
Briefing Note

Pesticides: A Cause for Concern



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Background

The government of Laos (GOL) aims to remove the country from the list of least-developed countries by 2020, according to the 8th Five Year National Socio-Economic Development Plan (8th NSEDP) (Ministry of Planning and Investment, 2016). The agricultural sector is the top priority for national development and the 8th NSEDP aims to improve general living standards through enhancing productivity, shifting the orientation of agriculture from subsistence farming to market-based systems. Besides maintaining economic growth, the 8th NSEDP promotes the development of a 'green economy' so as to conserve natural resources. GOL has identified several major farming systems based on Laos' geography, and the Northern Uplands is a target for rural development due to the medium-to-high levels of poverty.

In commercial agriculture systems, agrichemicals, especially pesticides, are commonly used to boost production, but they affect human health and potentially pollute soil and water. Harmful and illegal pesticide use is an issue of concern for environmental quality in upland Laos as well as human health.

Previous Studies

Studies on the use of pesticides in Laos have been carried out by a number of organisations, including:

- Food and Agriculture Organization of the United Nations (FAO);
- Department of Agriculture, under Ministry of Agriculture and Forestry (MAF-DOA);
- National Agriculture and Forestry Institute (NAFRI), also part of Lao Ministry of Agriculture and Forestry (MAF);
- Researchers from Faculty of Agriculture and Forest Resources, Souphanouvong University, Luang Prabang;
- Pesticide Action Network Asia Pacific (PAN-AP) in cooperation with the Sustainable Agriculture and Environment Development Association (SAEDA);
- Community Development and Environment Conservation Foundation (ECDECF).

All of these studies highlight that the growing use of pesticides, and the illegal pesticide trade, is likely to have significant environmental and health effects in Laos.

In 2004, FAO surveyed pesticide use in the middle and southern parts of Laos (Vientiane Capital, Vientiane, Savannakhet, and Champasak provinces) to explore trends and tendencies in Laos. Generally, the adoption of pesticides occurred as farmers shifted to market oriented production. The report noted that legally imported pesticide in Laos increased by 30% between 1995-2002, with additional imports entering the country illegally. Pesticides reached farmers by several ways such as farmer-to-farmer, commercial sales, and the 'development trail', including foreign assistance and extension services that promoted the model of the green revolution.

This report suggested that the pressure from the market or consumers to obtain unblemished, uniform, and large produce significantly contributed to agrichemical use. Even though farmers used pesticide when they detected the presence of pests (i.e. they were *not* making prophylactic applications), they often used stronger concentration than specified on the labeled instructions.

The same survey found many farmers mixed pesticides in order to achieve quick results in controlling pests. For instance, Folidol was commonly mixed with Lannate. These farmers experienced acute health effects of pesticides, but they did not fully understand the long-term effects of the pesticide treadmill. Moreover, few farmers were concerned about pesticide residues. The report concluded that these tendencies were likely to increase as Laos continues its process of economic growth and export-focused development.

A later study by FAO (2009) showed that Paraquat, a highly toxic herbicide, was promoted by the private sector as part of contract farming and concession systems within the northern provinces of Laos, including Xaignabouri, Xiangkhouang, Luangprabang, Phongsaly, Oudomxay, and Laungnamtha. Herbicide use increased following the government promotion of maize production as an important commodity for exports. Many other pesticides were found in household and shop surveys, such as Dicrotophos and Zinc phosphide, highly dangerous chemicals based on WHO classification.

The FAO report stated that farmers as well as farm labourers regularly handle hazardous pesticides and they risk themselves and their community in being poisoned due to unprotected exposure and frequent use. It was noted that over 57,000 liters of spray solution were used by a Xaignabury farmer in 15 hectare maize field. Also of concern was the fact that farmers keep pesticides in their rice mills, beneath their houses, in animal shelters etc.

