control of pesticides in 2010 (MAF, 2010)**.**

The regulations include registration; rules on import, export, distribution, transportation, storage and transit of pesticides; and on packaging, labeling and advertising. MAF's new regulations contain a list of banned pesticides, and provisions on pesticide labeling in Lao and/or English languages. DOA oversees the implementation of pesticide regulations at the national level.

The Provincial Agriculture and Forestry Office (PAFO) is in charge of implementing the regulations at the provincial level, such as import and distribution of pesticides and agricultural products, and license approval.

The District Agriculture and Forestry Office (DAFO) implements the regulations at the district level, such as inspection of retail shops that sell pesticides. In July 2011, enforcement was in a pilot stage in Vientiane Capital and Xiengkhouang province, and in 2012, with FAO's assistance, a nation-wide inspection scheme was established.

The field assessment in July 2011 indicated that for the most part import and sales of pesticides were taking place outside government regulations, i.e., most retail shop owners lacked a license to sell pesticides and were unaware of banned pesticides. Also, many government inspectors were not familiar with the new regulations and lacked appropriate training.

In addition to nationwide trainings of pesticide inspectors in 2012 by FAO and DOA, an IPM programme on pesticide reduction was implemented and is due to end in 2013.

IPM trainings have focused on stopping the use of paraquat and WHO Class Ia pesticides, which are banned under the new pesticide regulations.

At the same time that the rubber, sugar cane, and hybrid corn expansions have greatly increased inputs of herbicides, the government was making efforts to find a niche in the international market for Lao's chemical -free agricultural products. DOA was seeking collaboration with international organizations aimed at promoting sustainable agriculture and increasing marketing skills among farmers. To this end, DOA had facilitated FAO's Farmer Field Schools (FFS) trainings in three districts and wished to expand it further. However, funding for these projects was limited.

Lao has ratified the Stockholm, Rotterdam, and Basel Conventions. The new Ministry of Natural Resources and the Environment (MoNRE), created in 2011, was acting as the focal point.

Lao's new pesticide regulations enacted in 2010 and the ongoing government efforts could boost implementation of the chemical conventions, Stockholm and Rotterdam in particular, by eliminating or restricting persistent organic pollutants and by preventing unwanted trade of the respective chemicals listed in the conventions.

Government officials considered it a challenge to implement the new pesticide regulations because of Lao's long porous borders with pesticide manufacturing countries and farmers increasing dependence on these toxic chemicals.

Woman farmer in Vientiane Capital

Pesticide Exposure Risks

Pesticide applications were often done by women, and even children, using a pump sprayer, according to government officials. When mixing pesticides, the tank was frequently placed in the river with children playing nearby.

The wide availability of the OP insecticide dicrotophos (Ib) around the Mekong area indicated demand for this highly hazardous insecticide, which is acutely toxic, a cholinesterase inhibitor and possible carcinogen (PAN Pesticide Database 2010; American Bird Conservancy 2010; PAN International 2013).

The highly hazardous insecticide methomyl (Ib), acutely toxic, a cholinesterase inhibitor, a suspected endocrine disruptor and highly toxic to bees (PAN International 2013) was easily available and more common in places close to the Mekong River. Methomyl was banned in 2010, yet continued to be sold.

According to DAFO officials, farmers may spray vegetables with pesticides and bring them to the market the next day.

Personal Protective Equipment lacking and not suitable for climate

In Lao, as in most non-industrialized countries, adequate personal protective equipment (PPE) for pesticide applicators is lacking (Lao-FAO IPM and FAO Pesticide Risk Reduction Programme, 2009), and even if it were available, farmers may not be able to afford it. Furthermore, under the hot and humid weather conditions of the region it would be impractical to wear PPE during the long hours of pesticide application.

Also, the highly hazardous rodenticide, zinc phosphide (Ib) was found in Vientiane Capital and Xiengkhouang, available for household use.

In terms of quantity, the number and size of herbicide containers available in stores, indicated that herbicides were used in larger amounts than other pesticides, particularly in the rubber, sugar cane, and hybrid corn plantations.

Dish soap gift attached to household pesticide

Glyphosate herbicide stored inside farmer's house in Louang Namtha

Pesticides storage poses risks to people

While some farmers were aware of the health risks posed by pesticides and avoid storing them at home, others stored pesticides inside or under their houses.

According to government sources, herbicide use was seasonal, with applications taking place after the rains once or twice a year with (in descending order) glyphosate, paraquat, atrazine, and 2,4 D.

Government officials expressed concern about the storage and disposal of pesticides, which can present risks to human health and the environment.

Pesticide containers threaten the environment

Used pesticide containers were thrown in the field, river or near houses. Aside from the cost of implementing a collection system for pesticide packaging, the technology for their safe disposal is not available in less developed countries such as Lao.

Pesticide Enforcement in Vientiane Capital

Lao shares a 1,754 km border with Thailand along the Mekong River, which includes the capital, known as Vientiane Capital. On July 16-19, 2011, eight retail shop owners, and fifteen rice/vegetable farmers from six villages in the districts of Hadxayfong, Sikhottabong, and Saythany were interviewed (Table 1) along with government officials from DOA, MoNRE, PAFO, and FAO -IPM. Hadxayfong and Sikhottabong are located next to the Mekong and Saythany is about 16 km inland away from the river.

Daily, thousands of trucks carrying goods, including pesticides, cross Vientiane's international bridge. The Customs officer, interviewed in this survey, was not aware that, under Lao's new pesticide regulations, imported pesticides must be cross-checked with MAF's list of registered and banned pesticides. This situation might change with the government's undergoing efforts to train inspectors nationwide and to strengthen the regulatory framework for pesticides.

Empty pesticide and mixing containers thrown close to water sources around Vientiane Capital

Interview with retail shop owner. Shop sells pesticides and miscellaneous items, including prepared food

Daily trade with Thailand occurs through district checkpoints along the Mekong River (photo from Thadeua village, Vientiane Capital)

Table 1. Pesticide retail shops and farmers interviewed in Vientiane Capital, Louang Namtha and Xiengkhouang provinces.

1. Retails shops

No.	Province	District	Village	No. of Shops
Vientiane Capital (VTC)				
1	VTC	Hadxayfong	Thadeua Donekerd	1 2
2	VTC	Sikhottabong	Nongda Sikhai market	2 1
3	VTC	Saythany	Phakao	2
Louang Namtha Province (LNT)				
1	LNT	Sing	Donchai	2
2	LNT	Louang Namtha	Viengkham	3
Xiengkhouang Province (XK)				
1	XK	Nonghet	Thamsai Phakae	2 1
2	XK	Pek	Phon Sa-art Phonsavanh	1 1

2. Farmers interviewed

No.	Province	District	Village	No. of Farmers
Vientiane Capital (VTC)				
1	VTC	Hadxayfong	Donekerd	5
2	VTC	Sikhottabong	Mai Nongda	2 3
3	VTC	Saythany	Khok Yai Nongboua	3 2
Louang Namtha Province (LNT)				
1	LNT	Sing	Donchai Oudomsin	2 1
Xiengkhouang Province (XK)				
1	XK	Nonghet	Nongsamchai Korhad Phakae	1 1 1

Also, small-scale trade with Thailand takes place through the traditional checkpoints in the districts bordering the Mekong River. Barges take people to Thailand to buy goods including chickens, vegetables, yogurt, furniture, clothes, and also pesticides. The officers working at the traditional checkpoints were not aware of pesticide regulations and one of them said that he would not be able to recognize a bottle of pesticides. According to government officials, the checkpoint officers tend to originate from inside the districts and are acquainted with most of the people commuting across the Mekong river.

At the Thadeua checkpoint in Hadxayfong, only district residents were allowed to take the barge to Thailand.

In Sikhottabong, people from other districts were allowed to board the barge, which commuted to Thailand twice daily. People said that a 20-30 minute bus ride on the Thai side, across the river from Sikhottabong, led to a town where they could shop. Also, farmers used their own boats to cross the Mekong River to buy goods in Thailand. Saythani district is located inland away from the Mekong River and does not have a border checkpoint.

A DAFO official, in charge of teaching farmers the appropriate use of pesticides, was not aware of farmers experiencing skin rashes or health problems related to pesticides. He inspected retail shops once a year and was not aware of the latest pesticide regulations or about banned pesticides. This was the situation in 2011; however, the government has launched a nationwide inspection scheme, with FAO's assistance, to strengthen pesticide regulation enforcement.

In 2011 a government pilot project, supported by FAO, on the enforcement of Lao's new pesticide regulations was in the initial stage in Vientiane Capital with twelve DAFO inspectors conducting monthly inspections of pesticide retail shops. An inspector's handbook was under development and was released in 2012.

Vientiane's PAFO had established a Village Pesticide Control System in 14 villages in nine districts, which consisted of a village committee in charge of monitoring pesticides, making regulations, and imposing sanctions at the village level. Also, government officials expressed high interest in developing a model of ecological agriculture suiting Lao's climate and crops, and enticing farmers to use agro-ecological methods. However, DOA's deputy director, the head of the Pesticides Regulatory Division, and PAFO's director pointed out that, with limited staff and Lao's long porous borders, it would be a challenge to implement regulations at small border crossings in the Mekong River and around the country and thus help reduce the inflow of hazardous pesticides from neighboring manufacturing countries.

FAO is actively supporting the government's efforts to strengthen the pesticide regulatory framework and several initiatives have continued after the July 2011 survey described in this report.

Pesticides in the market: Vientane Capital

In 2011 in Vientiane Capital none of the eight retail shops surveyed were licensed to sell pesticides and all the pesticides sold at these shops had Thai labels (Table 2).

Also, in 2011 only 15 out of 65 shops in Vientiane Capital had a license to sell pesticides (PAFO Vientiane, 2011). A number of pesticides classified by the WHO as highly hazardous (Ib), were found (Table 2), including the OP insecticide dicrotophos, and the rodenticide zinc phosphide, the latter sold as a household pesticide. Methomyl, a banned insecticide, was found in all shops. The herbicide paraquat (WHO II), also banned, was found in four shops and the rest had run out of stock. Two rounds of nationwide inspections in 2012 conducted by FAO and DOA found that paraquat and methomyl were still sold.

Table 2. Pesticides recorded in eight retail shops of three districts in Vientiane Capital.

No.	Commercial Name	Active Ingredient	Type	Language	Shops*	WHO Class	Company
1	Alachlor	Alachlor	Herbicide	Thai	1	III	Mastec Vago Trade
2	Allethrin coil	Allethrin	Insecticide	Thai	1	II	
3	Almix	Metsulfuron-methyl + chlorimuron-ethyl	Herbicide	Thai	1	Tab. 5	DuPont
4	Siana	Thiametoxam	Fungicide, Insecticide	Thai	1	Not listed	Not found
5	Kaodao	Abamectin	Insecticide	Thai	1	Not listed	Unilife
6	Jacket	Abamectin	Insecticide	Thai	1	Not listed	KEF Industry
7	Avermectin	Abamectin	Insecticide	Thai	2	Not listed	Not found
8	Chix	Betacypermethrin	Insecticide	Thai	1	Not listed	Sotus Co., Ltd.
9	Not found	Carbosulfan	Insecticide	Thai	2	II	Not found
10	Dakonil	Chlorothalonil	Fungicide	Thai	2	Tab. 5	TJC Chemical Co.
11	Fonotox	Chlorpyrifos	Insecticide, Nematicide	Thai	1	II	Not found
12	Knocking	Cypermethrin	Insecticide	Thai	2	II	Thai On
13	Foliwdol	Cypermethrin	Insecticide	Thai	1	II	Not found
14	Molidol	Cypermethrin	Insecticide	Thai	1	II	Chia Tai
15	Nockthrin 35	Cypermethrin	Insecticide	Thai	1	II	Chia Tai
16	Phonewdol	Cypermethrin	Insecticide	Thai	1	II	Master Agro. Co.
17	Fronge 10 EC	Cypermethrin	Insecticide	Thai	1	II	Master Agro. Co.
18	Didrien 330	Dicrotophos	Insecticide	Thai	4	Ib	Master Agrotrade Co., Ltd.
19	Not found	Dichlorvos	Insecticide	Thai	1	Ib	Not found
20	Stek Honda	Dicrotophos	Insecticide	Thai	2	Ib	Master Agrotek Co., Ltd.
21	Dyfos	Dicrotophos	Insecticide	Thai	1	Ib	Unilife
22	Dynor	Dicrotophos	Insecticide	Thai	1	Ib	S&P Formulator Co., Ltd.
23	Dokip	Dicrotophos	Insecticide	Thai	1	Ib	Mastec Vago Trade
24	Veron	Dicrotophos	Insecticide	Thai	1	Ib	Mastec Vago Trade
25	Tonchondrin	Dicrotophos	Insecticide	Thai	4	Ib	V.C. Thailand
26	Roundup	Glyphosate	Herbicide	Thai	1	III	Monsanto
27	Glyphosate 48	Glyphosate	Herbicide	Thai	1	III	Sotus Co., Ltd.
28	Glyphosate 48	Glyphosate	Herbicide	Thai	1	III	Ag-gro Thailand Co., Ltd.
29	Glyphosate 16	Glyphosate	Herbicide	Thai	1	III	Unochem

