HIGHLY HAZARDOUS PESTICIDES IN VIETNAM: A SITUATIONAL ANALYSIS

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Objectives:

- To examine how highly hazardous pesticides (HHPs) are registered, used, and prohibited nationally on the basis of the PAN HHPs list.
- To identify manufacturers and exporters of pesticides.
- To document procedures for pesticide registrations and rules for reducing and prohibiting pesticide application.
- To provide several cases of environment and human health impacts of pesticides.
- To explore opportunities to reduce and prohibit the use of pesticides and promote the development of agroecology-based farming systems.

1. OVERVIEW

Vietnam is an agricultural country and has the total land area of 331,236 km^2 (33.2 million hectares (ha)). The total land area for production is 27.3 million ha, in which agricultural production land is 11.5 million ha (42.2%). Over the past few decades, rice has been a dominant crop. It occupies 4.1 million ha, accounting for 35.9% of the total agricultural production land area (**Table 1**).

Table 1. Land areas for production in Vietnam (GSO, 2018).

Categories	Area (thousand ha)	Percentage (%)
Agricultural production land	**11,508**	**42.2**
Paddy land	*4,126*	*35.9*
Annual crop land	*2,843*	*24.7*
Perennial crop land	*4,539*	*39.4*
Forestry land	**14,911**	**54.7**
Water surface area for aquaculture	**796**	**2.9**
Land for salt production	**17**	**0.1**
Land for other purposes	**37**	**0.1**
Total	**27,269**	**100**

Vietnam had the total population of 94.7 million people in 2018, with the growth rate of 1.08% compared to 2017. Those in working age (>15 years of age) are 54.3 million people, of whom about 20.5 million are engaged in the agricultural sector (37.7%) (GSO, 2018).

Endowed with large agricultural land and a high percentage of workers in the agricultural sector, Vietnam has effectively mobilized its abundant labor force for agricultural production, which has served as the key pillar for economic growth over the past decades. Vietnam has gradually shifted from a traditional farming approach to adopting new, high yielding varieties (HYV), including IR05 and IR08, since the Green Revolution in the 1960s. This was followed by Vietnam's mass import of a variety of fertilizers and pesticides, but slow progress was experienced due to the Vietnam War and the persistent dominance of the traditional farming practices. According to Vo Tong Xuan (1975), between 1973 and 1974, the total land area devoted to agriculture in Vietnam was 2.83 million ha, including traditional varieties (TRV) occupying 1.94 million ha and HYV occupying 0.89 million ha. In the Vietnamese Mekong Delta (VMD), the TRV occupy about 1.45 million ha and the HYV 0.55 million ha. During this period, the rice yields were low, with about 2.11 t/ha for TRV and 3.7 t/ha for HYV. As such, Vietnam had to

import 303,600 t/yr (paddy grains), 372,183 t/yr (fertilizers), and 2,561 t/yr (pesticides) to support the national farming production.

Under the embargo in the wake of the end of Vietnam War in 1975, the agricultural sector did not make any notable progress. This period witnessed the cultivation of both high yielding varieties and traditional varieties. It also recorded extensive outbreaks of brown planthoppers (*Nilaparvata lugens*) in the VMD. The major land areas of An Giang Province were dramatically afflicted by the outbreak between 1978 and 1982, including 85,753 ha (71% of the land area) in 1978, 20,595 ha (23.4%) in 1979, 8,668 ha (8%) in 1980, 10,783 ha (8%) in 1981, and 7,618 ha (6.7%) in 1982 (DARD of An Giang, 1985). Despite substantial impacts, there is yet to be a formal estimate of the outbreak at the delta level. This period (1976-1985) also witnessed booming population growth in Vietnam, which led to high demands of food grains nationally. It called for urgency to decision-makers in considering how to ensure food supply for the increasing number of more than 1.19 million people/year [(1)].

The Renovation policy (*Đổi Mới*) in 1986 marked a significant milestone for the liberalization of the national economy and the promotion of an open-door policy to the outer world. It paved the way for the establishment of bilateral trade between Vietnam and other countries. This move provided valued opportunities for import/exports of commercial goods, including agro-chemicals. At this point in time, the state played an exclusive role in importing and distributing the agro-chemicals. As stipulated in the Directive 09-CT by the State Council of Ministers dated January 17, 1989, while the Ministry of Agriculture and Rural Development was assigned to manage such commodities, the State takes the responsibility for the inspection of the pesticide lists permissible for import. In the domestic market, this policy allowed the legal privatization and mechanization of agro-chemicals on a larger scale. Vietnam resumed rice exports in 1993 (Le Thanh Duong, 1994). It is notable that the abundant supply of and accessibility to agro-chemicals for agricultural production in the domestic market enabled the surplus production of rice grains, which makes Vietnam the second rice exporter (after Thailand) in the world with rice grains produced mainly (90%) in the VMD. Over the last few decades, the mono-crop (TRV) (1 rice crop/year) has been replaced with the large-scale adoption of HYV with multiple-crop practices (two-three crops/year) throughout Vietnam.

Figure 1 and **Figure 2** present the correlations between the amount of rice produced in Vietnam and the use of active ingredients and trade names of pesticides between 1995 and 2018. These demonstrate the intractable routines of farmers in using pesticides for rice production, which obviously leads to the heavy dependence of pesticides in rice production in Vietnam. It is worth noting that the increased application of pesticides, on the one hand, helps increase the rice output, but on the other, causes significant adverse impacts, especially on environment and human heath, that need to be urgently addressed.

It is a big challenge to reduce the use of pesticides in Vietnam, as it forms an ingrained routine to most rice farmers. However, realities suggest that the Vietnam Government has made notable attempts to eliminate HHPs in the agricultural sector. According to the list published by the Ministry of Agriculture and Rural Development in 2019, there is a total of 503 mono-active ingredients that are categorized into the group of pesticides (133 active ingredients), fungicide (157 active ingredients), and herbicides (85 active ingredients) (**Figure 3**). Realities suggest that it is challenging to monitor the cocktailing of these mono-active ingredients into active groups. The list of HHPs allowed for use in 2019 in Vietnam (**Table 2**) suggests that there are 1,804 active groups and 4,021 trade names, with 82 active groups fewer than those in 2018 and 579 trade names fewer than those in 2017 (**Figure 2**).

[1] *Population of Vietnam over the periods. Source: https://vi.wikipedia.org/*

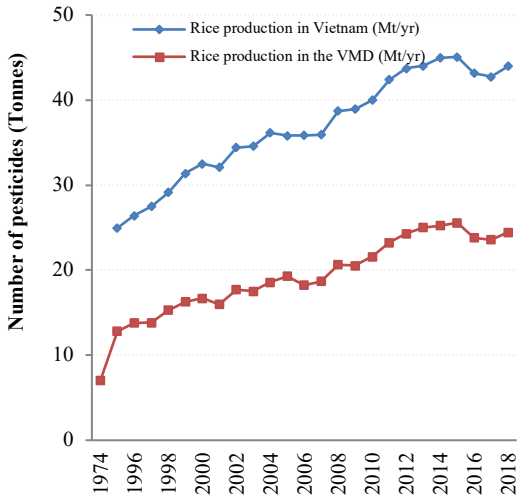


Figure 1. Comparison of rice production in Vietnam and the VMD from 1995-2018 compared to 1974.

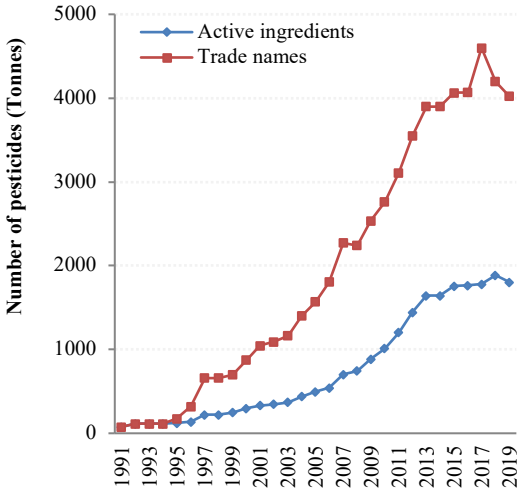


Figure 2. Comparison of number of active ingredients and trade names of pesticides permitted for use in Vietnam from 1991-2019.