In 2010, following the Stockholm Convention on Persistent Organic Pollutants (POPs), MAF issued regulations to control pesticides, including the banning of 55 chemicals (MAF, 2010). Three years later, PAN AP and SAEDA conducted a study on illegal pesticide trade in Laos, covering Vientiane capital, Loung Namtha and Xiengkhoung (PAN AP, 2013). They found that farmers have little or no understanding of the personal or environmental risks associated with the use of these chemicals; banned pesticides including Paraquat and Methomyl were still available in the market; and officials who manned checkpoints were unfamiliar with the regulations. The study reported that pesticides used in Laos are mainly produced in Thailand, China and Vietnam, and were distributed in Laos according to border proximity and trade networks.

Another survey by DOA in 2013 included residue tests in 500 samples of fresh vegetables and fruits (Louanglath and Van der Wulp, 2014). A total of 94 samples tested positive for organophosphate or carbamate pesticides, with 14 samples having a residue level considered to be unsafe. In early 2014, DOA conducted pesticide residue tests again in 450 samples and found that 149 of them had pesticide residues.

In addition, a study by Chanthakhoun (2016) has pointed out that pesticide residues were detected in 76% of vegetables from a Luangprabang market. A number of fruits and vegetables, including orange, apples, tomato, long bean, cabbage, bean sprouts, and cucumber from other provinces and countries (China and Vietnam, Thailand), are at risk of pesticide contamination.

Recently, ECDECF (2016a,b,c,d) reported pesticide use and health effects in Sangthong district, Vientiane. Sangthong farmers, particularly in Ang Gnay and Khokhea villages extensively use pesticides and some farmers still use banned pesticides including Paraquat and Methomyl. Cropping areas of these two villages are about 34 ha. An amount of pesticide sprayed, after dilution, is between 131,975-144,681 L/year in the two villages. Personal pesticide solution spray ranges between 4,384-13,198L/person/year and a personal spray day is 27-28 days/person/year. Typical sprayed crops include chilies, tomatoes, eggplants, and yard long beans. Many farmers have had acute effects such as feeling dizzy, shortness of breath, burning nose and itching eyes. Notably, blood tests were conducted in the two villages, which are high risk areas, and the tests detect carbamates and organophosphates by using test kits developed by the Thai Ministry of Health. The results show that 57% of the test participants (449 people including children, farmers, and consumers) have unacceptable levels of pesticide residues in their blood.

The latest study to be carried out is by the NAFRI Policy Research centre (2016), who have reported that Chinese banana plantations intensively use agrichemicals. More than 100 chemicals were identified during the study, including chemical fertilizers, herbicides, antibiotics, fungicide, insecticides, and preservatives. The levels of hazard among the pesticides is moderate to high. Of these, banned pesticides such as Paraquat and Methomyl were found. The report raised concerns over environmental and human health effects of the Chinese banana plantations in Laos, which was made worse by poor storage and disposal practices. Empty containers can be found littering fields and washed into streams. This case has been discussed in the latest session of the National Assembly.

Results of Pesticide studies supported by LURAS

Surveys of Pesticide Use in Xieng Khouang province

Xiengkhouang farmers have extensively used pesticides, particularly herbicides to respond to the government's policy on agricultural commercialization and their interest of high income generation. Popular insecticides are Cypermethrine, and Carbaryl and popular herbicides include Paraquat, Glyphosate, 2,4-D, and Atrazine 80 according to the Crops Division of the Provincial Agriculture and Forestry (Xiengkhouang PAFO, 2015a&b) and ECDECF (2016e). Overall, farmers in Koun, Paek, Kham districts spray their crops 8 days/person/year on average (ECDECF, 2016b) and this is classified as medium term exposure from a risk assessment perspective (Van de Gevel (1999) as cited in Drooge, Groeneveld, & Schipper,2001). ECDECF (2016e) also noted that farmers usually do not wear proper protective equipment and only few farmers (7%) observe wind direction while spraying. Also, improper storage and disposal of empty pesticides pose risk to children in particular and natural food sources.