Table 2. Pesticides recorded in eight retail shops of three districts in Vientiane Capital. (contd. from previous page)							
No.	**Commercial Name**	**Active Ingredient**	**Type**	**Language**	**Shops***	**WHO Class**	**Company**
30	Glyphosate	Glyphosate	Herbicide	Thai	2	III	V.C.S. Agro Chem Co., Ltd.
31	J-UP	Glyphosate	Herbicide	Thai	1	III	J Group Techno-chemical Co., Ltd.
32	Karate 2.5 EC	Lambda-cyhalothrin	Insecticide	Thai	3	II	Syngenta
33	Motine	Mancozeb	Fungicide	Thai	1	Tab. 5	Thao Agro Co.
34	Penncozeb	Mancozeb	Fungicide	Thai	4	Tab. 5	Sotus International Co., Ltd
35		Mancozeb	Fungicide	Thai	2	Tab. 5	Not found
36	Lannate	**Methomyl (banned)**	Insecticide	Thai	8	Ib	DuPont (Thailand) Co. Ltd.
37	Topsin-M	Methyl thiophanate	Fungicide	Thai	1	Tab. 5	T.J.C. Chemical Co., Ltd.
38	Starkle	Dinotefura	Insecticide	Thai	1	Not listed	Sotus International Co., Ltd.
39	Gramoxone	**Paraquat dichloride (banned)**	Herbicide	Thai	5	II	Syngenta
40	Kakdum	Zinc phosphide	Rodenticide	Thai	3	Ib	Panter United Co., Ltd.
41	Ashonud 95	2,4-D sodium salt	Herbicide	Thai	2	II	P.Chemitec Co. Ltd. (Red Dog)
42	Baygon	Propoxur	Insecticide (household)	Thai	1	II	Not found
43	Aquatoll Super K	Endothal, dipotassium salt	Herbicide	Thai	1	II	Not found
44	Shieldtox	Permethrin	Insecticide (household)	Thai	2	II	Reckitt Benckiser
45	Golden Plus	Not found	Insecticide (household)	Thai	1	Not found	ARS Chemical Co., Ltd.
46	Gungga	Metaldehyde	Molluscicide	Thai	2	II	Fern Leaf?
47	Benomyl	Benomyl	Fungicide	Thai	1	Tab. 5	J Group Techno-chemical Co., Ltd.
48	Fungural	Copper Hydroxide	Fungicide, Nematicide	Thai	1	II	Sotus International Co., Ltd.
49	Goadi	Pyrazosulfuron-ethyl	Herbicide	Thai	1	Tab. 5	Sotus International Co., Ltd.
50	Omega	Dimethoate	Insecticide	Thai	1	II	
51	Cartap	Cartap hydrochloride	Insecticide	Thai	1	II	Sumitomo

* Number of shops where pesticide formulations were found.

A shelf with pesticides, including dichrotophos, paraquat, and pyrethroids in the back of a restaurant, Vientiane Capital

Shop owners reported buying pesticides directly from Thailand or from shops that had purchased the chemicals in Thailand.

A woman-run shop in Thadeua village, Hadxayfong district, about 300 -500 m from the checkpoint, had been buying pesticides for over 15 years from two steady suppliers in Thailand, which were then distributed to other shops in Hadxayfong and other districts. The shop was inspected by DAFO, although it was not licensed to sell pesticides. It was a relief not to find the acutely toxic methyl parathion, monocrotophos, and metamidophos, which were common in the past (van der Borght et al., 2004). Thailand and China do not manufacture these HHPs anymore and consequently illegal imports of these products have stopped. In their place pyrethroid insecticides, such as cypermethrin, were sold in containers resembling Folidol, the old trade name for Bayer's methyl parathion, which is no longer produced by the company.

Folidol look -alike pesticides had names that rhymed such as Molidol, Fonewdol, Fanaedol. Cypermethrin, classed as moderately toxic (WHO II), is a nerve toxicant with symptoms of exposure including dizziness, nausea, headaches, and seizures. In experimental animals cypermethrin has been found to cross the brain barrier and induce neurotoxicity and motor deficits (Singh, et.al. 2012). It is also classified as a possible human carcinogen and a suspected endocrine disruptor (PAN Pesticide Database, 2010).

Pesticides sold close to fresh food

Pesticide retail shops also sold food items and drinks often in close proximity of the chemicals. A restaurant in Nongda village had a shelf with paraquat, dicrotophos, pyrethroid pesticides, and animal feed on the back of tables were food was served.

Pesticide use on farms: Vientiane Capital

WHO Ib pesticides were also found at Vientiane's farms, including dicrotophos, methomyl and carbofuran, all insecticides (Table 3). Carbofuran although not recorded in shops, was found in farms. Carbofuran in addition to being acutely toxic is a cholinesterase inhibitor, and a suspected endocrine disruptor (PAN International, 2013).

Farmers grew rice during the rainy season and vegetables in the dry season. Among the vegetables planted were cabbage, brinjal, spinach, radish, Chinese cabbage, chilies, and tomatoes.

Farmers spoke of having rashes and headaches after spraying pesticides. They recalled a farmer, about a decade before, who had died after applying the insecticide methomyl. Several farmers mentioned leaving pesticides in the field, either in the open or in storage, and not taking them inside their homes because of bad smell.

A farmer, who had training on the use of pesticides, did not allow his children to play in the field in order to minimize exposure. He had used methyl parathion and monocrotophos in the past when they were available on the market.

In Nongda village, Sikhottabong, a farmer with training on IPM was aware of the health risks from pesticide exposure and didn't allow anyone in his family except himself to apply them. Although feeling dizzy after applying pesticides, he dismissed it saying it could be the effect of his high blood pressure. This farmer purchased paraquat, methomyl, glyphosate, and abamectin in Thailand after crossing the river on his boat. He farmed on an island in the Mekong River, away from his home located on the mainland. Mindful of protecting his family, the pesticides were left on the island and not taken home. However, he used empty pesticide containers as buoys with bait to capture fish.

Table 3. Pesticides found in 15 farms from three districts in Vientiane Capital.						
No.	**Commercial name**	**Active Ingredient**	**Type**	**Language**	**WHO Class**	**Company**
1	Kaodao	Abamectin	Insecticide	Thai	Not listed	Unilife
2	Abamade	Abamectin	Insecticide	Thai	Not listed	Not found
3	Avermectin	Abamectin	Insecticide	Thai	Not listed	MC
4	Furadan	Carbofuran	Insecticide	Thai	Ib	Not found
5	Fonewdol, fonewdone	Cypermethrin	Insecticide	Thai	II	Not found
6	Cyper	Cypermethrin	Insecticide	Thai	II	Not found
7	Fronge 10	Cypermethrin	Insecticide	Thai	II	Master Agro. Co.
8	Diedrin 330	Dicrotophos	Insecticide	Thai	Ib	Master Agrotek Co., Ltd.
9	Tonchodrin	Dicrotophos	Insecticide	Thai	Ib	Not found
10	Not found	Dicrotophos	Insecticide	Thai	Ib	Contact Group Co., Ltd.
11	No Up 48	Glyphosate	Herbicide	Thai	III	Not found
12	Karate 2.5 EC	Lambda-cyhalothrin	Insecticide	Thai	II	Syngenta
13	Penncozeb	Mancozeb	Fungicide	Thai	Tab. 5	Sotus International Co., Ltd
14	Not found	Metalaxyl	Fungicide	Thai	III	Not found
15	Lannate	**Methomyl (banned)**	Insecticide	Thai	Ib	DuPont
16	Magnum	2,4-D, 2-ethylhexyl ester	Herbicide	Thai	Not listed	Not found
17	Gramoxone	**Paraquat dichloride (banned)**	Herbicide	Thai	II	Syngenta
18	Super troy	Cypermethrin	Insecticide	Thai	II	Same
19	Foden	Cartap hydrochloride	Insecticide	Thai	II	T.J.C. Chemical Co., Ltd.

A farmer reported using Folidol (Bayer's trade name for methyl parathion, which is no longer manufactured); however, there was no evidence of that, such as containers with the active ingredient. There were cypermethrin containers resembling the old "Folidol" carrying names such as Folidan, Fonewdol, Fonewdone.

Farmers were familiar with Thai companies that sold agricultural products and whose advertisements were carried on Thai TV channels.

In villages away from the Mekong River, farmers reported buying pesticides from retail shops in Vientiane Capital or in shops close to the river.

Some farmers reported buying and splitting pesticides with other farmers, a dangerous practice which increases exposure risks. Also, farmers disposed of empty pesticide containers by throwing them in the field, or in the Mekong River, or by burning them. These practices further contaminate the soil, plants, water, fish, air, and increase the health risks of rural communities.

This highlights the double exposure risk in rural areas, both from the pesticides applications and the lack of safe disposal of used pesticide containers.

Although some farmers had training on organic agriculture, they had not been able to apply it successfully and had gone back to using synthetic chemicals.

They reported being careful in following label instructions to minimize pesticide exposure and several mentioned not eating vegetables immediately after pesticide applications.

We met a woman farmer who was certified organic by DOA and she was also a DAFO trainee on biological control and IPM under the Plant Protection Center and FAO Programme. She followed Lao's organic certification regulations. This farmer said she switched into organic farming after her family' pesticide applicator died due to his internal organs being fatally compromised by toxic chemicals.

Herbicides in Louang Namtha shops: Glyphosate, Paraquat, Atrazine, and 2,4-D

Pesticide Trade in Louang Namtha Province

The province of Louang Namtha shares a 140-km land border on the north with Yunnan province of China, and a 130-km border stretch along the Mekong River with Myanmar on the northwest (Luang Namtha Provincial of Culture, Information & Tourism Department, Lao PDR, 2013).

On July 20-22, 2011, five retail shop owners and three farmers from four villages in the districts of Namtha and Sing were interviewed (Table 1), as well as government officials from PAFO, DAFO, and MNRE. The provincial capital, Louang Namtha, located in Namtha district, is about 60 km away from China's border. Sing district borders China on a stretch of 66 km.

The international border crossing at Panghai (Sing district) did not appear to be busy; nonetheless several trucks were seen crossing the border. The international border crossing at Boten (not visited in this study) also provides an important export route from China.

According to PAFO, additional trade took place informally through forest trails. Commercial towns in Yunnan province, China located about 7-15 km from the border could be reached by locals using tri-wheeler vehicles known as tuk tuk. Also, Chinese merchants brought goods including pesticides to the biweekly market at Boten (DAFO, personal communication, 2011).

Retail shop owners who imported products from China, mostly ethnic Chinese, reported that pesticide purchases were not scrutinized for banned or illegal pesticides. According to government officials, the majority of the herbicides and agricultural products coming from China were destined for the rubber and sugar cane plantations, which were under concession to Chinese nationals.

Land concessions operated without much government oversight and visits were not allowed. Contract farms that grew vegetables, mostly for export to China, also used pesticides. Data on pesticide use on land concessions and contract farms was not available. Containers with Chinese labels would make it difficult to identify the types of chemicals used. DAFO officials said that the herbicides used in descending order were glyphosate, paraquat, atrazine, and 2,4-D.

In Sing district, rubber tree plantations were the dominant crop with an area of 8,800 ha under cultivation. Of the total land area under rubber, 1,420 ha were under contract farming and the rest was under concession (PAFO, personal communication, 2011).

Pig farms run by Chinese businesses on land owned by Lao farmers reportedly used 'hygienic' pesticides to control for pests on pigs, and water coming from the pig farms, polluted with the pesticides, drained in the river (PAFO, personal communication, 2011).

One such product, Zhongle, with Chinese label, did not show the active ingredient.

Pesticides in the market: Louang Namtha province

None of the five retail shops that were surveyed in the districts of Namtha and Sing had a license to sell pesticides. Around 70% of the pesticide formulations found in shops had Chinese labels, the rest had Thai labels (Table 4).

Herbicides such as glyphosate, paraquat, atrazine, and 2,4-D, comprised about 70% of the pesticide formulations with glyphosate in 15-30 litre plastic containers being the most abundant.

Table 4. Pesticides found in five retail shops of two districts in Louang Namtha province.