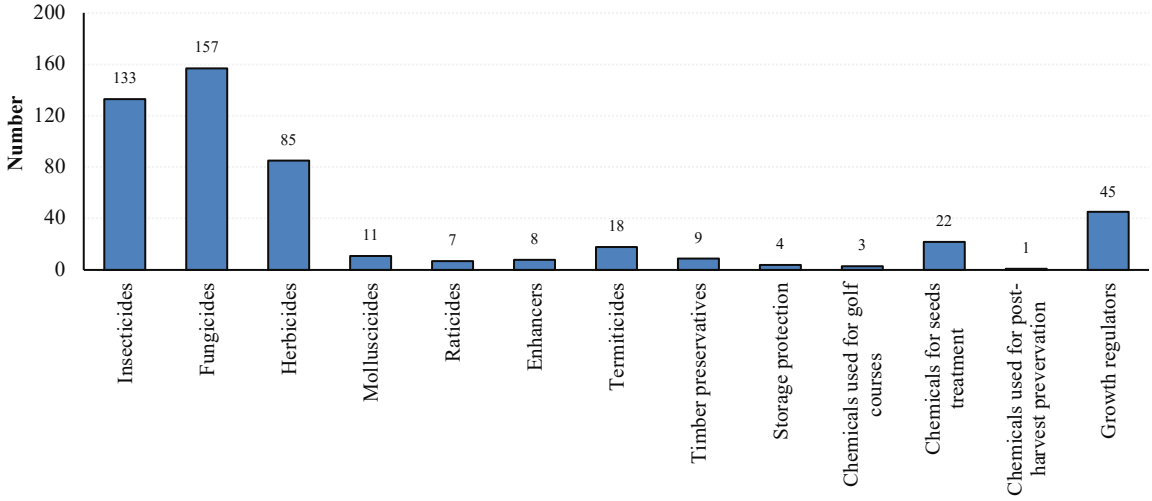


Figure 3. Number of active ingredients of pesticides permitted for use in Vietnam in 2019.

Table 2. Categories of active ingredients and trade names of pesticides allowed for use in agriculture in Vietnam in 2019.

Pesticides used in agriculture	**Active ingredients**		**Trade names**	
	Number	**(%)**	**Number**	**(%)**
Pesticides	874	48.45	1,796	44.67
Fungicides	573	31.76	1,202	29.89
Herbicides	235	13.03	659	16.39
Rodenticides	8	0.44	26	0.65
Molluscicides	33	1.83	153	3.81
Growth regulators	52	2.88	148	3.68
Pheromones	8	0.44	8	0.20
Chemicals used for drainage	5	0.28	6	0.15
Timber preservatives	8	0.44	9	0.22
Storage chemicals	4	0.22	10	0.25
Chemicals used for golf courses	4	0.22	4	0.10
Total	**1,804**	**100**	**4,021**	**100**

Source: *Adopted from Circulation No. 10/2019/TT-BNNPTNT dated 20 September 2019 by the Ministry of Agriculture and Rural Development*

Nowadays, the national government and the central government agencies in the agricultural sector have realized the adverse effects of pesticides. Obviously, they have significant implications on food safety, soil and water environments, and human health. A report on agricultural production in An Giang Province indicated rice production has come with the increasing cost of agro-chemicals (accounting for 48.9% the total production cost), in which 21.2% was spent on pesticides and 27.7% on fertilizers (DARD of An Giang, 2016, 2018). This suggests the need to reduce the cost by adopting technical approaches and farming models such as Global Good Agricultural Practices (Global GAP), Vietnamese Good Agricultural Practices (VietGAP), SRP (Sustainable Rice Platform), IPM, eco-engineering model, 1M5R (1 must do, 5 reductions)[2], organic farming and other greenhouse farming practices. Given the growing interest of farming groups and other associations, there is a new wave of clean/organic agriculture and nature-based agricultural practices that have been promoted throughout Vietnam. The Vietnam Government issued the Resolution 120/NQ-CP dated November 11, 2017 on climate-resilient sustainable development in the VMD. The document aims to push forward the restructuring of the delta agriculture sector towards quality-oriented and nature-based farming practices in the challenging context of climate change. It is also noted that the Vietnam Government issued the Decree 109/2018/NĐ-CP dated August 29, 2018 on organic farming, paving pathways for the development of organic farming in the country. Simultaneously, the Ministry of Science and Technology released Decision 3883/QĐ-BKHCN (December 29, 2017) and Decision 3965/QĐ-BKHCN (December 26, 2018), stipulating organic farming production criteria. This sets an important policy milestone for the reduced application of HHPs in agriculture in Vietnam at present and in the future.

2. KEY ANALYSIS

2.1. Examining how highly hazardous pesticides (HHPs) registered, used, and prohibited internationally on the basis of the PAN HHPs list

As shown in **Table 2**, the list of HHPs inventory in Vietnam includes 1,804 active groups and 4,021 trade names. In 2019, Pesticide Action Network (PAN) updated 98 active groups into their list of HHPs. Given the PAN HHPs list, in Vietnam 310 active groups are listed as HHPs, in which there are 32 active ingredients prohibited, 104 allowed for use and 168 not present in Vietnam (**Figure 4**). The analysis of the PAN HHPs inventory suggests that the Chlordane group is prohibited in most countries (141 countries). **Appendix 1** also shows that there are 32 HHPs prohibited in Vietnam. From cross-checking the HHPs inventory in Vietnam with the PAN 2019 list, we found 207 active ingredients prohibited in other countries, while the other 103 are insufficiently documented. We also found that among the active ingredients, 104 are still allowed for use in Vietnam (**Figure 5**). The list of the PAN HHPs prohibited in some countries, but being used in Vietnam, is presented in **Appendix 2**. Those without sufficient information that are prohibited in some countries but used in Vietnam is presented in **Appendix 3. Appendix 4** presents the current status of PAN HHPs in Vietnam and other countries**.**

As shown in the HHPs inventory in Vietnam in 2019, there are 1,804 groups of active ingredients allowed for use, including 104 identified in the PAN HHPs. The latter is present in the 1,312 cocktailing methods, accounting for 32.6%, together with the formulation of thousands of trade names. This suggests a big challenge in substituting HHPs in agricultural production in Vietnam, which needs time and greater efforts. **Figure 6**, **Figure 7**, **Figure 8**, and **Figure 9** suggest the possible cocktailing of active ingredients from pesticides, fungicides, herbicides, and molluscicides. All these appear in more than 5% of pesticides that are used for a particular purpose in the list of HHPs allowed for use in Vietnam in 2019 (those in red indicate HHPs types).

[2] *1M5R: 1 must do (1M) is the use of certified rice seeds; 5 reductions (5R) of seedlings, fertilizer, pesticides, water use, and post-harvest loss.*

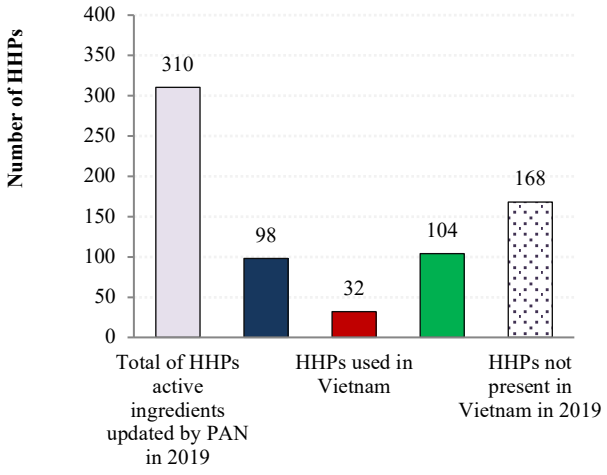


Figure 4. Number of HHPs allowed for use in Vietnam.

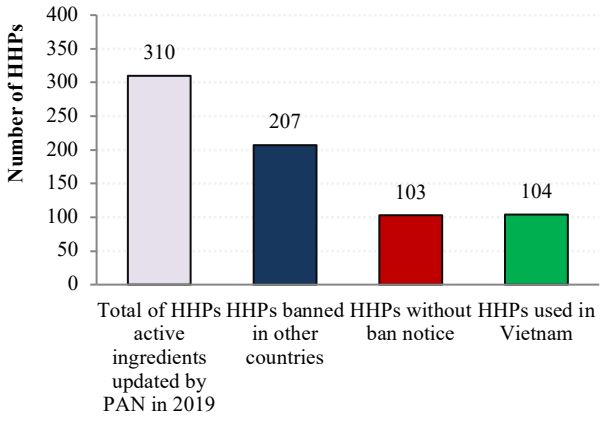


Figure 5. Number of HHPs internationally banned while being used in Vietnam.

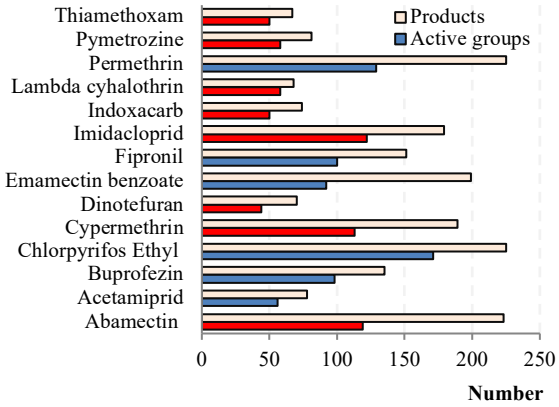


Figure 6. Commonly-used pesticides and number of trade names.