Maize production for export was booming during 2004-2013 in Laos. Xieng khouang in particular extended maize cultivation and has a total area of maize farms about 25,707 ha. Notably, Kham and Nonghad districts have the largest areas and 90% of surveyed maize farms in these districts are applying pesticides, mainly herbicides, according Xiengkhouang PAFO (2015a&b). Overall, annual quantities of pesticide reportedly sold in Kham and Nonghad districts are 12.9 t/year and 95.3t/year, respectively (Xiengkhouang PAFO, 2015 a&b). Moreover, the farmers use pesticides exceeding the recommended application rates (Table 1) because they want to be sure that their maize farms are completely protected from pests and weeds. Shop keepers reported that most pesticides are brought from Vientiane and some from Vietnam.

Table 1: A comparison of actual herbicide used by farmers and use rate based on instructions

Popular Pesticides	Unit	Actual rate used by famers per hectare	Recommended application rate per hectare
Paraquat (banned herbicide)	L	5.8-6.5	2
Glyphosate		8.3-9.5	4
2,4-D		0.3-0.8	2
Cypermethrine		0.5	0.3
Atrazine	Kg	6.2-6.4	2

(Adapted from Xiengkhouang PAFO, 2015a&b)

Vegetables and Fruits Test for Pesticide Residues

Pesticide residues on vegetables and fruits pose health risk to consumers and this issue has been emerging in Laos. Recently, pesticide residue tests in Xiengkhoung and Oudomxai provinces were conducted by the Crop Divisions of PAFOs. Overall, thirty-four types of plants were tested by using GT-Pesticide Residual Test Kit¹ for Organophosphate and Carbamate. It was found that several types of vegetables, including one type of fruit were contaminated by high pesticide residues (Table 2). These contaminated plants came from both within Laos and neighboring countries.

¹ GT-Pesticide Residual Test Kit does not detect herbicide residue and some categories of pesticides.

Table 2: Plants found with high pesticide residues

No.	Types of plant	Sources
1	Cabbage	China
2	Yard long bean	Bangkham Village, Bang District and Buamlao Village, Houn District, Oudomxai province, Nathong Village, Kham District, Xieng khouang province.
3	Cucumber	Buamlao Village, Houn District, Oudomxai province
4	Sponge Gourd	
5	White cauliflower	Thailand
6	Carrot	
7	Young pumpkin leaves	Souk Village, Pakbang District, Oudomxai province
8	Fern	
9	Eggplants	Nathong Village, Kham District, Xieng khouang province.
10	Lettuce	Doung Village, Kham District and Nong kiew Village, Nonghad District, Xieng khouang province.
11	Mustard green	Doung Village, Kham District, Xieng khouang province.
12	Mustard green (yellow flower)	Nong Sang, Nonghad District, Xieng khouang province.
13	Coriander	Xieng Giew Village, Kham District, Xieng khouang province.
14	Upland mustard greens	Pa kom Village, Nonghad District, Xieng khouang province.
15	Tomato	Nonghad market, Xieng khouang Province
16	Lychee	Xieng Khouang, a local market, imported from Vietnam.
17	Big apple	Xieng Khouang, a local market, imported from China.
18	Small apple	

(Adapted from Xieng Khouang PAFO,2016c&d; Oudomxai PAFO, 2016)

Health Effects of Pesticides

Acute effects

According to ECDECF (2016e), many Xieng Khouang farmers experienced acute effects of pesticides. Mostly, they feel dizzy, headache, tired, burning/stinging/itching eyes, short breath and sore throat. Some people have moderate acute effects such as nausea, stomach cramp, vomiting, and tremor. A couple of farmers were reported having severe effects such as coma and seizure.

Blood tests for pesticide detection

Pesticides affect not only farmers, but also other groups of society such as children and consumers. Blood tests for pesticide detection are significant scientific evidence indicating a health effect of pesticides and this may link to chronic illnesses. Glyphosate for instance has been linked to cancer. Others are persistent in both the human body and in the environment, so routine risk assessment needs to be performed. Recently, 767 blood samples were taken from Xieng Khouang people, including farmers, school children, and consumers. The tests detect only carbamates and organophosphates at 4 levels: normal, safe, risky and unsafe by using the reactive paper developed by Ministry of Health, Thailand. Of these, risky and unsafe levels are considered to be unacceptable pesticide residue in blood. A proportion of people with unacceptable pesticide residue in blood, disaggregated by gender, is shown in Table 3.