No.	Commercial name	Active Ingredient	Type	Language	Shops*	WHO Class	Company
1	Jing fen	Abamectin	Insecticide	Chinese	1	Not listed	Zouping lvda
2	Almix	Metsulfuron-methyl + chlorimuron-ethyl	Herbicide	Thai	1	Tab. 5 (metsulfuron) III (chlorimuron)	DuPont
3	Denmix	Metsulfuron-methyl	Herbicide	Thai	1	Tab. 5	Systemic Company (Happy Farmer)
4	Not found	Atrazine	Herbicide	Chinese	1	III	Not found
5	Sapata-D	Butachlor + 2,4-D	Herbicide	Thai	1	Tab. 5 (butachlor), II (2,4-D)	Sahapan Agricultural Promotion Co. Ltd.
6	Dee-Den	Butachlor + 2,4-D	Herbicide	Thai	1	Tab. 5 (butachlor), II (2,4-D)	Pato Agricultural Clinic Co. Ltd.
7	Not found	Dichlorvos	Insecticide	Chinese	2	Ib	Not found
8	Not found	Dimethoate	Insecticide	Chinese	2	II	Not found
9	No Name, 15-30 litre	Glyphosate	Herbicide	Chinese	4	III	Not found
10	Glyphosate	Glyphosate	Herbicide	Chinese	2	III	Zyzn
11	Glyphosate 16	Glyphosate	Herbicide	Thai	1	III	Sahapan Agricultural Promotion Co. Ltd.
12	Glyphosate 48	Glyphosate	Herbicide	Thai	1	III	Formula-A
13	Glyphosate	Glyphosate	Herbicide	Thai	1	III	V.C.S. Agro Chem Co., Ltd.
14	Not found	Lambda-cyhalothrin	Insecticide	Chinese	1	II	Not found
15	Meta	Metaldehyde	Molluscicide	Chinese	1	II	Guangzhou Chemicals
16	Hecal	Paraquat AS	Herbicide	Chinese	2	II	Sinon Chemical Co., Lt.
17	Gramoxone	**Paraquat dichloride (banned)**	Herbicide	Thai	3	II	Syngenta
18	M.R. Zone	**Paraquat dichloride (banned)**	Herbicide	Thai	1	II	V.C.S. Agro Chem Co., Ltd.
19	Yi Ba Huo (a fire)	**Paraquat (banned)**	Herbicide	Chinese	1	II	Not found
20	Sha Wu Song (kill weeds)	**Paraquat (banned)**	Herbicide	Chinese	1	II	Shenzhen Noposion Agrochemical Co., Ltd.
21	Not found	**Paraquat (banned)**	Herbicide	Chinese	1	II	Guangdong Linong Biotech Co., Ltd
22	Not found	**Paraquat (banned)**	Herbicide	Chinese	2	II	S company
23	Zhean	MCPA ametryn	Herbicide	Chinese		II	Guangxi Tianyuan
24	Sindax (DuPont)	Bensulfuron methyl	Herbicide	Chinese	1	Tab. 5	DuPont
25	Not found	Trichlorfon	Insecticide	Chinese	1	II	Not found
26	Zhongle	Not found	Insecticide	Chinese	1	Not found	Zhengzhou Annong Biotech Co., Ltd.

* Number of shops where pesticide formulations were found.

Paraquat with Chinese labels. Sing district, Louang Namtha province

Shop owners were not yet aware of the new pesticide regulations or about banned pesticides, since the government pilot project on pesticide enforcement was in its initial stage in Vientiane Capital.

Most of the pesticides originating from China had been purchased in Yunnan province. La district in Yunnan province was mentioned as one place to buy pesticides. Three of the five shop owners interviewed spoke a dialect from the Lao/China border and were familiar with pesticide shops in Yunnan province. One of them, a Chinese national, had worked with the local government as an agriculturalist in Yunnan. They sometimes would drive to cities in Yunnan province and purchase pesticide and other agricultural products, or had the pesticides shipped by bus to the border.

Two shop owners spoke only Lao and sold pesticides mostly with Thai labels that were shipped by bus from Vientiane Capital or were purchased on occasional trips to Thailand. However, 15- and 30-litre plastic containers containing glyphosate with Chinese labels were seen in one of the shops, suggesting that glyphosate from China was within reach despite the language difference.

Pesticide use on farms: Louang Namtha province)

Three rubber farmers were interviewed in Sing district. The herbicides glyphosate, paraquat, and atrazine with Chinese labels were found, and also a paraquat formulation with a Thai label (Table 5). Glyphosate was used the most, as indicated by the size of several plastic containers, 15-30 litre, found in all three farms.

Herbicides from Thailand, as indicated by the Thai label, in Louang Namtha province

The herbicides with Chinese labels were purchased from a shop in Yunnan province about 7 km from the Lao-China border or from a shop in town. Two farmers said that during visits to relatives in towns across the border they took the opportunity to bring goods including pesticides. According to PAFO officials, many people on both sides of the border are related and speak a common ethnic dialect.

Farm 1: A family-run farm, 7- 8 ha, part of a DAFO/PAFO model farm, located about 3 km from the Panghai international border, had been under rubber cultivation for 16 years. The farm owners were willing to teach other farmers what they learned as part of a government program that offered trainings on agriculture.

Prior to planting rubber the farm had experimented with citrus trees. The husband, wife, and daughter were involved in the farm operations, which included applying the herbicides glyphosate and paraquat. They reported wearing protective clothes when applying herbicides and to experience dizziness after applications done during three consecutive days. Herbicides were applied once a year for old rubber trees and twice for the younger trees.

For the past 16 years they had purchased pesticides from a shop in Yunnan province located about 7 km away from the border. The farmers understood Thai and did not speak Chinese, however, the shop in Yunnan offered advise on pesticides. They had relatives across the border in China and for them it was more economic to buy pesticides in China during visits to relatives than in Louang Namtha. They could bring up to 10 large (30-litre) pesticide plastic containers with herbicides for their own use across the border provided they showed receipts indicating the amount purchased. Occasionally, a family member would go to Thailand through Bokeo province and purchase pesticides and other items.

Farm 2: This farm was about 3 kilometers from the Panghai international checkpoint and for 12 years grew rubber on less than 4 ha. Rice and vegetables were grown on 400 m^2 of land.

Herbicides were applied to rubber, and insecticides to rice and vegetables in the hot rainy season when insects were common. For the family's consumption, rice and vegetables were grown without pesticides. They bought 30-litre plastic containers of glyphosate with Chinese labels in a local shop in town, about 7 km away.

Table 5. Pesticides found in three rubber farms in Sing district, Louang Namtha province.

Commercial name	Active Ingredient	Type	Language on label	WHO Class	Company
Not found	Atrazine	Herbicide	Chinese	III	Not found
Not found	Glyphosate	Herbicide	Chinese	III	Not found
Not found	**Paraquat (banned)**	Herbicide	Chinese	II	Not found
Not found	**Paraquat (banned)**	Herbicide	Thai	II	Not found

The shop advised on the toxicity of pesticides, for instance the farmer had been told not to eat vegetables when there were no signs of insects after pesticide applications. Neighbors or a Chinese expert would advise on what insecticides to apply. The farmer would wear protective clothes when applying pesticides or would ask another farmer to do it.

Occasionally the farmer or his cousin drove a truck for about 15 km to Mang district in Yunnan and bought pesticides. There were no tax charges at the border for up to eight to ten 30 -litre plastic pesticide containers. However, trucks were subject to a levy of 200,000 kip when leaving and entering the country which, added to gas expenses, made frequent trips to China unaffordable.

Farm 3: A woman farmer said that her husband bought atrazine and other herbicides in the local shop located 7 km away, and applied them himself. Leftover pesticides were stored at the farm. Empty pesticide bags were burned.

Pesticide Trade in Xiengkhouang Province

Lao shares a 2,069 km border with Vietnam that runs the entire length of Lao's eastern side. The province of Xiengkhouang, where the survey took place, lies 435 km northeast of Vientiane Capital and borders Vietnam on Nonghet and Mok-Mai districts. Pek is the provincial capital. On July 24 -27, 2011 five retail shop owners and three farmers from six villages in the districts of Pek and Nonhet were interviewed (Table 1), as well as PAFO and DAFO officials.

Although Xiengkhouang is next to Vietnam, most of the pesticides found (about 89%) had Thai labels, (Table 6). Herbicides such as atrazine, glyphosate, paraquat were in high demand. Plastic containers, 15 - 30-litre, with glyphosate and Chinese labels were purchased in Louang Namtha and sold in Xiengkhouang. According to DAFO officials, a biweekly market took place in Nam Kahn, the international border crossing in Nonghet district, where products from Vietnam and Lao were sold.

Vietnam is a large pesticide manufacturer, however pesticides from Vietnam were rare in Xiengkhouang and were not seen in Vientiane Capital or in Louang Namtha.

The herbicides atrazine, pyribenzoxim, and ethoxysulfuron, with Vietnamese labels, were recorded in two shops in Xiengkhouang, although there were only a few samples. The time when the survey took place was outside the peak season for herbicide applications and stocks were low for most pesticides.

DAFO inspected the only pesticide shop in the Nam Kahn market. DAFO officials said that people from Xiengkhouang made frequent trips to Vietnam, especially to the town of Gisen, 25 km away from the border, to shop for goods.

The fact that few pesticides with Vietnamese labels were found in Lao was attributed to the language barrier. On the other hand, the Thai language and Thai TV ads were easily understood by most people in Lao.

Shop in Xiengkouang sold glyphosate, paraquat, 2,4-D, atrazine and other agricultural items

Xiengkhouang's PAFO had begun to implement its own pilot project of the new pesticide regulations. There were six DAFO officials on duty inspecting the pesticide retail shops. They had granted licenses to sell and distribute pesticides to 20 retail shops, of which half were located in Nonghet district.

However, adequate infrastructure to fully enforce the regulations was lacking. For instance, a DAFO official in Nonghet had found 6,000 litres of pesticides with Chinese labels and without import permits, which made them illegal (the new regulations stipulate that pesticide formulations should bear Lao labels and import permits are required). Nevertheless, he did not confiscate the pesticide formulations as authorized under the law, because of the difficulty of disposing of them in a safe manner.

DAFO inspectors have not been able to handle well smaller amounts of illegal pesticides either. In Nonghet, for instance, five small bottles of pesticides originating from Vietnam were confiscated because of lack of registration and import licenses. The five bottles were placed inside plastic bags and buried underground. However, pesticides buried under the soil surface may be found inadvertently by people (including children), and animals. They also could break and spill their contents and become a health and environmental hazard.

Rice was the dominant crop followed by corn. Vegetables were grown mostly in home gardens separate from corn and rice. According to government sources, in the past few years there has been an expansion of the area planted under corn, particularly hybrid corn, and consequently there has been an increase in the use of herbicides to control the increasing weed problem.

According to PAFO, **glyphosate was used in the largest quantities followed by atrazine and paraquat**.

Technology to dispose of pesticides safely is lacking

Lao lacks the technology to destroy pesticides safely, and there is no mechanism in place in the region to send illegal pesticides back to their country of origin.

Herbicide sales were seasonal, usually in April and May during land preparation before planting. In rice cultivation herbicides were applied before planting and insecticides after that. According to government sources most of the hybrid corn seed planted in Xiengkhouang and other provinces originated from Vietnam and was grown under contract for export to Vietnam where it was processed into animal feed. Animal feed was sold inside Vietnam and also exported back to Lao.

Xiengkhouang's PAFO in collaboration with the IPM programme were offering trainings twice a year to shop retailers, farmers, and DAFO officials on the correct use of pesticides and on the negative impacts of pesticide exposure. The trainings were focused on increasing yields, particularly of hybrid corn, which appeared to be a goal of the provincial government. With the corn expansion, pesticide use has escalated and PAFO has seen the need to educate relevant authorities, sellers, and users on the hazards of toxic chemicals and ways to minimize their impact.

Pesticides in the market: Xiengkhouang province

All five shops surveyed were inspected monthly by DAFO and only three were licensed to sell pesticides. Paraquat and methomyl, banned in Lao, were found in most shops.

About 60% of the pesticide formulations were herbicides, particularly of atrazine, 2,4 -D, glyphosate and paraquat. Most of the pesticides sold had Thai labels (Table 6), the only Chinese product were 30-litre plastic containers of glyphosate.