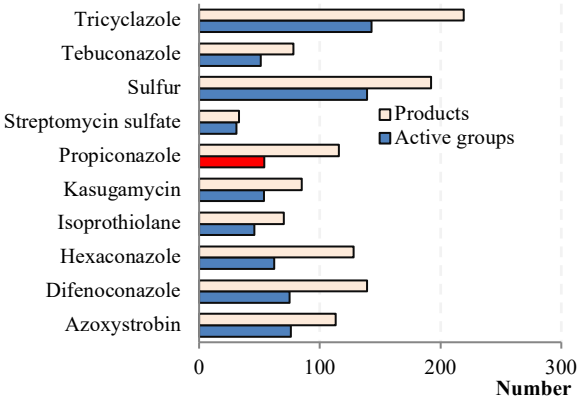


Figure 7. Commonly-used fungicides and number of trade names.

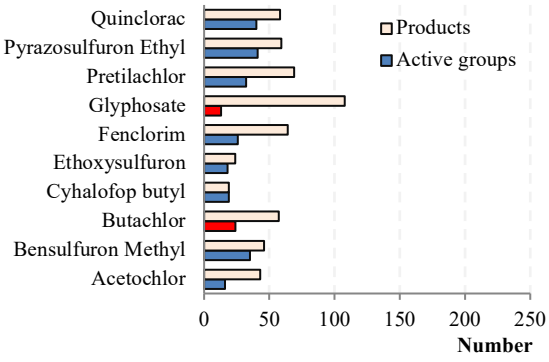


Figure 8. Commonly-used herbicides and number of trade names.

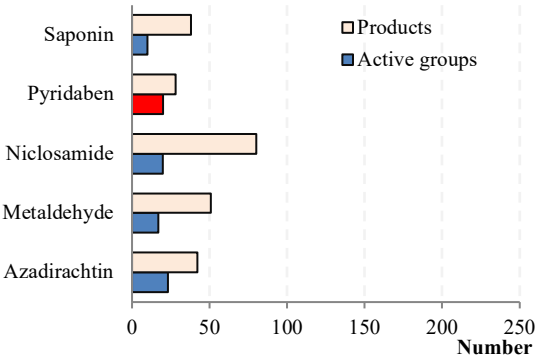


Figure 9. Commonly-used molluscicides and number of trade names.

2.2. Identifying manufacturers and exporters of pesticides

2.2.1. Identifying manufacturers

There are not many companies that produce active ingredients for pesticides in Vietnam. Those that are domestically produced include resistant fungi, parasite fungi, bacteria and antibiotic substances: *Trichoderma* spp., *Metarhizium anisopliae*, *Beauveria bassiana*, *Streptomyces spp., Bacillus thuringiensis, Azotobacter beijerinckii, Paecilomyces lilacinus*... Pesticide chemicals are mostly imported from overseas, with 99% chemicals and 100% pesticides (Vibiz.vn, 2018).

According to the Vietnam Customs documentation from 2006-2018, imported values of pesticides in Vietnam have increased significantly, with the highest values (1,022 million USD/yr) obtained in 2017 and quintupled compared to 2006. In 2018, the imported values of pesticides in Vietnam came to 939 million USD/yr. (**Figure 10**). According to Vibiz.vn (2018), the import of pesticides in Vietnam is enormous, with the total amount of import and application in the agricultural sector reaching up to 70,000- 100,000 tonnes. Similarly, during the first nine months of 2017, Vietnam imported 133,295 tonnes, from which those from China account for 70% (94,166 tonnes). Vietnam imported 100% of chemicals of all kinds, 90% additives and 50% of pesticides of finished products. (**Figure 11**).

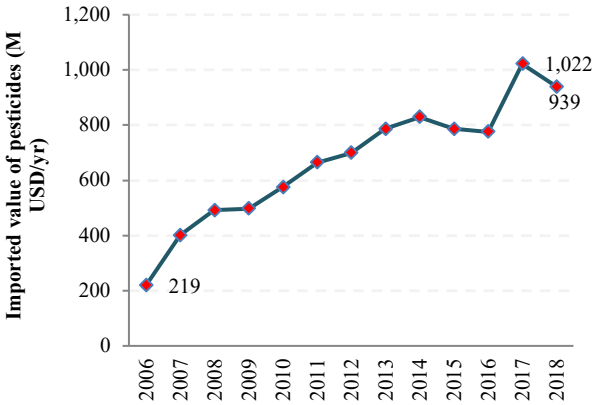


Figure 10. Imported values of pesticides in Vietnam from 2006 to 2018.

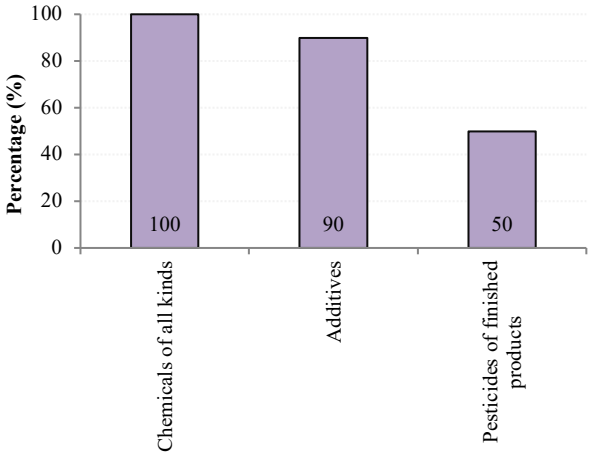


Figure 11. Imported pesticides (Vibiz.vn, 2018).

According to a report by Vibiz.vn (2018), there were 12 major import groups/companies of pesticides. These companies occupy 44.8% of the import bulks into Vietnam. Hai Binh Service Trading Production Limited Company is the top one, with 8.7% of the total imports (**Figure 12**).

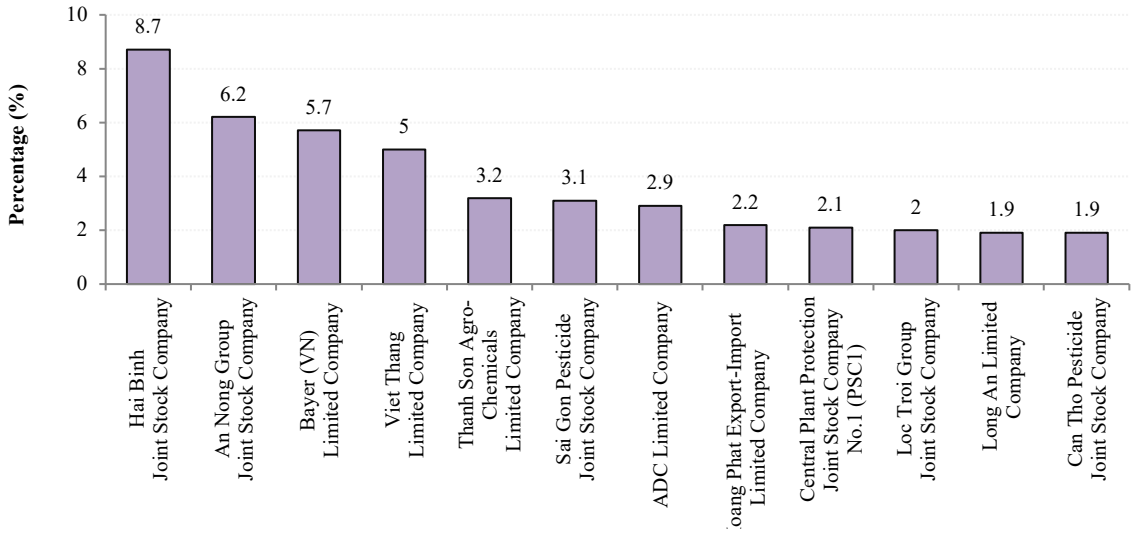


Figure 12. Leading pesticide importers in Vietnam (Vibiz.vn, 2018)

There are 200 manufacturers of pesticides and 100 enterprises in Vietnam that focus solely on importing raw materials (chemicals), mixing them, and packaging finished products (Vibiz.vn, 2018). Accordingly, there are 30,000 wholesaler and retailers of pesticides throughout the country. About 50% of pesticides produced are used domestically and equivalent to 30,000-40,000 tonnes/yr. **Figure 13** shows the development history of 08 largest groups/companies of pesticides in Vietnam, operating within the range between 15 and 41 years. **Figure 14** shows that these companies take up leading positions in the pesticide market of Vietnam, with such enormous market share values as (1) Loc Troi Group Joint – Stock Company (7,783 billion VND/yr), (2)

Vietnam Fumigation Joint Stock Company (2,290 billion VND/yr), (3) Can Tho Techno-Agricultural Supply Joint Stock Company (1,677 billion VND/yr), (4) HAI Agro-Chemical Joint Stock Company (1,611 billion VND/yr), (5) Sai Gon Pesticides Joint Stock Company (863 billion VND/yr), (6) Vietnam Pesticides Joint Stock Company (750 billion VND/yr), (7) TW1 Pesticide Joint Stock Company (480 billion VND/yr), and (8) Can Tho Pesticides Joint Stock Company (211 billion VND/yr).