Table 3: Results of blood tests for pesticide detection in Xieng Khouang Province

Target groups	Total number of people	Number of Female	Number of Male	% of people have unacceptable pesticide residue in blood	% of females have unacceptable pesticide residue in blood	% of males have unacceptable pesticide residue in blood
Farmers	375	248	127	50	46	57
School Children	199	113	86	41	43	38
Consumers	193	80	113	55	58	53
All groups	767	441	326	49	47	51

(Adapted from ECDECF, 2016b)

The results from the blood tests show there is significant exposure to toxic chemicals in the uplands of Laos, and the health effects of pesticides have become a serious concern. While it is obvious that many farmers are directly exposed during spray operations, the results of blood tests for children and consumers suggest other types of exposure are taking place.

The level of pesticides in the blood of children is particularly worrying because they are more vulnerable compared to adults. These children could be exposed to pesticide through contaminated environment such as soil and water, contaminated food chains, and even through proximity to spray operation. Some children in upland Laos were seen helping their parents on pesticide spray operation (see Figure 1), which is exceedingly dangerous. Much scientific evidence (e.g. Bouchard et al., 2011; Engel et al.,2011; Rauh et al.,2015) indicates that chemical pesticides, particularly organophosphates can affect cognitive development in childhood.

Women are also a vulnerable group because they have a high proportion of fat tissue that attracts certain pesticides into their bodies. Mounting scientific evidence shows that women exposure to pesticides is associated with breast cancers (Kettles, Browning, Prince, & Horstman, 1997; Muir et al.,2004; Ferro, Parvathaneni, Patel, & Cheriyaath, 2012; Watts, 2013). Moreover, pregnant and lactating women who are exposed to pesticides risk the health of themselves and their children.

The consumers in the ECDECF study were mostly government officials, who tend to be exposed to pesticides through food chains, i.e. consuming vegetables and fruits, much of which is imported from other Provinces and countries.

In summary, LURAS has collected data of pesticide sales, application rates, residues in fruit and vegetables, and exposure levels as indicated through blood tests². The results are consistent with earlier studies, but also suggest that efforts to reduce the misuse of these toxic chemicals over the past decade has had limited impact. There is a clear need for all stakeholders to take urgent actions to address this cause for concern. Otherwise, this can lead to more serious effects and it can be more difficult to deal with.

²Information on soil and water contamination has not been collected by LURAS. The International Water Management Institute (IWMI) is currently carrying out research that will fill this knowledge gap in the very near future.



Figure 1: Pesticide Use and a pesticide shop in northern Laos (sources: Lao Farmer Network, 2016; LaoFAB,2016; Bartlett, 2016)

Key observations

- Banned pesticides are available in local markets and still used by farmers and this suggests that pesticide regulation enforcement is not working.
- Farmers have extensively and intensively used pesticides in commercial agriculture, particularly maize, fruit, and vegetable production.
- Farmers usually use pesticides in higher rates than pesticide use instructions and they lack appropriate protection when operating spray.
- Highly pesticide contaminated vegetables and fruits are carried from local farms and imported from neighboring countries.
- Unacceptable pesticide levels in blood are present in all sections of society, including producers and consumers.
- Exposure of women and children to pesticides is especially worrying.

The way a head

To address these pesticide issues, it is required a systematic approach consisting of these important mechanisms:

- Enforcing regulation on control of pesticides, particularly by local authorities.
- Education, information, and training for farmers to reduce exposure risks.
- Promoting alternative farming systems (different crops and practices) with equivalent economic value but lower requirement for toxic chemicals.
- Data monitoring on pesticide use, pesticide residues on food, environmental and health effects.
- Strengthening food safety monitoring and consumer awareness, especially for fruits and vegetables.
- Promoting organic and/or clean agriculture and providing incentives for farmers such as organic markets.
- Campaign for protection of women and children from pesticide poisoning.

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