Table 6. Pesticides found in five retail shops of two districts in Xiengkhouang province.							
No.	**Commercial name**	**Active Ingredient**	**Type**	**Language**	**Shops***	**WHO Class**	**Company**
1	Almix	Metsulfuron methyl + chlorimuron-ethyl	Herbicide	Thai	3	Tab. 5 (metsulfuron) III (chlorimuron)	DuPont
2	Sunrice Super	Ethoxysulfuron	Herbicide	Vietnamese	1	Not listed	Bayer Vietnam Ltd.
3	Navat	Abamectin	Insecticide	Thai	2	Not listed	Chia Tai
4	Servil	Abamectin	Insecticide	Thai	1	Not listed	Master Agro Co.
5	Mizin 80 WP	Atrazine	Herbicide	Vietnamese	1	III	Saigon Plant Protection Joint Stock Company
6	Maizine 80	Atrazine	Herbicide	Thai	1	III	Zagro
7	Atrazine 80	Atrazine	Herbicide	Thai	1	III	PATO (Agricutlural Clinic)
8	Atrazine 80	Atrazine	Herbicide	Thai	1	III	P.Chemitech Co. Ltd. (Red Dog)
9	Atrazine 80	Atrazine	Herbicide	Thai	1	III	Thai Herbicide Co., Ltd.
10	Netrazine	Atrazine	Herbicide	Thai	1	III	Daza Gro
11	Daratox-X	Butachlor + 2,4-D	Herbicide	Thai	1	Tab. 5 (butachlor), II (2,4-D)	P.Chemitech Co. Ltd. (Red Dog)
12	Not found	Butachlor + 2,4-D	Herbicide	Thai	1	Tab. 5 (butachlor), II (2,4-D)	Ag-gro Thailand Co., Ltd.
13	Dara amine	2,4-D dimethyl ammonium	Herbicide	Thai	1	Not listed	Thai Herbicide Co., Ltd.
14	S-zonus 95	2,4-D sodium salt	Herbicide	Thai	1	II	Thai Herbicide Co., Ltd.
15	Kakdum	Zinc phosphide	Rodenticide	Thai	3	Ib	V.C.S. Agro Chem Co., Ltd.
16	Faenidol 150	Cypermethrin	Insecticide	Thai	1	II	Fomothai Corporation Co., Ltd.
17	Frong 10-EC	Cypermethrin	Insecticide	Thai	1	II	Master Agro. Co.
18	Folytech 025 EC	Beta-cyfluthrin (Bayer)	Insecticide	Thai	1	II	Bayer
19	Chix	Beta-cypermethrin	Insecticide	Thai	1	Not listed	Sotus Co., Ltd.
20	Tonchondrin	Dicrotophos	Insecticide	Thai	1	Ib	Intercrop
21	Not found	Dicrotophos	Insecticide	Thai	1	Ib	Contract Group
22	Shieldtox	Permethrin (household)	Insecticide	Thai	1	II	Reckitt Benckiser
23	Produim 400	Chlorpyrifos	Insecticide	Thai		II	Not found
24	Ezodin-M	Chlorpyrifos	Insecticide	Thai		II	Maroway Co.
25	No Name, 15-30 litre containers	Glyphosate	Herbicide	Chinese	1	III	Not found
26	Glyphosate 48	Glyphosate	Herbicide	Thai	1	III	Big Giant

Table 6. Pesticides found in five retail shops of two districts in Xiengkhouang province. (contd. from previous page)							
No.	**Commercial name**	**Active Ingredient**	**Type**	**Language**	**Shops***	**WHO Class**	**Company**
27	Glyphosate 48	Glyphosate	Herbicide	Thai	2	III	Ag-gro Thailand Co., Ltd.
28	Glyphosate 75%	Glyphosate	Herbicide	Chinese	1	III	Zyzn
29	Mencozeb	Mancozeb	Fungicide	Thai	1	Tab. 5	Not found
30	Fungural	Copper hydroxide	Fungicide	Thai	1	II	Not found
31	Art Rat killer	Warfarin	Rodenticide	Thai	1	Ib	Art Chemical Co., Ltd.
32	Lannate	**Methomyl (banned)**	Insecticide	Thai	2	Ib	Dupont
33	Gramoxone	**Paraquat dichloride (banned)**	Herbicide	Thai	5	II	Syngenta
34	Biozone	**Paraquat dichloride (banned)**	Herbicide	Thai	1	II	Not found
35	Pyanchor 3EC	Pyribenzoxim	Herbicide	Vietnamese	1	Not listed	Saigon Plant Protection Joint Stock Company
36	Sevin 85	Carbaryl	Insecticide	Thai	1	II	Bayer

* Number of shops where pesticide formulations were found.

A few herbicide formulations were found with Vietnamese labels, such as atrazine and pyribenzoxim recorded in one shop and ethoxysulfuron in another shop. Shop retailers said that pesticides from Vietnam sold poorly.

Nonghet district had three one -day weekly markets, where pesticides were sold. Shop retailers indicated that pesticides were sold mostly during the planting season and that stocks were low at the time of this survey. Shop retailers reported that most of the Thai pesticides were shipped on passenger buses from Vientiane Capital with occasional purchases directly from Thailand.

About once a month a salesperson from Vientiane Capital brought pesticides by bus to the Pek area. Some shop retailers had sourced pesticides from Vientiane Capital for 16 and 20 years. A lady shop owner from Pek who called pesticides “medicines” said that most of her clients were rice farmers.

Glyphosate in 30-litre plastic containers from China, destined largely for hybrid corn, were purchased in Louang Namtha. A woman shop owner reported buying two tons of glyphosate, 30-litre containers, from China during five trips to Louang Namtha in her truck.

Herbicides and other items, Xiengkhouang province

Additionally, this shop bought pesticides with Thai labels from two-well known suppliers in Vientiane. The shop also sold hybrid corn seeds supplied by a Vietnamese company. Pyrethroids, such as cypermethrin, packed in containers that looked similar to what used to be marketed as "Folidol" (methyl parathion brand no longer produced by Bayer) were common.

Pyrethroid insecticides, according to shop owners, were popular among rice growers, who also used the herbicide 2,4-D. Sevin 85, with active ingredient carbaryl, from Bayer, was used on vegetables.

Pesticide use on farms: Xiengkhouang province

The herbicides atrazine, glyphosate, and paraquat with Thai labels were found in three farms, which grew corn. Corn was grown for mills in Vietnam that processed it into animal feed, which was sold in Vietnam and Lao. Three corn growers with 1 to 5 ha farms were interviewed (Table 7)**.**

A 3-ha farm with traditional corn had begun using pesticides 2 years before, following the advise of the local retail shop. The farmer's wife purchased and applied the herbicides with the help of her son -in-law. In the past they used to plant rice using traditional methods, such as salt, to control weeds and other pests. Two of the farms planted hybrid corn. A 5-ha farm had been growing hybrid corn for 3 years using herbicides. Prior to that, rice without pesticides was grown.

Table 7. Pesticides used in two farms of Nonghet district in Xiengkhouang province.

Commercial name	Active Ingredient	Type	Language on label	WHO Class	Company
Atrazine	Atrazine	Herbicide	Thai	III	Not found
Glyphosate	Glyphosate	Herbicide	Thai	III	Not found
Gramoxone	**Paraquat dichloride (banned)**	Herbicide	Thai	II	Syngenta

A 1- ha farm managed by a woman farmer grew hybrid corn and also traditional corn varieties for home consumption. She was unsure about using pesticides, which were new to her family. Her farm's hybrid corn, upon harvest, was sold to a middleman who transported it to the border and delivered it to Vietnamese companies to be milled and processed into animal feed.

Farmers said that they grew their own vegetables for home consumption without pesticides.

PAFO officials reported that IPM trainings had been offered to farmers aimed at both: reducing pesticide exposure and decreasing the use of pesticides, which has surged with the hybrid corn expansion.

However, DAFO officials did not inspect farms or monitor pesticide use. Pesticides inspection by DAFO officials was limited to retail shops. As part of PAFO and DAFO's efforts to promote the new pesticide regulations, farmers were encouraged to use glyphosate instead of the banned paraquat.

Hybrid corn had been introduced in the preceding 5-6 years and was viewed as a hot commodity. PAFO officials said that many farms were undergoing conversion, increasing both the area under this crop and herbicide use. People mentioned environmental problems associated with the hybrid corn expansion and the surge in pesticide use. Local residents blamed pesticides applied in the cornfields for the contamination of traditional foods, such as wild mushrooms that people ate to supplement their diets. Since 2010 several people have been hospitalized in Kham district after eating mushrooms collected in the forest, adjacent to cornfields.

Officials from the Ministry of Environment said that they would like to see more cooperation among the different branches of government to reduce the health impacts of pesticides, such as providing trainings to raise awareness among farmers. However, the hybrid corn expansion is seen as a government strategy to increase the country's revenue and pesticide use was considered as part of the agricultural development plan.

Xiengkhouang's market sells a variety of local foods that may be threatened by increased used of pesticides

Conclusions & Recommendations

The survey in Vientiane Capital and the provinces of Louang Namtha and Xiengkhouang found that most Regional cooperation among governments is needed to prevent illegal flow of pesticides across borders. Lao is an example of a country whose long porous borders make it difficult to enforce pesticide regulations and prevent hazardous products from entering the country and endangering rural communities.
Manufacturing countries should enact mechanisms to prevent export of hazardous pesticides to countries, that have banned them.
To facilitate this process governments should exchange information on banned pesticides in their countries and the manufacturing countries should put regulations in place that forbid pesticide distributors to export pesticides to countries that have banned them.
In addition, pesticide manufacturing exporting countries should establish protocols to accept returned pesticides and hazardous chemicals from the countries where these chemicals are banned. Such an initiative should be part of a regional effort to curtail the illegal trade of pesticides.
A mechanism to curtail illegal trade of pesticides should be in place and the Strategic Approach on International Chemicals Management (SAICM) offers a platform to advance this initiative.
Ultimately, governments and international agencies should support policies to encourage farmers to transition away from toxic chemicals and promote sustainable agricultural practices that provide safety and a dignified livelihood to rural communities pesticides had Thai and Chinese labels. Pesticides with Vietnamese labels, such as atrazine and other herbicides, were rare. This was attributed to people in Lao not being familiar with the Vietnamese language.

Paraquat with Syngenta's logo and several brands with Chinese label; and methomyl with DuPont's logo, were easily available, although these pesticides are banned in Lao PDR.

All of the pesticides in Vientiane Capital and most of the pesticides in Xiengkhouang province (Tables 2 and 6) had Thai labels. Most of the pesticides in Louang Namtha province had Chinese labels.

Herbicides were found in all areas surveyed. However, they were in high demand by the plantations in the provinces of Louang Namtha and Xiengkhouang, where over 60% of the pesticide formulations found were herbicides. Glyphosate, paraquat, atrazine, and 2,4-D, and others were recorded in shops in both provinces, and the first three herbicides were found also in farms. The survey took place off the planting season and the findings reflect what was available at the time.

Pesticide movement took place without much restriction across Lao's long porous borders. The numerous pesticide formulations with Thai labels indicate that active trading takes place across the Mekong River. Thai is easily understood by people in Lao and Thai TV channels carrying pesticide adds were common. Also, the abundance of pesticide formulations with Chinese labels in Louang Namtha indicate these substances enter the country through the border with China. Vietnam is a large pesticide formulator and although not many pesticides with Vietnamese label were found, this could change in the future.

In 2011 most officials in charge of inspecting pesticides were not familiar with these chemicals and few knew about Lao's new regulations enacted in 2010. Inspection of pesticides and detection of banned agricultural chemicals were not an important aspect of the daily routine of officers at the checkpoints.

To counteract the increasing pesticide use, DOA with support from FAO embarked on a nationwide effort to strengthen the regulatory framework of pesticides, which included new regulations enacted in 2010 and awareness -raising activities. Their programme is focused on raising awareness among shopkeepers and conducting regular inspections of distribution hubs in the provincial capitals.

Pesticides originate from neighboring countries

Lao does not manufacture pesticide formulations or active ingredients. Synthetic pesticides originate mostly from the neighboring manufacturing countries, particularly from Thailand and China.
Recommendations

CASE OF CAMBODIA

Pailin Province and Takeo Province

Introduction

This report on the survey of illegal pesticides is a part of the project “Community Pesticide Monitoring in Cambodia”, under the collaborative program, “Towards a non-toxic environment in South-east Asia”, between Pesticide Action Network Asia and the Pacific (PAN AP) and a local partner, Cambodian Center for Study and Development in Agriculture(CEDAC), to raise public awareness on pesticide risks, community-based pesticide action monitoring, and public education and advocacy on these issues.

The specific objectives of the project are to:

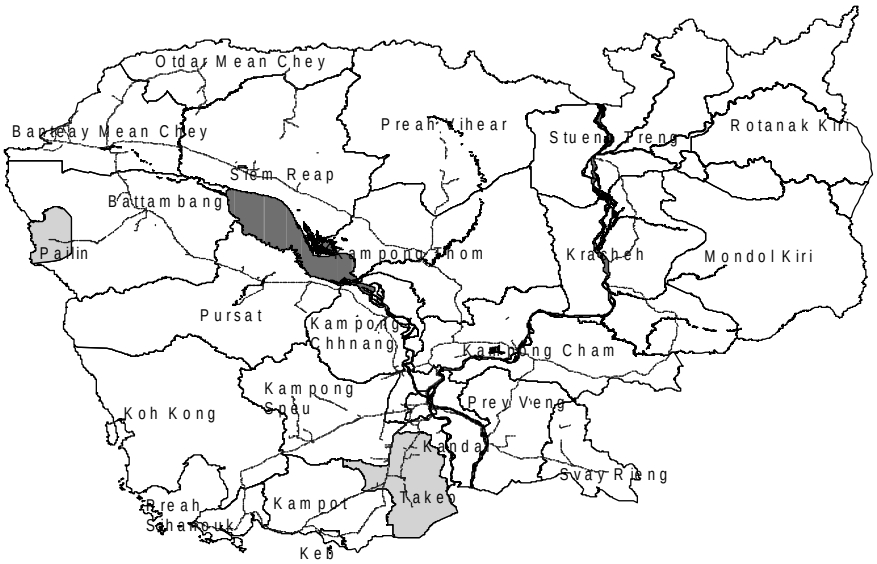
- Reduce pesticide risks to human health and environmental hazards of pesticides, along with supporting and promoting the development of ecological and locally appropriate agriculture which brings food security and other benefits to farming communities.
- Empower communities to tackle pesticide problems and alert local authorities and communities on the dangers/hazards of pesticides so as to deal with the problems.