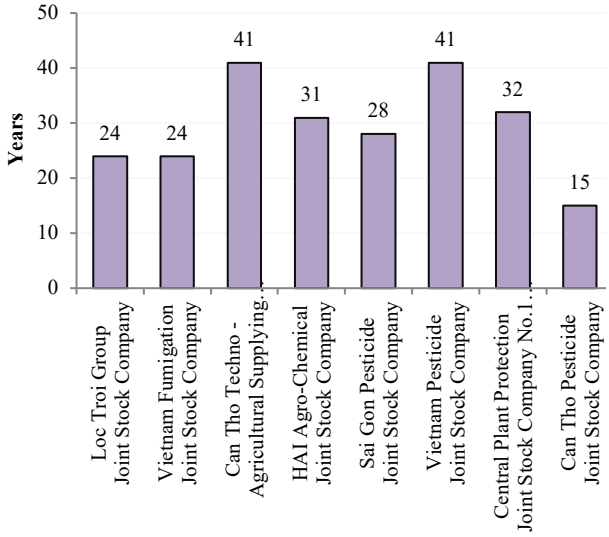


Figure 13. Operating periods (years) of pesticide groups/companies (Vibiz.vn, 2018)

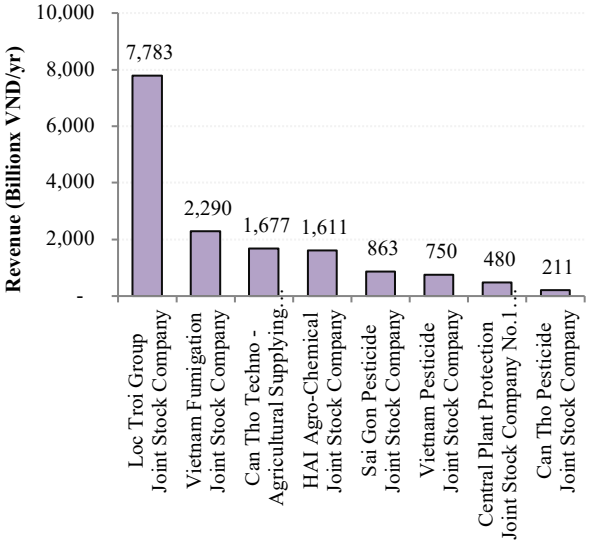


Figure 14. Values of market share by pesticide groups/companies (Vibiz.vn, 2018)

There are 17 groups/companies that are identified as the largest importers, manufacturers, packagers and distributors of pesticides in Vietnam. They are:

1. Sai Gon Pesticides Joint Stock Company
2. Can Tho Pesticides Joint Stock Company
3. HAI Agro-Chemical Joint Stock Company
4. Vietnam Pesticides Joint Stock Company
5. Long An Advanced Agriculture Solution Limited Company
6. ADC Limited Company
7. Bayer VN Limited Company
8. Hai Binh Service Trading Production Limited Company
9. An Nong Group Limited Company
10. Thanh Son Agro-Chemicals Limited Company
11. Viet Thang Limited Company
12. Hoang Phat Import-Export Limited Company
13. Sai Gon Pesticide Joint Stock Company
14. TW1 Pesticide Joint Stock Company
15. Vietnam Fumigation Joint Stock Company
16. Loc Troi Group Joint – Stock Company
17. Can Tho Techno-Agricultural Supply Joint Stock Company

2.2.2. Identifying key exporters

According to Vibiz.vn (2018), until the end of 2017, there were up to 8,767 tonnes of pesticides and related chemicals exported overseas (entering 15 markets). Among these were 38,6% of pesticides, 30,5% of growth regulators, 10,2% of herbicides, 8,8% of fungicides, 2,5% of molluscicides, and 9,4% of others. The markets that imported the pesticides included: Cambodia (4,252 tonnes), Taiwan (666 tonnes), Singapore (350 tonnes), Myanmar (143 tonnes) and Laos (83 tonnes).

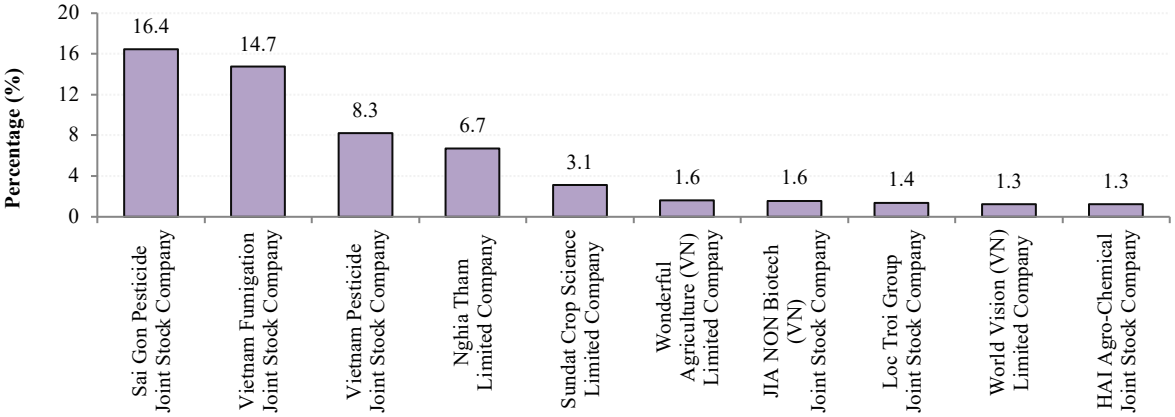


Figure 15. Groups/Companies in Vietnam of the largest pesticide exports (Vibiz, 2018).

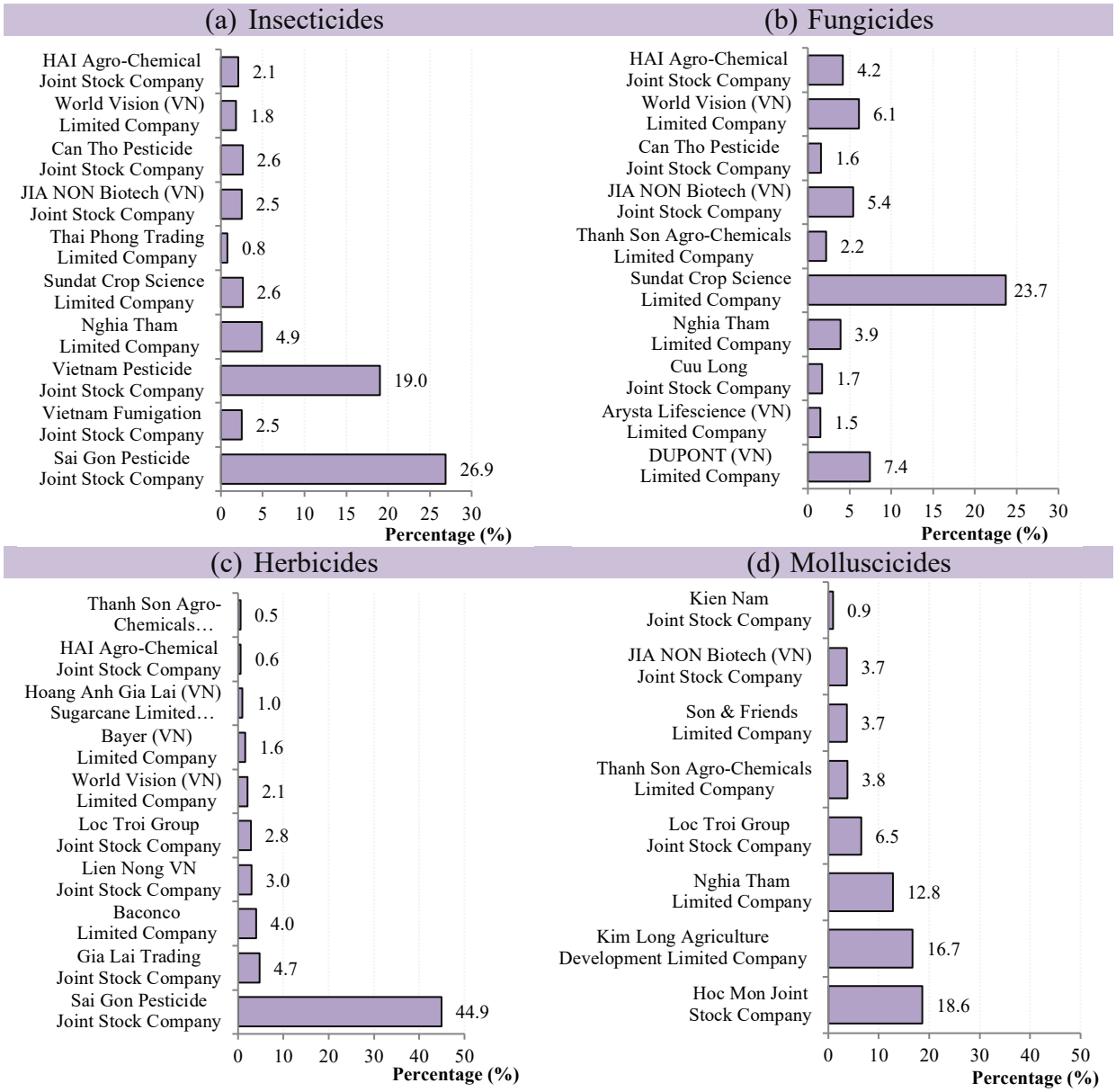


Figure 16. List of Groups/Companies in Vietnam that export the bulk of (a) insecticides, (b) fungicides, (c) herbicides, and (d) molluscicides (Vibiz, 2018)