Survey objective

Towards these ends, the survey sought to analyse the types of pesticides being sold and used in two border areas and identify the types of iillegal pesticides still available in Cambodia and the routes and systems by which they are brought into the country and distributed.

Survey methodology

Map of the survey areas in Cambodia



The survey was carried out by the CEDAC team and PAN AP consultant, Dr. Koa Tasaka from PAN Japan. Conducted during July and August 2011, it focused on the trade in banned pesticides in Cambodia -- sources of banned pesticides, the types of pesticides available and the labels used for these pesticides.

Field surveys were conducted in two areas of Cambodia: (i) the area near the border with Vietnam in the Takeo province; and (ii) the area near the border with Thailand in the Pailin province. Border check points were visited in both provinces.

Three complementary surveys were conducted throughout the study areas:

- Key informant interviews with a government officer of the Ministry of Agriculture, Forestry and Fishery (MAFF), Japan International Cooperation Agency (JICA) and non-government organizations (NGOs).
- Interviews with pesticide retailers and observations at pesticide stores.
- Interviews with farmers, both individual interviews and focused group discussions.

In all, 30 farmers and 12 pesticide retailers were interviewed -- 15 farmers and four pesticide retailers near the border with Thailand (in Pailin market) and 15 farmers and eight pesticide retailers near the border with Vietnam (in Takeo and Tonlop markets). These included individual interviews and group discussions. A questionnaire provided by PAN AP was used for interviews with and collection of data from retailers and farmers, and photographs of pesticides being displayed in the pesticide stores were taken.

Pesticide management in Cambodia

The agriculture sector plays an important role as the backbone of the economy and the rural poverty reduction strategy in Cambodia. In an effort to improve their livelihood by increasing crop yields, farmers have increasingly turned to the use of chemical fertilizers and pesticides. However, they lack training and information on the appropriate use of these agricultural chemicals, resulting in sub-optimal yield improvements, environmental damage and human health impacts.

Prior to 1998, Cambodia had no official stance on pesticide use. As a first step towards formalizing pesticide use, on 28 October 1998, the Cambodian Co-Prime Ministers signed a sub-decree (No.69) titled “On Standards and Management of Agricultural Material”, pertaining to the regulation of seeds, chemical fertilizers and

pesticides in agriculture. Later, supporting this sub-decree, on 15 December 2003, MAFF issued a Ministerial Declaration (No. 598) on the Lists of Pesticides banned and allowed to be used in Cambodia. This declaration had three lists of pesticides – (i) pesticides banned from use (116 common names); (ii) pesticides restricted for use (40 common names); and (iii) pesticides permitted for use (136 common names). In this regulation, pesticides classified as banned and restricted conform to the World Health Organization's (WHO's) hazard classifications 1a and 1b.

Development partners are assisting MAFF in pesticide management and JICA is providing assistance in building staff capacity and facilities for strengthening the pesticide analysis laboratory. The Food and Agriculture Organization (FAO) and the Swedish Chemicals Agency (Kemal) have supported Cambodia's Pesticide Risk Reduction Program to develop a regulatory framework and draft law on pesticide and fertilizer management. As a result, in 2011, a draft law on pesticide and fertilizer management was developed by MAFF and approved by the Cambodian Council of Ministers.

However, pesticide management in Cambodia still lacks law enforcement and implementation. To import pesticides, one needs to have a license from MAFF.
But the border check point has only one veterinary officer to control all agricultural products and inputs coming into the country. There is no machine to scan and check trucks and motorbikes crossing the border. From the year 2004 to July 2011, only 562 trade names of pesticides from 26 pesticide companies were registered at MAFF (Department of Agricultural Legislation, 2011). But most of these were expired pesticides. And the number of registered trade names was less than the number of pesticides (trade names) actually available in Cambodia if we see the result of CEDAC's pesticide monitoring in 2010 which listed 757 trade names (CEDAC, 2011).

Displays in pesticide stores

A pesticide stores in Tonlop market

A pesticide stores in Pailin market

A pesticide stores in Takeo market

A commune pesticide store

Pesticides are seen displayed for sale in houses and communes close to markets, and in city and district markets. It was observed that pesticide stores in Tonlop, Takeo and Pailin markets displayed many types of pesticides having a range of trade names. Observations and photographs of products in pesticide stores showed that they displayed 31 to 87 different trade names openly or in sealed glass cabinets. All the retailers interviewed in the Takeo province said that they stored fewer products in the wet season because farmers grew crops mainly in the dry season. In all, 243 trade names based on 93 formulations of pesticides were found in the pesticide stores where interviews were conducted.

Sources and transport of pesticides

Pesticide retailers in villages bring pesticides from the provincial city and sell these to farmers in the villages and the commune. Pesticides are sold alongside other products such as soft drinks, kitchen commodities, agricultural tools and fishing equipment. Retailers at district levels and in cities get their supplies from suppliers or dealers of pesticide companies.

Most of the retailers reported that they didn't know how many types of pesticides or pesticide names were displayed in their stores. They only knew that these pesticides came from China, Thailand and Vietnam; the suppliers transported pesticides to these stores by vans. Retailers preferred to buy from suppliers who sold on credit.

The survey team observed that pesticides were imported directly from Vietnam, Thailand, China and Japan. Also, pesticides produced in India, Indonesia, Singapore and the USA were relabelled/repacked in countries like China, Japan, Vietnam and Thailand and sent to Cambodia. Most of the retailers reported that the pesticides are imported by land routes from Poi Pet in Thailand and Ba Vet in Vietnam and by the sea route, through the Shank port in Cambodia, from China, Japan and other countries. These pesticides are stored in Phnom Penh (Cambodia).

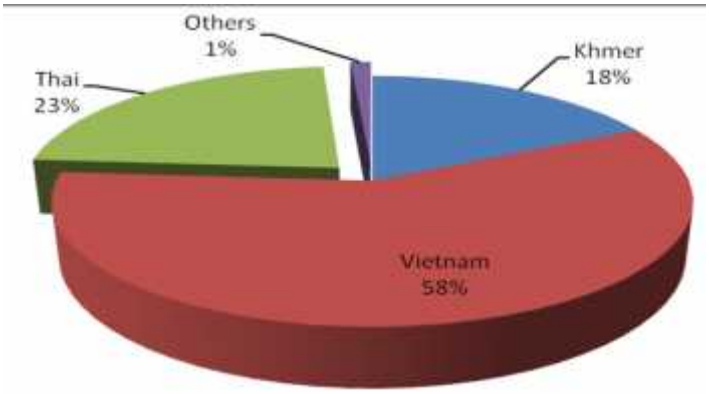
None of the retailers interviewed knew if their suppliers had an import license. They assumed that the pesticide companies had import licenses because they distributed their products everywhere in the country. The survey showed that 103 pesticide companies sold their products in the markets in the survey areas. However, the list of pesticide companies registered with MAFF showed that only 26 companies had registered their products with MAFF.

Pesticide labels

According to MAFF, all pesticide packages must be labelled in Khmer language but most of the pesticide companies had not followed this rule. The survey showed that only 18 percent of the pesticide products displayed at the stores had labels in Khmer; 58 percent had labels in Vietnamese, 23 per cent in Thai and one percent in languages such as Chinese, Arabic and English (see pie chart).

Most of the pesticides with Khmer labels were registered with MAFF; these included products from companies such as Syngenta, Aggrotech Vita and Kelvinside. However, only a few products had the date of manufacture or expiry date (printed or stamped) on the labels. The date of manufacture was seen mostly on pesticides from Vietnam. Most retailers and farmers seemed to be less concerned about expiry dates or expired pesticides.

All the retailers and farmers interviewed said that pesticides with labels in Khmer were more expensive than products with labels in foreign languages. So the farmers preferred to use pesticides with foreign labels as they were cheaper and also perceived as more effective. The retailers also said that if they didn't sell pesticides with foreign labels, farmers would go and buy these products from shops near the border in the neighbouring countries. Pesticides with Vietnamese and Thai labels could be more easily bought as 81 percent of the pesticides in the stores had these labels (though this was illegal); only 18 percent of the pesticides had Khmer labels.



Languages used on pesticide labels in the stores studied

However, recently (that is, in 2011) there had been an increase in labelling in Khmer, according to the retailers and farmers. Furthermore, following a national campaign on banned pesticides in April 2011, government inspectors now visited pesticide stores and checked for banned pesticides The retailers added that the officers also confiscated the banned pesticide metamorphose (with the trade name Thom) from a pesticide store in Takeo market. Now they were afraid of displaying banned pesticides, especially pesticide types mentioned in MAFF and JICA posters on banned pesticides. If they know the pesticides are banned, they hide them or keep them at home, and sell them when farmers ask for them or place a special order.

All retailers said that whereas earlier they sold pesticides in smaller quantities after transferring smaller portions from bigger containers into flasks, they didn't need to do this now as suppliers had started distributing pesticides in smaller quantities/bottles (for example, products ranging from 10-ml to 5-liter packages). They can also now sell many types of pesticides which farmers can mix and use.

Retailers interviewed near the Vietnam border said they received training on pesticide application from agriculture officers but retailers near the Thai border said they never had any training and just depended on their experience in selling pesticides. Retailers near the Thai border also said they had to pay around 100-150 US dollars to access the one-week training and to get a selling license when retailers near the Vietnam border received training without payment. It means that most of the retailers near the Vietnam border have the license to sell pesticides while most retailers near the Thai border, especially in Pailin, do not have the license.

As for the list of pesticides that can be used in Cambodia, the retailers said they never received it (as also the lists of banned and restricted pesticides) but agriculture officers had put up posters of banned pesticides in a few pesticide stores.

Posters of banned pesticides posted at a sticide store near the Vietnam border

Banned and restricted pesticides

Pesticide applications in areas close to the Vietnam and Thai borders depended significantly on the season and crop production patterns.

Pesticide use in the area near the Vietnam border is more common during dry-season rice production than in wet-season rice production; the most frequently used pesticides in this area are insecticides, followed by rodenticides and herbicides. Farmers near the Thai border (Pailin) generally used pesticides in both dry and rainy seasons for industrial crops such as corn (two harvests) and cassava. For these crops, they used herbicides, followed by plant hormones (to make plants grow faster) and insecticides.

Farmers generally bought pesticides from stores in the village, commune or the provincial city but some at times went and bought pesticides in Vietnam or Thailand. Pesticide suppliers/companies had also started advertising, promoting (making promotional offers) and selling pesticides, using vehicles, directly to farmers in villages, particularly companies such as Syngenta, DuPont, Aggrotech Vita and Kasen Viscid.

Most farmers, though, preferred to buy pesticides from city markets because they said the products were cheaper and of reliable quality. The market is not very far from their villages -- only 5-10 km away -- and they carried the pesticides on motorbikes. For greater reliability, they bought from stores (about 10 km away) in Vietnam and Thailand. A farmer in Pailin said that he bought pesticide in Thailand and carried it on his motorbike; he had to only inform the Thai Customs about the location of his farm. Generally, when they need pesticides in small quantities, they buy from the village store (sometimes on credit) and when they need bigger quantities, they go to the city market.

None of the farmers interviewed could read the pesticide use instructions on labels written in foreign languages -- Vietnamese or Thai. They learn these from pesticide retailers, and they understand the meaning of the pictures on the labels. They buy pesticides when they see a picture of pests on the label or when they see other farmers using such products. It should also be noted that some farmers reported spraying pesticides after they saw other farmers doing so, even if there was no evidence of crop damage or insects in their farms; they said that they used it for prevention.

All the farmers interviewed said that retailers never offered any gift. Some farmers said that the retailers themselves may get some gifts or incentives like t-shirts, caps and raincoats from suppliers; they had seen them wearing these. Sometimes the suppliers gave the farmers a smaller bottle of a new pesticide to test but they do not compensate the farmers if any damage or loss occurred in crop production.

As mentioned earlier, Cambodia had banned or restricted the use of some pesticides since 1998. Nonetheless, the use of banned pesticides remains common. Findings from this survey showed that a high percentage of farmers applying pesticides in the areas surveyed had used banned and restricted pesticides. Interviews with farmers near the Vietnam border showed that 70 per cent of these farmers had used the banned pesticides metamorphose (Thom) and methyl and the restricted pesticides zinc phosphide and dichroism in the previous dry season. The farmers interviewed near the Thai border used the banned pesticide paraquat.

Methyl

Metamorphose

Dichroism

Carbofuran

.

Paraquat

However, not all the farmers interviewed knew that some pesticides were banned and that these included the pesticides they were using, until the survey team showed them the pictures of banned and restricted pesticides.

Of the 243 pesticides available in the two survey areas, nine trade names (with three common names) were in the banned list and 10 trade names (with five common names) in the restricted list. Further, 31 trade names (with 21 common names) were not in any of the lists;these were not registered and thus illegal.

Table: Banned and restricted pesticides available in the survey areas.