A Vibiz.vn report in 2018 suggested that there were 10 leading exporters of pesticides as indicated in **Figure 15**. Four groups/companies that occupy more than 5% of the market share include Sai Gon Pesticide Joint Stock Company (16.44%), Vietnam Fumigation Joint Stock Company (14.73%), Vietnam Pesticides Joint Stock Company (8.25%), and Nghia Tham Limited

Company (6.69%). **Figure 16** shows that some companies have their own strengths in exporting several types of pesticides. Two leading companies exporting pesticides include Sai Gon Pesticides Joint Stock (26.9%) and Vietnam Pesticides Joint Stock Company (VIPESTCO) (19%); Three leading companies exporting fungicides include Sundat Crop Science Limited Company (23.7%), DUPONT (VN) Limited Company (7.4%), World Vision (VN) Limited Company (6.1%); A leading company exporting herbicides include Sai Gon Pesticides Joint Stock Company (44.9%); and four leading companies exporting molluscicides include Hoc Mon Joint Stock Company (18.6%), Kim Long Agriculture Development Limited Company (16.7%), Nghia Tham Limited Company (12.8%), and Loc Troi Group Joint – Stock Company (6.5%) (**Figure 16**).

Table 3 provides the list of 25 Groups/Companies that export a bulk of agro-chemicals overseas. Those having the highest variety of exported agro-chemicals include Sai Gon Pesticide Joint Stock Company, JIA NON Biotech (VN) Joint Stock Company, HAI Agro-Chemical Joint Stock Company, Loc Troi Group Joint – Stock Company, Thanh Son Agro-Chemicals Limited Company, Nghia Tham Limited Company, Sundat Crop Science Limited Company, and World Vision (VN) Limited Company.

Table 3. List of groups/companies and the types of exported agro-chemicals

No	Groups/Companies	Names of agro-chemicals				Total
		Pesticides	Fungicides	Herbicides	Molluscicides	
1	**Sai Gon Pesticide Joint Stock Company**	**X**		**X**		**2**
2	Cuu Long Joint Stock Company		X			1
3	Hoc Mon Joint Stock Company				X	1
4	**JIA NON Biotech (VN) Joint Stock Company**	**X**	**X**		**X**	**3**
5	Vietnam Fumigation Joint Stock Company	X				1
6	Kien Nam Joint Stock Company				X	1
7	Lien Nong VN Joint Stock Company			X		1
8	**HAI Agro-Chemical Joint Stock Company**	**X**	**X**	**X**		**3**
9	Can Tho Pesticides Joint Stock Company	X	X			2
10	Vietnam Pesticides Joint Stock Company	X				1
11	**Loc Troi Group Joint – Stock Company**			**X**	**X**	**2**
12	Gia Lai Trading Joint Stock Company			X		1
13	Arysta Lifescience (VN) Limited Company		X			1
14	Baconco Limited Company			X		1
15	Bayer (VN) Limited Company			X		1
16	DUPONT (VN) Limited Company		X			1
17	**Thanh Son Agro-Chemicals Limited Company**		**X**	**X**	**X**	**3**
18	**Nghia Tham Limited Company**	**X**	**X**		**X**	**3**
19	Kim Long Agriculture Development Limited Company				X	1
20	Son & Friends Limited Company				X	1
21	Hoang Anh Gia Lai (VN) Sugarcane Limited Company			X		1
22	**Sundat Crop Science Limited Company**	**X**	**X**			**2**
23	Thai Phong Trading Limited Company	X				1
24	Wonderful Agriculture (VN) Limited Company					N/a
25	**World Vision (VN) Limited Company**	**X**	**X**	**X**		**3**
26	VIPESTCO (Vietnam Pesticides Joint Stock Company)	X				1

2.3. Documenting procedures for pesticide registrations and rules for reducing and prohibiting pesticide application

Procedures for registrations and application of any pesticides in Vietnam shall be stipulated by the Law on Protection and Plant Quarantine Regulations No. 41/2013/QH13, Law on Chemicals

No. 06/2007/QH12, Law on Product and Goods Quality No. 06/2007/QH12, and Law on Standards and Technical Regulations No. 68/2006/QH11. Specific regulations on agro-chemical management are presented in Circular No. 21/2015/TT-BNNPTNT (June 08, 2015) on agro-chemical management, as indicated below:

2.3.1. Summary of the Circular No 21/2015/TT-BNNPTNT (June 08, 2015) on agro-chemical management

This Circular includes 15 chapters and 85 articles, encompassing the following areas:

i. Chapter 1: General principles
ii. Chapter 2: Registration of agro-chemicals
iii. Chapter 3: Testing of agro-chemicals
iv. Chapter 4: Manufactures and trades of agro-chemicals
v. Chapter 5: Import and export of agro-chemicals
vi. Chapter 6: Monitoring of agro-chemical quality
vii. Chapter 7: Certification and circulation of agro-chemicals
viii. Chapter 8: Transport and preservation of agro-chemicals
ix. Chapter 9: Advertisement of agro-chemicals
x. Chapter 10: Labelling agro-chemicals
xi. Chapter 11: Packaging agro-chemicals
xii. Chapter 12: Application of agro-chemicals
xiii. Chapter 13: Collecting and disposing of agro-chemicals
xiv. Chapter 14: Arrangements of enforcement
xv. Chapter 15: Terms of enforcement

Regulations relevant to the granting of certification or elimination for new agro-chemicals can be found in Chapter 2, from article 5 to article 7. In general, the Law on Protection and Plant Quarantine and the Circular provides instructions for conformity with international conventions such as: FAO Code (FAO), environmental regulations (UNEP), health safety regulations (WHO), Rotterdam Convention and Stockholm Convention. It is, however, found that the sizable market of pesticides in operation in Vietnam can be attributed to the privatization process, the phase-out of subsidy policy by the State, and the population growth since the 1980s. At the same time, the pesticide business truly brings about a huge profit, thus attracting the mushrooming of groups, companies, distributors of levels 1, 2, and 3 (ranking of pesticide distributors according to the size of their businesses and capital), and even retailers in rural areas. Cognizant of the adverse impacts of pesticides, the Vietnamese Government has put in place regulations with stricter control of pesticides and made sustained efforts in finding alterative measures to reduce the negative environmental and health impacts.

2.3.2. Granting certifications for new agro-chemicals

According to Article 5, Circular No. 21/2015/TT-BNNPTNT, it is stipulated that:

- All pesticides allowed for use shall be provided in the registered list.
- Domestic or international agencies shall be allowed to register the trade names of pesticides they manufacture.
- They are allowed to transfer to only one competent organization/individual.
- Each unit is entitled to register only 1 active ingredient manufacturer.
- Those registered shall satisfy the following conditions. They shall be:
    - Entitled to register one trade name for each active ingredient
    - Entitled to register one amount of active ingredient for each finished product
    - Entitled to transfer the trade names
    - Not allowed to change trade names of pesticides provided in the list

    - Allowed to change the name of manufacturers as provided in the pesticide registration certificates
- It shall be five years since the organizations, individuals are successfully granted registration certificates for active ingredients allowed in the list, and others would be allowed to submit additional registration documents for new pesticide trade names of the same active ingredients.
- Pesticides that have bio-chemical compounds in their active ingredients shall be managed under specific regulations of chemicals.

2.3.3. Agro-chemical prohibition

Principles provided in Article 6, Circular No. 21/2015/TT-BNNPTNT concern:

- The State promulgated the list of banned agro-chemicals
- Complying with Globally Harmonized System of Classification and Labeling of Chemicals (GHS), finished products or active ingredients in the finished products that have the toxic levels of I, II shall be categorized accordingly.
- HHPs with high adverse impacts on human health, animals, ecosystems, and environment include the following:
    - Pesticides warned about by Food and Agriculture Organization (FAO), United National Environment Program (UNEP), World Health Organization (WHO); Agro-chemicals in the Appendix III of Rotterdam Convention;
    - Agro-chemicals as the compounds of active ingredients for various purposes (insecticides, herbicides, crop diseases, and growth regulators) except the ones on seed treatment;
    - Agro-chemicals containing micro-organisms of high risks to humans;
    - Agro-chemicals causing gene mutation, cancer, adverse impacts on human productivity;
    - Agro-chemicals of high toxicity or finished products of III, IV types (GHS standards); Agro-chemicals of organo-chlorine groups.
    - Agro-chemicals of redundant trade names of active ingredients or the trade names of other agro-chemicals in the list.
    - Agro-chemicals containing methyl bromide.
    - Agro-chemicals registered to prevent species different from pests in Vietnam.
    - Agro-chemicals manufactured overseas but not allowed for use.

Process of pesticide elimination in the Article 7, Circular No. 21/2015/TT-BNNPTNT stipulates that:

- Condition type: a) Agro-chemicals stipulated in Section 2 Article 49; Item b, c, Section 1, Article 54 of Law on Protection and Plant Quarantine; b) Agro-chemicals in the Appendix III of Rotterdam Convention, warnings by the Food and Agriculture Organization (FAO), United National Environment Program (UNEP), and World Health Organization (WHO).
- Process of eliminating pesticides from the list includes:
    - Plant Protection Department shall be responsible for submitting formal documents on pesticide elimination to the Minister of Agriculture and Rural Development;
    - Plant Protection Department shall be responsible for synthesizing the documents, setting up the Review Committee to advocate the pesticide elimination and reporting to the Ministry of Agriculture and Rural Development thereof.

- As stipulated in Item c, Section 2, Article 49; Item b, c, Section 1, Article 54 of Law on Protection and Plant Quarantine, the Plant Protection Department shall submit requests on pesticide elimination to the Minister of Agriculture and Rural Development.

- Regulations include: (1) Ban in import within one year, (2) Pesticides traded and used within two years since the date of elimination issued by the Ministry of Agriculture and Rural Development.

The list of pesticides banned in Vietnam is presented in **Appendix 4** and **Appendix 5**.

2.4. Impacts of pesticides on human health and environment

2.4.1. Impacts of pesticides on human health

According to GSO (2006-2019), food poisonings (hospitalizations, deaths) in Vietnam have decreased in recent years (**Figure 17**). A study by the World Bank (2017) also noted that the poisonings are attributed to toxic residues in food, which come from various sources such as: (1) micro-organisms, (2) chemicals, (3) nature, and (4) unknown. Chemicals-induced poisonings account for 3.8%, suggesting the reduction of cases from 2012-2015 (**Figure 18**). Chemical residues are found as the most common cause of poisonings due to the overuse of pesticides in crop production.

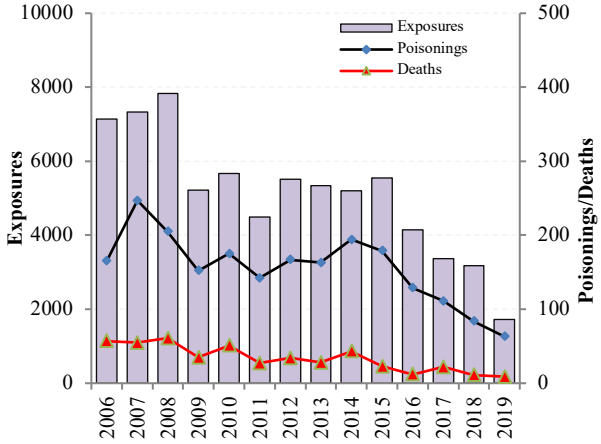


Figure 17. Poisoning incidences in Vietnam from 2006 to 2019

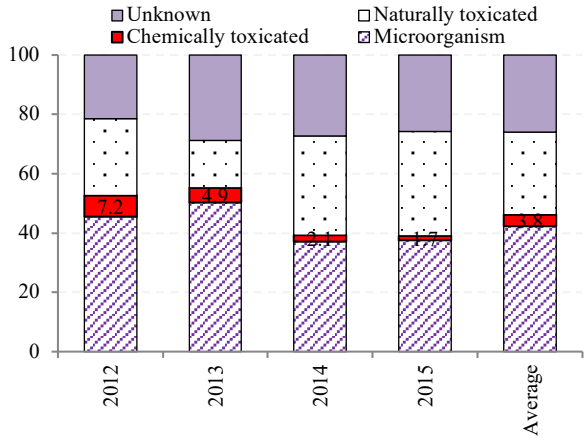


Figure 18. Causes of poisonings in Vietnam

A study on Knowledge (K)-Attitude (A)-Practice (P) conducted by RCRD (Research Center for Rural Development), CGFED (Research Centre for Gender, Family and Environment in Development), and SRD (Center for Sustainable Rural Development) in An Giang, Nam Dinh, and Phu Tho Provinces in 2014 suggest eight symptoms commonly experienced by pesticide applicators while applying pesticides (**Table 4**). A survey on 355 farmers suggested that in An Giang Province, 95.2% of those who directly sprayed pesticides were males, while in the other two (Nam Dinh and Phu Tho Provinces) the majority are females (71 and 74% respectively). In terms of gender, level of sensitivity to pesticides of females is higher than that of males. In the northern provinces (Nam Dinh and Phu Tho), common symptoms were weariness (100%), itchiness (52.2%), dizziness (51.3-62.7%) and headaches (66.4-80.7%), while in An Giang, symptoms of itchiness were the most common (62.5%). Those involved in orchard farming had lower exposure rates than rice and upland crop farmers. Overall, the most common exposures (>50%) to pesticides include weariness (82.1%), itchiness (57%), and headaches (56.6%). Others include dizziness (45.7%), dry skin (17.2%), skin blister (5.3%), cough (9.6%), and stomachaches (3.6%). The blood test on Enzyme Acetylcholinesterase (AChE) results on 190 farmers in An Giang Province suggested that 35% had the low AChE level by 25%, while 25% had the lower level (67%). It is noted that the level of AchE in blood is indicative of exposure to pesticide use. Another study by Dasgupta et al. (2007) on 213 workers in pesticide companies suggested that 34.7% had a low AchE level.

Table 4. Common symptoms of farmers after pesticide application

Symptoms	Research sites (%)				Farming practices (%)			
	An Giang	Nam Dinh	Phu Tho	Total	Rice	Fruits	Upland crops	Total
Weariness	31.3	100.0	100.0	82.1	91.6	48.3	68.6	82.1
Itchiness	62.5	52.2	57.8	57.0	56.7	55.2	58.6	57.0
Dizziness	15.0	51.3	62.4	45.7	54.2	17.2	32.9	45.7
Headache	10.0	66.4	80.7	56.6	68.0	13.8	41.4	56.6
Dry skin	13.8	15.0	22.0	17.2	20.2	17.2	8.6	17.2
Skin blister	1.3	7.1	6.4	5.3	6.4	3.4	2.9	5.3
Cough	2.5	6.2	18.3	9.6	12.8	0.0	4.3	9.6
Stomachache	0.0	2.7	7.3	3.6	5.4	0.0	0.0	3.6
Others	11.3	6.2	0.0	5.3	3.0	6.9	11.4	5.3

Source: *RCRD, CGFED & SRD, 2014*

A sample of 335 participants suggested that 8.2-9.5% of poisoning cases were found in rural areas. Those who apply pesticides on rice and fruits are more likely to be exposed to pesticides than on vegetables (**Figure 19**). The results also suggested that five out of 19 cases have been poisoned with pesticides twice, one out of 18 poisoned five times, and others once (**Figure 20**).

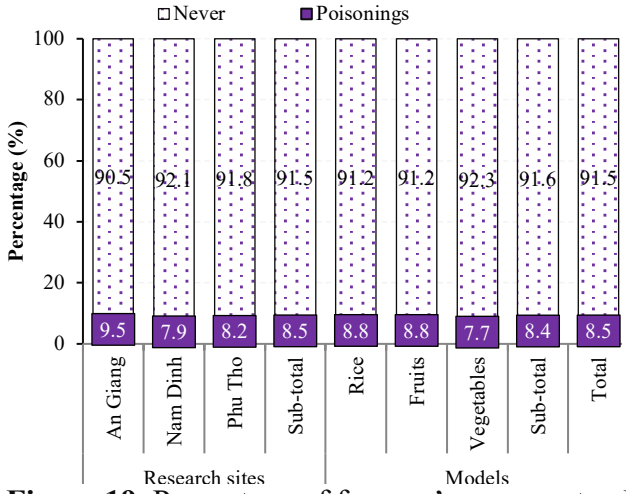


Figure 19. Percentage of farmers' exposure to pesticides by research sites and farming models.

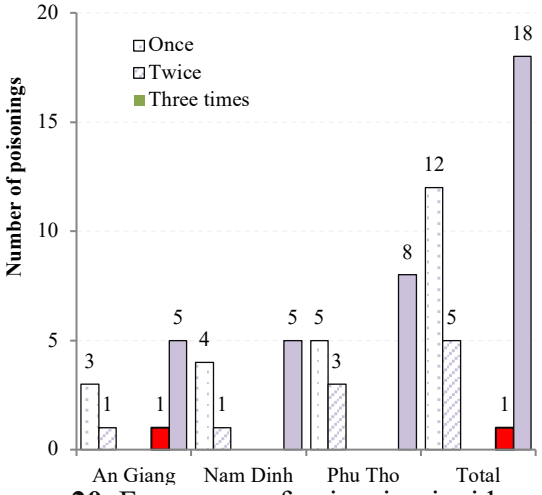


Figure 20. Frequency of poisoning incidences in research sites.