No.	Active ingredient	In MAFF list	WHO categories
1	Dibromochloropropane DBCP	B	O
2	Methomyl	B	Ia
3	Paraquat dichloride	B	II
4	Fomesafen	NL	II+III
5	Acetamiprid	NL	NL
6	Bispyribac sodium	NL	NL
7	Chlorantraniliprole	NL	Nl
8	Citrus oil	NL	NL
9	Dinotefuran	NL	NL
10	Emamectin,benzoate	NL	NL
11	Fenoxaprop-P-ethyl	NL	II+III
12	Flubendiamide	NL	NL
13	Fomesafen	NL	III
14	Imazethapyr	NL	U
15	Indoxacarb	NL	II
16	Metalaxyl	NL	III
17	Metaldehyde	NL	II
18	Metsulfuron methyl	NL	U
19	Chlorimuron ethyl	NL	NL
20	Niclosamide	NL	U
21	Oxytetracyclinehydrochoride +gentamicinesulphate	NL	II
22	Pymetrozine	NL	NL
23	Pyribenzoxim	NL	III
24	Fenoxaprop-P-ethyl	NL	NL
25	Brodifacoum	R	Ia
26	Carbofuran	R	Ib
27	Dichlorvos	R	Ib
28	Dicrotophos	R	Ib
29	Zinc phosphide	R	Ib

It also appears that many farmers may be using pesticides without training in how to use them. None of the farmers surveyed had received training from pesticide companies on the appropriate application of pesticides.

A farmer mixing four types of pesticides to spray on rice in Kirivong district of Takeo province, without using personal protection equipment.

All farmers disposed of pesticide cans and bottles and washed sprayers in their farms and/or in water courses and canals. Some farmers suggested that the abundance of aquatic resources in the nearby lakes and rivers had declined.

Heath problems among farmers

Pesticide-related health problems among the farmers appear to be widespread. All the farmers interviewed sprayed pesticides during the wet and/or dry season, and about 70 percent of them reported experiencing pesticide-related health problems. These problems, which occurred during or soon after spraying, included tiredness, dizziness and headaches. However, they did not know which specific pesticide caused more poisoning incidents because they mixed many pesticides including banned and registered pesticides. They use a cocktail of pesticides and also different types of pesticides in one crop season. So it is difficult to establish a direct link between a type of pesticide and its health impacts.

Conclusions and recommendations

Pesticides are generally displayed for sale in stores like any other product without worrying about their impacts on the health of retailers or farmers. Banned and restricted pesticides are still available in the market and are used by farmers. Pesticides are imported by traders, middlemen and companies, and the imports are not controlled by government officials.

Though the use of Khmer language in pesticide labelling (as required by MAFF rules) has increased recently, labels written in foreign languages are still common. All pesticide companies should therefore be made to label pesticide containers in Khmer so that retailers and farmers can understand them easily.

Most of the pesticide retailers, especially retailers near the Thai border, are not trained in the appropriate way to use pesticides.

MAFF should use stricter measures to make pesticide companies and retailers abide by the rules/law, especially the sub-decree on standards and management of agricultural inputs.

The Parliament of Cambodia should approve the law on pesticide and fertilizer management that MAFF and the Council of Ministers had drafted in 2011, to regulate pesticide trade and reinforce pesticide management.

Pesticide retailers and farmers including hired labour should be trained in the proper use of pesticides and also in the use of personal protection equipment. They should be made aware of the health and environmental impacts of pesticides.

The relevant institutions and concerned bodies should educate retailers and farmers on the health risks and environmental hazards of pesticides and provide them with information on banned and restricted pesticides.

Table: List of pesticides found during in the survey area in July –August 2011

No.	Trade name	Active ingredient	Language on label (indicate if no label)	Source	Use type	List in Cambodia	WHO category by formula	Contents	Company name /country
1	A K-D 95	2,4-D	Thai	Thailand	Herbicide	P	II	1kg	TCPA
2	Anco 600 DD	2,4-D	Vietnamese (VN)	Vietnam	Herbicide	P	II	480ml	An Giang /Shinochem Shanghai
3	Anco 600SL	2,4-D	VN/Khmer	VN	Herbicide	P	II	480ml	An Giang /Shinochem Shanghai
4	Anco 720DD	2,4-D	VN	VN	Herbicide	P	II	100ml;480 ml	An Giang
5	Eranal 95SP	2,4-D	Thai	Thailand	Herbicide	P	II	500g	ERAWAN
6	Hai Bon-D 480DD (2,4-D)	2,4-D	VN/Khmer	VN	Herbicide	P	II	480ml,1000 ml	ADC
7	O.K 683DD	2,4-D	VN	VN	Herbicide	P	II	480ml	PhanNong/ H.A.I
8	Pata 95	2,4-D	Thai	Thailand	Herbicide	P	II	1kg	Red elephant/S.C Prola
9	Sarika	2,4-D	Khmer	China	Herbicide	P	II	500ml	KaseVisiddh Group
10	Vitoxhormone	2,4-D	Thai	Thailand	Herbicide	P	II	100ml, 500g,	Red Elephant
11	Zico 720 DD	2,4-D	VN/ Khmer	VN	Herbicide	P	II	480ml	SPC
12	Zico 80BHN/wp	2,4-D	VN	VN	Herbicide	P	II	480ml	SPC
13	Ababest	abamectin	Thai	Thailand	Insecticide	P	III	100ml,500 ml	SK
14	Abamectin	abamectin	Thai	Thailand	Insecticide	P	III	100ml, 500ml	12:00, AstimEnterprise, T.K Agro Co,.Ltd, Golden Door, Tra Chang PrahAtit,RedElephant
15	Abamine 1.8EC	abamectin	VN	VN	Insecticide	P	III	480ml	ThanhDien/ShenzhenGoumeng
16	Abatin 1.8EC	abamectin	VN/Thai	VN	Insecticide	P	III	50ml	Map Pacific
17	Abvertin 3.6	abamectin	VN	VN	Insecticide	P	III	100ml	Golden Rice Agro-chemistry Corp
18	Andomec 5EC	abamectin	VN	VN	Insecticide	P	III	480ml	Hoang An
19	Aremec 18EC	abamectin	VN	VN	Insecticide	P	III	100ml	HoaBinhAgrochem Corp/ Cali Parimex INC-USA
20	Aremec 36EC	abamectin	VN	VN	Insecticide	P	III	100ml.480 ml	HoaBinhAgrochem Corp/ Cali Parimex INC-USA
21	Aremec 4.5EC	abamectin	VN	VN	Insecticide	P	III	240ml	HoaBinhAgrochem Corp/ Cali Parimex INC-USA
22	Bompmek	abamectin	Thai	Thailand	Insecticide	P	III	100ml	NOKKHUM THONG
23	Citrameth-Luxen	abamectin	Thai	Thailand	Insecticide	P	III	100ml	Luxen
24	FA FAabamectin	abamectin	Thai	Thailand	Insecticide	P	III	100ml	Fafa super ame
25	Fanty 4.2 EC	abamectin	VN	VN	Insecticide	P	III	100ml, 240ml	Jiangsu Shengda Chemical Co,.Ltd
26	Hen Abide 18	abamectin	Khmer	China	Insecticide	P	III	100ml	HC
27	LongphABA	abamectin	VN	VN	Insecticide	P	III	480ml	Long Phu/Zhejiang RutheAgrochemical
28	Masket	abamectin	Thai	Thailand	Insecticide	P	III	100ml, 500ml	Thailand Chemical Ltd
29	Mectin	abamectin	VN, Thai	Thailand	Insecticide	P	III	100ml	
30	Plutel 3.6 EC	abamectin	VN	VN	Insecticide	P	III	480ml	CVC ING
31	Plutel 5 EC	abamectin	VN	VN	Insecticide	P	III	480ml	CVC ING
32	Promectin	abamectin	Thai	VN	Insecticide	P	III	100ml	MitSobo
33	PropaK	abamectin	Thai	Thailand	Insecticide	P	III	500ml	Kang ChakKakseKam Cambodia Co,Ltd
34	Reasgant 1.8EC	abamectin	VN	VN	Insecticide	P	III	480ml	VITHACO
35	Reasgant 3.6EC	abamectin	VN	VN	Insecticide	P	III	480ml	VITHACO
36	SieuSher 1.8EC	abamectin	VN	VN	Insecticide	P	III	100ml,500 ml	Thanh HUNG
37	Sock-D	abamectin	Thai	Thailand	Insecticide	P	III	500ml	
38	TUNGATIN 3.6 EC	abamectin	VN	India	Insecticide	P	III	100ml	CP SX-TM-DV Ngoc Túng/ United Phosphorus Limited. India
39	Vicare	abamectin	Khmer	China	Insecticide	P	III	100ml	KaseVisiddhGroup
40	Lasi75SP	acephate	Khmer	India	Insecticide	P	III	100ml	
41	Mopride 20WP	acetamiprid	VN	VN	Insecticide	NL	NL	8g	HP
42	**Service**	acetamiprid	Thai	Thailand	Insecticide	NL	NL	1000ml	12:00/Nippon Soda,Co.Ltd., Japan
43	Fas/tac 5EC	alpha cypermethrin	VN	VN	Insecticide	P	II	100ml	Map Pacific

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44	Motox 5EC	alpha cypermethrin	VN	VN	Insecticide	P	II	100ml. 480ml	NongPhat/United Phosphorus
45	Sapan Alpha 5EC	alpha cypermethrin	VN	VN	Insecticide	P	II	50ml	Spc
46	Vifast 5ND	alpha cypermethrin	VN	VN	Insecticide	P	II	480ml	VIPESCO
47	Atax 90	atrazine	Thai	Thailand	Herbicide	P	III	500g	Syngenta
48	Atrazine	atrazine	Thai	Thailand	Herbicide	P	III	1000g	TP MD+ Sing Ben+ Asian Pacific Agrochemical; Phosum Chemical Co.Ltd
49	Atrazine 80	atrazine	Thai	Thailand	Herbicide	P	III	1000g	PATO + Rtas<an
50	Folitec 025EC	beta-cyfluthrin	Thai	Thailand	Insecticide	P	II	100ml	TCPA, Bayer
51	Nominee 10SC	bispyribac sodium	VN	VN	Herbicide	NL	NL	100ml	VFC/KUMIAI Chemical industry Co,.Ltd
52	RodiKill-1	brodifacoum	Arabic		Rodenticide	R	Ia	50g	
53	Butyl 10WP	buprofezin	VN	VN	Insecticide	P	III	100g	Spc
54	Difluent 10WP	buprofezin	VN	VN	Insecticide	P	III	100g	Dibapes
55	Atylo 650WP	buprofezin + acetamiprid	VN	VN	Insecticide	P	III	100g	MAI Thai Nong/Changzhou Pesticide Factory
56	Penalty 40WP	buprofezin + acetamiprid	VN	VN	Insecticide	P	III	100g	Kim Dien
57	Meco 60EC	butachlor	VN	VN	Herbicide	P	III	480ml	Angiang
58	Michelle	butachlor	VN	VN	Herbicide	P	III	480ml	Sinon Corporation, Taiwan
59	Taco 600EC	butachlor	VN	VN	Herbicide	P	III	480ml	VITHACO
60	Arin 50 SC	carbendazim	VN	VN	Fungicide	P	III	1L	King Tech Corporation
61	Carben50SC	carbendazim	VN, Khmer	VN	Fungicide	P	III	480l	
62	Carbendazim 50SC	carbendazim	Thai	Thailand	Fungicide	P	III	1L	
63	Carzim	carbendazim	Thai	Thailand	Fungicide	P	III	100g	SK
64	Vicarben 50HP,	carbendazim	VN	VN	Fungicide	P	III	100ml, 500ml	VIPESCO
65	Andoral 50WP/500WP	carbendazim + iprodione	VN	VN	Fungicide	P	III	100g	TNHH – TM HoàngÂn
66	Furadan 3 G	carbofuran	VN	VN	Insecticide	R	Ib	1kg	FMC Chemical International
67	Vifuran 3G	carbofuran	VN	VN	Insecticide	R	Ib	1kg	VIPESCO
68	Solida 50G	carbosulfan	Khmer	China	Insecticide	P	II	1kg	KaseVisiddh
69	Prevathon 5SC	chlorantraniliprole	Khmer	Khmer	Insecticide	NL	Nl	100ml	Duont
70	Mapy 48EC	chlorantraniliprole +thiamethoxam	VN	VN	Insecticide	P	II	80ml	Map Pacific
71	Tanil 50SC	chlorantraniliprole +thiamethoxam	Khmer	Thailand	Fungicide	P	III	500ml	Agrotech
72	Virtako 40WG	chlorantraniliprole +thiamethoxam	VN	VN	Insecticide	P	Nl	3g	Syngenta
73	Vitashield 40EC	chlorantraniliprole +thiamethoxam	VN	VN	Insecticide	P	II	100ml. 480ml	THANKSON
74	DacoNI'L	chlorothalonil	Khmer	Japan	Fungicide	P	III	100ml	Agrotech/SDS Biotech K.K, Japan
75	Vitasi	chlorpyrifos ethyl	Khmer	China	Insecticide	FR	II	100ml	KaseVisiddh
76	Jia-cyfos 600EC	chlorpyrifosethyl + cypermethrin	VN	VN	Insecticide	P	II	100ml	CP. Jia Non Biotech
77	Dato	chlorpyrifos ethyl+ cypermethrin	Khmer	China	Insecticide	P	II	500ml	KaseVisiddh
78	Docytox 40EC	chlorpyrifos ethyl+ cypermethrin	VN	VN	Insecticide	P	II	100ml. 480ml	KrishiRasayan ,India
79	Kita	chlorpyrifos ethyl+ cypermethrin	Khmer	China	Insecticide	P	II	500ml	KaseVisiddh
80	Naga	chlorpyrifos ethyl+ cypermethrin	Khmer	China	Insecticide	P	III	500ml	Agrotech
81	Naphorid USA 250EC	chlorpyrifos ethyl+ cypermethrin	Khmer		Insecticide	P	III	500ml	NoKorthom Agriculture Development
82	Nato 55SC	chlorpyrifos ethyl+ cypermethrin	Khmer	China	Insecticide	P	II	500ml	Agrotech
83	Paolo 505	chlorpyrifos ethyl+ cypermethrin	Thai	Thailand	Insecticide	P	III	100ml	Penok
84	Toto	chlorpyrifos ethyl+ cypermethrin	Khmer	VN	Insecticide	P	II	500ml	
85	Triceny 595	chlorpyrifos ethyl+ cypermethrin	VN		Insecticide	P	II	100ml	
86	Tungcydan 30EC	chlorpyrifos ethyl+ cypermethrin	VN	VN	Insecticide	P	II	480ml	Aquarius Overseas Private Limited
87	Victory 585	chlorpyrifos ethyl+ cypermethrin	VN	VN	Insecticide	P	II	480ml	