2.4.2. Impacts of pesticides on environment

According to a study by World Bank (2017), there is an increasing amount of pesticides in rice fields in the VMD. On average, farmers in the VMD applied 0.3 kg of active ingredients (ai)/ha/year (1981-1986), 0.4-0.5 kg ai/ha/year (1986-1990), 0.67-1 kg ai/ha/year (1991-2000), and 2.54 kg ai/ha/year (2001-2010) (World Bank, 2017). A study by Le Thanh Phong (2012) suggested that those in Chau Thanh District (Soc Trang Province) applied 10.5 kg ai/ha/year, Cai Lay District (Tien Giang Province) 10,6 kg ai/ha/year, Thoai Son District (An Giang Province) 6.65 kg ai/ha/year, and Phuoc Long District (Bac Lieu Province) 5.4 kg ai/ha/year. According to the World Bank (2017) (cited from MDRI , 2015), rice cultivation that does not comply with the "1 must do, 5 reductions" demands a higher amount of pesticides of up to **7.02** kg ai/ha/year; otherwise, **5.26** kg ai/ha/year is needed (found in Kien Giang and An Giang Provinces). Realities suggest that farmers in the VMD waste a large amount of pesticides while using them on fields. This is linked to the overuse of molluscicides (1,790.3 t ai/year), herbicides (209.9 t ai/year), insecticides (1,224,0 t ai/year), and other chemicals (4,245,5 t ai/year) (**Table 5**).

Table 5. Estimated wastes (losses) of agro-chemicals used in rice production in the VMD.

No	Provinces	Agro-chemicals *(Tonnes of ai/yr)*			
		Molluscicides	Herbicides	Pesticides	Fungicides
1	An Giang	263.8	31	180.4	625.6
2	Bac Lieu	75.4	8.8	51.6	178.9

3	Ben Tre	28.1	3.3	19.2	66.6
4	Ca Mau	53	6.2	36.2	125.7
5	Can Tho	97.9	11.5	67	232.2
6	Dong Thap	222.9	26.1	152.4	528.6
7	Hau Giang	86.6	10.2	59.2	205.3
8	Kien Giang	317.7	37.3	217.2	753.4
9	Long An	218.9	25.7	149.7	519.1
10	Soc Trang	153.4	18.0	104.9	363.8
11	Tien Giang	97.2	11.4	66.5	230.5
12	Tra Vinh	99.4	11.7	68.0	235.7
13	Vinh Long	76	8.9	51.9	180.2
	Total	**1,790.3**	**2099**	**1,224**	**4,245.5**

Source: World Bank, 2017

The overuse of pesticides leads to serious environmental contamination. According to the Ministry of Natural Resources and Environment (2018), disposed water from agricultural production is the key issue that needs to be taken into consideration. It is because it contains toxic chemical residues from pesticides. Given the rice cultivation areas of nearly 2 million ha with more than 50% of triple-crop areas, the VMD has witnessed the disposal of large amounts of water from fields. According to Nguyen Quoc Tinh et al.'s (2019) assessment on organic (P) phosphorus collected on rice fields, 03 out of 10 samples are pesticide-contaminated (accounting for 23%). Active ingredients found were quinalphos (relevant to organic (P) phosphorus). As noted by Son Trang (a journal of agricultural science) from July 25, 2017, the overuse of pesticides in farming activities has tremendous impacts on aquaculture. Evidence suggests that the residue of chlorpyrifos was found in Tra fish (fillet) exported to the US. According to Professor Harry Futselaar, an international expert in water treatment from Saxion University of Applied Sciences, the Netherlands, the groundwater in Vietnam is subject to serious contamination; more than 60% of groundwater is contaminated by the use of pesticides and fertilizers from agricultural production (https://tuoitre.vn/, from November 5, 2019).

Overall, adverse impacts of pesticides on human health and the environment are self-evident and a critical issue to be urgently addressed. However, there is a lack of incentives to study these issues in Vietnam. This accounts for the modest scientific publications in these areas. While the impacts of pesticides on environment and human health remain a big challenge to policy makers in Vietnam, it is essential to promote alternatives such as clean-organic agriculture on the larger scale.

2.5. Exploring opportunities to reduce and prohibit the use of pesticides and promote the development of agroecology-based farming systems

There have been changes in policies over the past few years. This enables changes in customers' perceptions and behaviors in using HHPs, which paves the way for the extensive adoption of ecological farming models in Vietnam.

2.5.1. Trends of agricultural production in Vietnam

In a published book on the potential of export market for clean, organic agricultural products, by McCoy and Parlevliet (2000), the concept "clean" is defined as "pure", free of residues. Residues are known as chemical substances or micro-organisms. Physical residues include materials added into foods while being processed. Chemical residues include the use of pesticides, herbicides, fertilizers or improper use of cleansers or others in producing food. Exposure to micro-organisms is largely due to a lack of hygiene in one's everyday practices. Recently, customers have defined clean food as non-GMO.

According to the authors, the descriptive definition of clean products is based on farming or production methods. There are nine different farming/production methods pertaining to chemical or non-chemical/natural inputs.

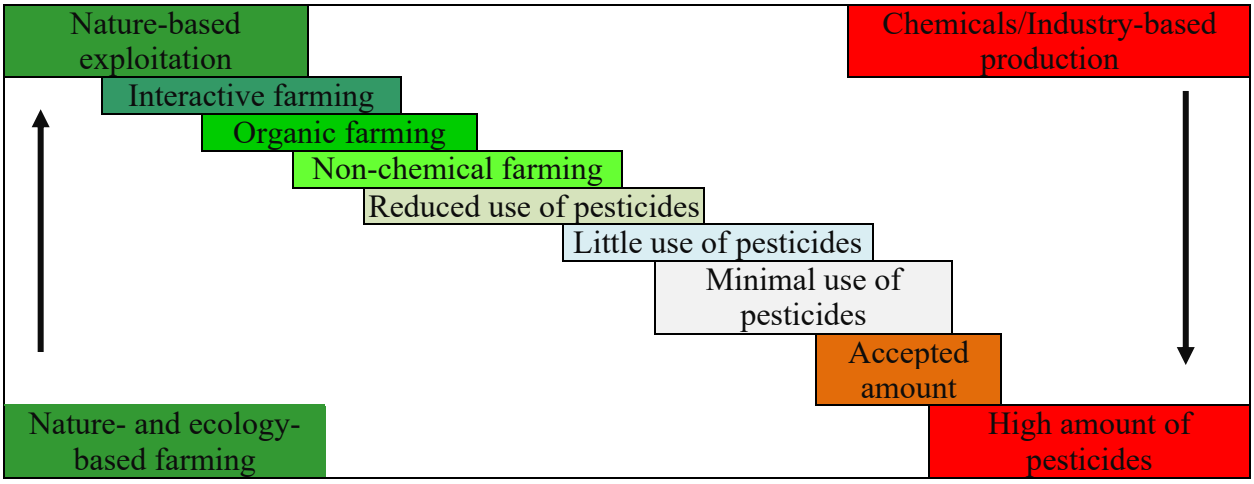
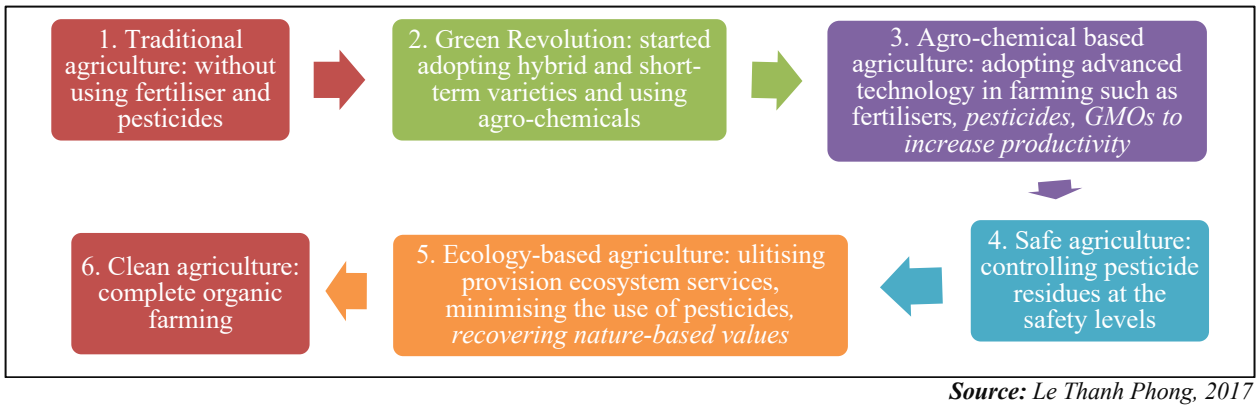


Figure 21. Illustrations of agricultural production stages in Vietnam.