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88	Cyriphos	chlorpyrifosethyl+cypermethrin	Khmer	VN	Insecticide	FR	II	100ml	Nokor Thom
89	Hen Bayon 680	chlorpyrifosethyl+cypermethrin	Khmer	China	Insecticide	P	II	100ml	Hen
90	Super Amey	chlorpyrifos+ alpha cypermethrin+ imidacloprid	Khmer	China	Insecticide	P	II	500ml	
91	Map Green 10AS	citrus oil	Khmer	VN	Repelent	NL	NL	100ml	Map Pacific
92	Funguran	copper hydroxide	Thai	Thailand	Fungicide	P	III	1kg	Sotus
93	Kungulan	copper oxychloride	Thai	Thailand	Fungicide	P	III	1kg	SK
94	Cyperan 10EC	cypermethrin	VN	VN	Insecticide	P	II	100ml. 480ml	Angiang
95	Cypermethrin 35,	cypermethrin	Thai	Thailand	Insecticide	P	II	100ml	Seed Tech Chemical, co.ltd
96	Cyrux 25 EC	cypermethrin	VN, Khmer	VN	Insecticide	P	II	500ml,1L	HPC/United Phosphorus Ltd(AN DO)
97	Dosher 25 ND	cypermethrin	VN	VN	Insecticide	P	II	100ml	Tanh Hung
98	Frong 35	cypermethrin	Thai	Thailand	Insecticide	P	II	100ml	Master Agrotech
99	Kaperthrin 10EC	cypermethrin	Khmer	Thailand	Insecticide	P	II	1L	Red Elephant
100	SecSaigon 10 EC	cypermethrin	VN	VN	Insecticide	P	II	100ml. 480ml	SPC
101	Super Rin 100EC	cypermethrin	VN	VN	Insecticide	P	II	500ml	HoaBinhAgrochem Corp/ Cali Parimex INC-USA
102	Tenzo 10	cypermethrin	Thai	Thailand	Insecticide	P	II	100ml	SK
103	Visher 25 ND	cypermethrin	VN	VN	Insecticide	P	II	100ml	VIPESCO
104	Vit-Sunchiro 10	cypermethrin	Thai	Thailand	Insecticide	P	II	100ml	Silver Door
105	Nevo 330	cyproconazole + propiconazole	VN	VN	Fungicide	P	III	500ml	ĐồngXanh/ Syngenta Vietnam Ltd
106	Videci 2.5 ND	deltamethrin	VN	VN	Insecticide	P	II	100ml	VIPESCO
107	Cazinon 10H	diazinon	VN	VN	Insecticide	P	II	1kg	CPC
108	Diazan 40EC, 50EC. 60EC	diazinon	VN/Khmer	VN	Insecticide	P	II	480ml	Angiang
109	Atonik 1.8 DD	dibromochloropropane DBCP	VN	VN	Insecticide	B	II	1g	ADC
110	Bosdin	dichlorvos	Thai	Thailand	Insecticide	R	Ib	100ml, 500ml	Kemocraft
111	DDVP	dichlorvos	VN	VN	Insecticide	R	Ib	480ml	
112	KraChoa 330	dicrotophos	Thai	Thailand	Insecticide	R	Ib	100ml, 500ml, 1lit	TCPA
113	Catodan 18SL	difenoconazole + propiconazole + tebuconazole	VN	VN	Insecticide	P	II	1L	CPC
114	Goltil super 300EC	difenoconazole + propiconazole + tebuconazole	VN	VN	Insecticide	P	II	100ml	CP QuốctếHoàBình
115	Neretox 95WP	difenoconazole + propiconazole + tebuconazole	VN	China	Insecticide	P	II	100g	PSC.1
116	Vithadan 95WP	difenoconazole + propiconazole + tebuconazole	VN	VN	Insecticide	P	II	100g	VITHACO
117	Bian 40EC	dimethoate	VN, Khmer	VN	Insecticide	P	II	100ml. 480ml	Angiang
118	Palm 5H	dimethoate + fenobucarb	VN	VN	Insecticide	P	II	100g	CPS
119	Vibam 5H	dimethoate + fenobucarb	VN	VN	Insecticide	P	II	1 kg	Vipesco
120	Oshin 20 WP	dinotefuran	Khmer	Japan	Insecticide	NL	NL	6.5g	Agrotech
121	Starkle G	dinotefuran	Thai	Thailand	Insecticide	NL	NL	100g	Sotus/Metsul Chemical
122	HBBULU	emamectin, benzoate+cypermethrin+chlopyriphos ethyl	VN	VN	Insecticide	NL	II	480ml	TNHH HoaSinh a chau
123	Angun	emamectin,benzoate	VN	VN	Insecticide	NL	NL	100ml	Angiang
124	Apache 1EC	emamectin,benzoate	VN	VN	Insecticide	NL	NL	480ml	Tanh Hung
125	Map Winner 5WG	emamectin,benzoate	VN	VN	Insecticide	NL	NL	4g	Map Pacific
126	TikEmectin	emamectin,benzoate	VN	VN	Insecticide	NL	NL	240ml	
127	Jetan 50EC	fenobucarb/ BPMC	VN, Khmer	VN	Insecticide	P	II	480ml	Angiang

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128	Pasha 50EC	fenobucarb/ BPMC	VN	VN	Insecticide	P	II		ADC
129	Turbo 89 OD	fenoxaprop-p- ethyl + ethoxysulfuron	VN	VN	herbicide	P	III	250ml	Bayer
130	Tiller. S	fenoxaprop-P-ethyl+ 2,4-D	VN	VN	herbicide	NL	II+III	100ml	Bayer
131	Legend 0.3G	fipronil	VN	VN	Insecticide	P	II	1kg	DIBAPES
132	Phironin 800WG	fipronil	VN	VN	Insecticide	P	II	0.8g	
133	Rambo 0.3G	fipronil	Khmer	VN	Insecticide	P	II	1kg	ADC Agro Tech
134	Ranger 0.3 G	fipronil	VN	VN	Insecticide	P	II	500g, 2kg	Thanh HUNG/KrishiRasayan. India
135	Ranger 800 WG	fipronil	VN	VN	Insecticide	P	II	1.6g; 500g, 2kg	Thanh HUNG/KrishiRasayan. India
136	Rigell 50SC	fipronil	VN	VN	Insecticide	P	II	5ml	Map Pacific
137	Virigent	fipronil	VN	VN	Insecticide	P	II	100ml	Vipesco
138	Chief 260SC	fipronil+chlorpyrifos	VN	VN	Insecticide	P	II	100ml	ADC Agro Tech
139	Takumi 20WG	flubendiamide	VN	VN	Insecticide	NL	NL	20g	Ngat Ban
140	Ople	fomesafen	Thai	Thailand	herbicide	NL	III	100ml	Sotus, TCPA
141	Arogip 100SP	Gibberellic acid	VN	USA	lUtlas	P	NL	10ml	TNHH-TM Hoang An
142	Gibberellic acid 90%	Gibberellic acid	English	USA	lUtlas	P	NL	10ml	
143	Proger 20WP	Gibberellic acid	VN	USA	lUtlas	P	NL	1g	Thai NongCo.,LTD
144	48 Glyphosate	glyphosate	Thai	Thailand	herbicide	P	III	4l	
145	Fast-Max	glyphosate	Thai	Thailand	herbicide	P	III	5L	AstimEnterprise
146	Gly plus	glyphosate	Thai	Thailand	herbicide	P	III	4l	TCCA
147	Glyphosan 480 DD	glyphosate	VN	VN	herbicide	P	III	480ml;1L	Angiang
148	Glyphosate 48	glyphosate	Thai	Thailand	herbicide	P	III	1000ml, 4000ml	T.K AGRO Co.Ltd, TCCA, Contact group, Thai Crop; TCPA, Sotus
149	Glyphosate 48 Man up	glyphosate	Thai	Thailand	herbicide	P	III	5L	BM
150	Glyphosate 48%	glyphosate	Thai	Thailand	herbicide	P	III	1000ml, 4000ml	Tosun
151	Kleenup 480	glyphosate	Khmer	Indonesia	herbicide	P	III	5L	Agrotech
152	Lan up	glyphosate	Khmer	Thailand	herbicide	P	III	4L	Red Elephant
153	Lyphoxim 40SL	glyphosate	VN	VN	herbicide	P	III	5L/1l	SPC
154	Ly Rin 480DD	glyphosate	VN	VN	herbicide	P	III	1 L	Ngoc Yen Trading and Production Co. Ltd
155	Newsate	glyphosate	VN	VN	herbicide	P	III	1L	CO PHAN THUOC SAT TRUNG CAN THO
156	Sahara 480SL	glyphosate	Khmer	China	herbicide	P	III	4l	KaseVisiddh Group
157	Annong vin 100 SC	hexaconazole	VN	VN	Fungicide	P	III	1L	AN NONG
158	Annongvin 45 SC	hexaconazole	VN	VN	Fungicide	P	III	1L	AN NONG
159	Anvil 5SC	hexaconazole	VN	VN	Fungicide	P	III	100ml,250 ml, 1L	Syngenta
160	Dovil 5SC	hexaconazole	VN	VN	Fungicide	P	III	0.5l, 1lit	Th
161	Honvil 5SC	hexaconazole	VN, Khmer	VN	Fungicide	P	III	2 L	Thom Tranh
162	Sanasa 100SC	hexaconazole	Khmer	China	Fungicide	P	III	1L	KaseVisiddh Group
163	Tungvil 5SC	hexaconazole	VN	VN	Fungicide	P	III	1L	CP SX -TM & DV NgọcTùng/ Aquarius Overseas Private Ltd
164	Vivil 5SC	hexaconazole	VN	VN	Fungicide	P	III	1L	Vipesco
165	Do.One 250	hexaconazole + carbendazim	VN	VN	Fungicide	P	III	100ml	Khisu Don
166	Pursuit 50%	imazethapyr	Thai	Thailand	herbicide	NL	U	1000ml	TCPA/BASF
167	Samarai 100SL	imazethapyr	Khmer	China	herbicide	NL	U	100ml	KaseVisiddh Group
168	Admire 50EC	imidacloprid	VN	VN	Insecticide	P	II	100ml	Bayer
169	Biffiny 70WP	imidacloprid	VN	VN	Insecticide	P	II	100ml	TNHH TM & SX NgọcYến
170	Chungsiling (TM 25% 38%)	imidacloprid	Chinese, Khmer	China	Insecticide	P	II	5g	Sinomaya
171	Superman	imidacloprid	Khmer	China	Insecticide	P	II	100ml,1 L	CYNOYAMA
172	Superman 12.5 EC	imidacloprid	Chinese	China	Insecticide	P	II	500ml	CYNOYAMA
173	Ammate 150SC	indoxacarb	VN	VN	Insecticide	NL	II	8ml	DuPont

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174	Steward 15SC	indoxacarb	Khmer	USA	Insecticide	FR	II	10g	DuPont
175	ThAmaten 150SC	indoxacarb	VN	VN	Insecticide	NL	II	5ml	Thanh Hung
176	Anbas 200WP	isoprocarb + fenobucarb	VN	VN	Fungicide	P	III	100g	Hoang AN(H.A.C)
177	Fuan 40EC	isoprothiolane	VN	VN	Fungicide	P	III	480ml	Angiang
178	Sawant 400EC	isoprothiolane	Khmer	China	Fungicide	P	III	500ml	KaseVisiddh Group
179	Tung One	isoprothiolane	VN	VN	Fungicide	P	III	480ml	Ngoc Yen Trading and Production Co. Ltd
180	Karate 2.5 EC	lambda-cyhalothrin	VN	VN	Insecticide	P	II	250ml	Syngenta
181	Maneb 44	mancozeb	Thai	Thailand	Fungicide	P	III	500g	
182	Penncozeb	mancozeb	Thai	Thailand	Fungicide	P	III	1kg	Sotus . elf atochem
183	Lanomyl 680WP	mancozeb+ metalaxyl	VN	VN	Fungicide	NL	III	100g	TNHH ThạnhHưng
184	Sethey 720WP	mancozeb+ metalaxyl	Khmer	China	Fungicide	NL	III	100g	KaseVisiddh Group
185	Foraxyl	metalaxyl	VN	VN	Fungicide	NL	III	100g	Forward International Ltd
186	Molucide 6GB	metaldehyde	VN	VN	Molluscicide	NL	II	500g	CPC
187	Methomyl	methomyl	Thai	Thailand	Insecticide	B	Ia	250g,500g, 1kg	
188	Penic	metsulfuron methyl	Thai	Thailand	Herbicide	NL	NL	100g	Happy Farmer
189	Almix 20WP	metsulfuron-methyl + chlorimuron ethyl	VN	VN	Herbicide	NL	NL	1.5g	DuPont
190	Master 20WP	metsulfuron-methyl + chlorimuron ethyl	Khmer	China	Herbicide	NL	NL	100g	Agrotech
191	PeStop	monosultap(monomehypo)	Khmer	China	Insecticide	P	III	100g	FAFA SUPER AME, Evergreat Farm Chemical Co.y
192	Flower 95 0.3 DD	Naphthylacetic acid	VN	VN	PRG	P	III	25ml	TNHH SX - TM Tô Ba
193	Viniclo 70WP	niclosamide	VN	VN	Molluscicide	NL	II	35g	VIPESCO, Co Phan THUOC SAT TRUNG Viet Nam
194	Sieutar 20WP	Oxolnic acid	VN	VN	Insecticide	P	Ib	10g	ThanhHung
195	Avalon 8WP	oxytetracyclinehydrochoride +gentamicine sulphate	VN	VN	PRG	NL		10g	TNHH - TM ACP
196	Glaszone	paraquat dichloride	Thai	Thailand	Herbicide	B	II	1L, 5L	
197	Goxizone	paraquat dichloride	Thai	Thailand	Herbicide	B	II	5L	Contact Group
198	Gramoxone	paraquat dichloride	Thai	Thailand	Herbicide	B	II	1L, 5L	Syngenta
199	Noxzone	paraquat dichloride	Thai	Thailand	Herbicide	B	II	5L	TCPA
200	Sotuszone	paraquat dichloride	Thai	Thailand	Herbicide	B	II	5L	Sotus
201	Zeenzone	paraquat dichloride	Thai	Thailand	Herbicide	B	II	5L	DAZAGRO
202	Zenvap	paraquat dichloride	Thai	Thailand	Herbicide	B	II	5L	TCPA/ PATO
203	Map-permethrin 50EC	permethrin	VN	VN	Insecticide	P	II	480ml	Map Pacific
204	Patriot 50EC	permethrin	VN	VN	Insecticide	P	II	100ml. 480ml	Thanh Hung NG/KrishiRasayan. India
205	Peran 50 EC	permethrin	VN/Khmer	VN	Insecticide	P	II	480ml	Angiang
206	Tungperin 10EC	permethrin	VN	VN	Insecticide	P	II	100ml,480 ml	CP SX-TM-DV Ngoc Tung/Agriculture Oversea
207	Vigo 500EC	permethrin	Khmer	China	Insecticide	P	II	100ml	KaseVsidomgroup
208	Bigson-fit 300EC	phenthoate+ fenobucarb	VN	VN	Insecticide	P	II	100ml	CP HóaNôngLúaVàng
209	Dodofit 300EC	phenthoate+ fenobucarb	VN	VN	Insecticide	P	II	100ml	TNHH ThạnhHưng/KrishiRasayan, Inda
210	Hopsan 75ND	phenthoate+ fenobucarb	VN	VN	Insecticide	P	II	250ml, 480ml	H.A.I
211	Tilt Super 300EC	propiconazole	VN	VN	Fungicide	P	II+III	250ml	Syngenta
212	TilusaSuper 300EC	propiconazole	VN	VN	Fungicide	P	II	100ml	
213	T-supernew 350EC	propiconazole + difenoconazole + tebuconazole	VN	India	Fungicide	P	II	Ngoc Tung	Ngoc Tung/Aquarius Overseas Pvt.ivate Ltd
214	Tung Super 300EC	propiconazole + isoprothiolane	VN	VN	Fungicide	P	II	100ml,250 ml, 1L	NgọcTùng
215	Filia 525SC	propiconazole + trycozole	VN	VN	Fungicide	P	II	100ml	Syngenta
216	Antracol 70 WP	propineb	VN	VN	Herbicide	P	III	100g	Bayer

No.	Trade name	Active ingredient	Language on label (indicate if no label)	Source	Use type	List in Cambodia	WHO category by formula	Contents	Company name /country
217	Chess 50WG	pymetrozine	VN	VN	Insecticide	NL	NL	15g	Syngenta
218	Zebiya	pyrazosulferon-ethyl	Thai	Thailand	Herbicide	P	III		Peniok
219	Pyanchor 3EC	pyribenzoxim	VN	VN	Herbicide	NL	III	400ml, 100ml	SPC/GL Life Science Korea
220	Kinalux 25EC	quinalphos	VN/Khmer	VN	Insecticide	P	II	480ml	AnGiang/United Phosphorus
221	Facet 25SC	quinclorac	VN	VN	Herbicide	P	III	250ml	H.A.I/BASF
222	Nomicet 25SC	quinclorac	VN	VN	Herbicide	P	III	250ml	HoabinhAgrochem Corp
223	Ankill	quinclorac +bensulfuron methyl	VN	VN	Herbicide	P	III	100ml	AnGiang
224	Topgun 700WP	quinclorac+ fenoxaprop-P-ethyl+ pyrazosulferon-ethyl	VN	VN	Herbicide	NL	II+III	14g	Map Pacific
225	FaSi 50WP	quinclorac+ pyrazosulfuron-ethyl	VN	VN	Herbicide	P	III	1.5g	Syngenta
226	FuRy 50WP	quinclorac+ pyrazosulfuron-ethyl	VN,Khmer	VN	Herbicide	P	III	15g	Syngenta
227	Power 95WP	quinclorac+ pyrazosulfuron-ethyl	Khmer	China	Herbicide	P	III	20g	Agrotechvita
228	Sanaro 160EC	quizalofop-p-ethyl+fomesafen	Khmer	China	Herbicide	N L/P	II+III	1000ml	KaseVisiddh Group
229	Anthomil 250EW	tebuconazole	VN	VN	Insecticide	P	III	100ml	TNHH TH Hoang An
230	Actara 25WG	thiamethoxam	VN	VN	Fungicide	P	III	1g	Syngenta
231	Tata 25WG	thiamethoxam	VN	VN	Fungicide	P	III	2g	TNHH SX -TM & DV NgọcTùng
232	VieTeam 98WP	tricyclazole + sulfur	VN	VN	Insecticide/fungicide	P	II	10g	CP Thuốc BVTV ViệtTrung/Japanusapesco
233	Bimvin 250SC	tricyclazole +hexaconazole	VN	VN	Fungicide	P	II	480ml	Thanh Hung
234	Forvil new 25SC	tricyclazole +hexaconazole	VN	VN	Fungicide	P	II	100ml	TNHH PhúNông
235	Flash 75WP	tricyclozole	VN	VN	Fungicide	p	II	10g	Map Pacific
236	Tridozole 45SC	tricyclozole	VN/ Khmer	VN	Fungicide	P	II	100ml	TanhDien/Shenzhen Guomeng Industry
237	Citti 750WP	tricyclozole +isoprothiolane+ carbendazim	VN	VN	Fungicide	P	II	100g	Jiangsu Wuxi Ruize Agrochemical Co., Ltd
238	Validan 3 sl	tricyclozole +isoprothiolane+ carbendazim	VN/ Khmer	VN	Fungicide	P	III	1L	AnGiang
239	Validan 3DD	tricyclozole +isoprothiolane+ carbendazim	VN	VN	Fungicide	P	III	480ml, 1L	AnGiang
240	QT-92 18%	zinc phosphide	VN/ Thai	Thailand/VN	Rodenticide	R	Ib	25g	ADC/Thanh Son Hoa NONG
241	Tytco	zinc phosphide	Thai	Thailand	Rodenticide	R	Ib	5g	ChreunphalKasetreCo.,LTD
242	Zinc Phosphide 80	zinc phosphide	Thai	Thailand	Rodenticide	R	Ib	0.5kg,1000 g	LuttaCo.Ltd ; Tong Ka Agro Chemical Co,Ltd
243	Zinc Phosphide	zinc phosphide	VN	VN	Rodenticide	R	Ib	.5kg	

Literature Cited

American Bird Conservancy, 2010. Pesticide Profile – Dicrotophos. http://www.abcbirds.org/abcprograms/policy/toxins/profiles/dicrotophos.html

DAFO. 2011. Personal communications. District Agriculture and Forestry Office Louang Namtha, Lao, P.D.R.

FAO IPM Vegetable Regional Programme. 2010. Country Strategy Paper Lao PDR. Extension Period: July 2010-
June 2013. Pesticide Risk Reduction "IPM Component"/ Towards a non-toxic environment in South East Asia – Phase I (GCP/RAS/229/SWE).

Lao-FAO IPM and FAO Pesticide Risk Reduction Programme, 2009. Report on Pesticide Surveys Conducted in Xaignabouri & Xiangkhouang Province during March 2009. Integrated Pest Management Team with support from FAO Inter -Country Programme for Vegetable IPM in South and SE Asia Pesticide Risk Reduction Project (GCP/RAS/229/SWE).

Lao-FAO IPM and FAO Pesticide Risk Reduction Programme, 2011. *Report of the Study on the Effect of Pesticides on Health and Environment in Vientiane Capital, Lao PDR*. Lao National and FAO IPM Programme and FAO Pesticide Risk Reduction Programme,18-29 May 2009.

Luang Namtha Provincial of Culture, Information and Tourism Department, Lao. 2013. Welcome to Luang Namtha, Northern of Lao PDR. http://www.luangnamtha-tourism-Lao PDR.org/index.html

Louanglath, K., Tiapangnavong, T, van der Wulp, H. Pesticide Survey Northern Lao PDR. FAO-DOA, January 2008.

MAF. 2010. *Regulation on the Control of Pesticides in Lao PDR*. Lao People's Democratic Republic.Ministry of Agriculture and Forestry, June 11, 2010. Printed with the support of the Food and Agriculture Organization and the Swedish International Development Cooperation Agency.

PAFO Vientiane. 2011. Quarterly Report on Retail Shop Monitoring in Vientiane capital, May 2011. Provincial Agriculture and Forestry Office (PAFO) Vientiane capital, Lao PDR, Vientiane capital.

PAFO. 2011. Provincial Agriculture and Forestry Office, Louang Namtha, Lao P.D.R.

PAN International. 2013. PAN International List of Highly Hazardous Pesticides. PAN Germany for PAN International, June 2013.

PAN Pesticides Database. 2010. Chemical Summary for Dicrotophos. http://www.pesticideinfo.org/Summary_Chemical.jsp?Rec_Id=PC35045

PAN Pesticides Database. 2013. Chemical Summary for Cypermethrin. http://www.pesticideinfo.org/Summary_Chemical.jsp?Rec_Id=PC35735

Pathilath, B. 2013. Personal communication. Programme officer. Sustainable Agriculture Development Association. Lao PDR. September 2013.

PEAC. 2013. Personal communication. Pesticide Eco-Alternative Center, Yunnan, China.

Singh, A. K., Tiwari, M. N., Prakash, O., and Singh, M. P. 2012. A Current Review of Cypermethrin-Induced Neurotoxicity and Nigrostriatal Dopaminergic Neurodegeneration. Current Neuropharmacology, 2012, 10, 64-71

Van der Borght, D., Litthamalay, S., Khamphouvong, P. 2004. *The Path to Pesticides…? A Case Study on Trends and Tendencies in the Lao PDR*.FAO IPM Vegetable Regional Programme. February, 2004.

Van der Wulp, H. 2006. *Pest and Pesticide Management in Lao PDR, An Initial Assessment*. Food and Agriculture Organization of the United Nations, December 2006.

Van der Wulp, H. 2013. Personal communication. Senior IPM Policy Officer, Global IPM Facility, Plant Protection Service, Food and Agriculture Organization of the United Nations.