The Green Revolution started with a series of scientific researches on wheats and corns in the 1930s, which was followed by extensive research on rice varieties, and some recognised achievements in hybrid rice varieties (Gary Toenniessen, 2016) were attained. This laid an important groundwork for the upscaling of the production methods internationally. The 1960s witnessed successful cross-breeding between short-stem rice lines (non-photoperiod) and long-stem, long-term lines (photo-period) to obtain a hybrid line (non-photoperiod). This hybrid line provides high productivity that helped address contemporary food shortages. However, demands for increased productivity and corresponding intensive farming production resulted in serious contamination of soil, water and air due to the farmers' overuse of agro-chemicals (World Bank, 2017). This encourages the wider adoption of traditional practices such as eco-friendly or organic farming. However, it takes time to change famers' perspectives of clean agricultural practices that need feasible investment in knowledge acquisition, farming methods and technology. In the case of Vietnam, the national agricultural development has undergone the above-mentioned stages: traditional farming, Green Revolution agriculture, agro-chemical-based agriculture, safe agriculture, eco-engineering agriculture, and clean-organic agriculture (**Figure 22**). The stages also witnessed the deviation in the traditional farming practices with greater support of advanced technology to generate clean-organic products. At present, agriculture in Vietnam has shifted from stage 3 (agro-chemical-based agriculture) to stage 4 (safe agriculture). Moving forward, making a frog leap towards the large-scale adoption of pro-nature and clean-organic farming practices requires the mobilization of social resources and the inclusion of multiple stakeholders.



Source: *Le Thanh Phong, 2017*

Figure 22. Summary of agricultural evolution in Vietnam.

2.5.2. Signs of changes

a. Change in policies

** Production*

The Vietnam Government issued Decision No.1393/QĐ-TTg on approval of national strategies on green growth dated September 25, 2015, stipulating the imperative to implement sustainable organic agriculture solutions, reduce the use of solid wastes, economic use of resources, and technological advancement. This forms an important foundation for the promulgation of other relevant documents to improve the policy framework across administrative levels.

Resolution No.30/NQ-CP, dated March 07, 2017 concerns "Solutions to promote high-tech agriculture development". The Ministry of Agriculture and Rural Development was assigned to set up standards on planning for high-tech agriculture application projects, pinpointing key high-tech solutions for clean agriculture development.

Decision No.738/QĐ-BNN-KHCN, dated March 14, 2017 stipulates the "Standards on planning for high-tech agriculture application projects, pinpointing key high-tech solutions for clean agriculture development". The Decision suggests the objectives of application, whereby the built standards are applied.

Resolution No.120/NQ-CP, dated November 17, 2017 on the "Climate-resilient Sustainable Development in the Mekong Delta". It highlights the 'pro-nature'-oriented agricultural production, reduced use of agro-chemicals, safeguarding of bio-diversity and ecological values in adapting to climate change. The Resolution enables the reduction of triple-crop farming areas and encourages the adoption of eco-friendly models, putting more weight on quality over quantity.

Decision No.3879/QĐ-BKHCN, dated December 29, 2017) released a national standard marked "TCVN 12134:2017" on conformity with organic agriculture by certification agencies.

Decision No.3883/QĐ-BKHCN, dated December 29, 2017) released three national standards which include: (1) TCVN 11041-1:2017 on organic agriculture - Section 1: General requirements on production, processing, labelling of agricultural products; (2) TCVN 11041-2:2017 on organic agriculture - Section 2: Organic horticulture; and (3) TCVN 11041-3:2017 on organic agriculture - Section 3: Organic husbandry.

Resolution No.109/2018/NĐ-CP, dated August 29, 2018 stipulates requirements on productions, certifications, labelling, logo marking, product traceability, businesses; monitoring organic agricultural products in the areas of horticulture, husbandry, forestry, aquaculture; and incentives on organic agricultural productions.

Decision No.3965/QĐ-BKHCN, dated December 26, 2018 released four national standards on: (1) TCVN 11041-5:2018 on organic agriculture - Section 5: Organic rice; (2) TCVN 11041-6:2018 on organic agriculture - Section 6: Organic tea; (3) TCVN 11041-7:2018 on organic agriculture - Section 7: Organic milk; and (4) TCVN 11041-8:2018 on organic agriculture - Section 8: Organic shrimp.

** Prohibition of HHPs active ingredients*

A number of agro-chemicals in groups of POPs (persistent organic pollutants) and HHPs (**Appendix 5**) have been banned in Vietnam. Despite being banned, they have still been found in the ban list between 2000 and 2017. During this period, more active ingredients were added to the list of those allowed for use in Vietnam (**Figure 2**). Since 2017, there has been a positive sign in this regard. The Ministry of Agriculture and Rural Development promulgated a number of regulations on reducing and eliminating HHPs from being used in Vietnam. Between 2017-2019, five Decisions were released to remove 10 active ingredients and 740 trade names that have been used in Vietnam (**Table 5**). This paves a pathway for the state government to ban other HHPs in the future.

Table 5. List of HHPs banned in Vietnam from 2017-2019.

No	Active ingredients	Pesticides	Products	Date of issue	Date of ban	Government's decisions
1	Carbendazim	Fungicide	71	03/01/2017	03/01/2019	No.03/QD-BNN-BVTV

2	Benomyl	Fungicide	15	03/01/2017	03/01/2019	No.03/QD-BNN-BVTV
3	Thiophanate-methyl	Fungicide	48	03/01/2017	03/01/2019	No.03/Qd-BNN-BVTV
4	2.4 D	Herbicide	36	08/02/2017	08/02/2019	No.278/QD-BNN-BVTV
5	Paraquat	Herbicide	82	08/02/2017	08/02/2019	No.278/QD-BNN-BVTV
6	Trichlorfon	Insecticide	11	16/10/2017	16/10/2017	No.4154/QD-BNN-BVTV
7	Carbofuran	Insecticide	4	16/10/2017	16/10/2017	No.4154/QD-BNN-BVTV
8	Glyphosate	Herbicide	104	10/04/2019	10/04/2020	No.1186/QD-BNN-BVTV
9	Chlorpyrifos ethyl	Insecticide	228	12/02/2019	12/02/2021	No.501/QD-BNN-BVTV
10	Fipronil	Insecticide	141	12/02/2019	12/02/2021	No.501/QĐ-BNN-BVTV
Total	**10**		**740**			

Source: *Vietnam Law library (https://thuvienphapluat.vn/)*

b. Change in customers' habits

The increasing educational attainment and income of Vietnamese people have changed their consumption habits towards products that are of high quality. More and more families favor clean, organic, high-tech agricultural products, GlobalGAP, VietGAP-standard products, those with certifications from the US, Australia, or Europe. The introduction of Smartphone devices and their applications allow customers to select the products of certified origins by using QR scanners. The customers gain more trust on products in supermarkets owing to their safety and quality to their health. This behaviour change demonstrates a sense of 'smart' customers needed in a modern life.

c. Institutional changes

- *The role of State:* As indicated in **Figure 22**, Vietnam has enjoyed a promising development in the agricultural sector, which is moving towards clean, environment-friendly, climate-resilient modes of production. Over the past few years, several high-tech industrial zones have been built in efforts to minimize and eliminate the use of agro-chemical products. There are 07 industrial zones that have been put in operation and allocated across the country, including: (1) Ho Chi Minh City (specializing in production, training, transfer, tourism, nursery of vegetables, flowers, and bonsai fish varieties); (2) Hanoi (specializing in research, vegetable-flower nursery, training, transfer of breeding techniques, and production processes), (3) Hai Phong (specializing in research, vegetable-flower nursery, and plant breeding); (4) Son La (specializing in breeding research, production of vegetable-flower-fruit varieties); (5) Khanh Hoa (specializing in research, production, transfer of rice-corn, flower, sugarcane, cashew, pig, and fish breeds); (6) Phu Yen (specializing in research, production, training, transfer of sugarcane, cotton, fruits, husbandry, poultry breeds); and Binh Duong (specializing in research, production, training, transfer of vegetables, fruit, and medicinal herbs breeds). In recent years, there has been a mushrooming of Centres for Bio-Technology Application (excluding Genetic Modification of crops) that aim to provide high-tech solutions to agricultural production.

- *Change from businesses:* Many businesses have expressed their interest in clean/organic/sustainable agriculture and environmental protection. Several businesses include Dalat Flower Forest Biotechnology Corporation, Agrivina (Dalat Hasfarm) Limited Company and G.A.P Dalat Limited Company in Lam Dong Province and True Milk Limited Company in Nghe An Province. Quite recently, some big businesses have put joint investment in organic agriculture such as Vinamilk and Vingroup, with organic plantations and high-tech agriculture in sizeable farm areas up to thousands and tens of thousands of hectares.

- *Change from others:*

At present, a number of groups have been formed on social media, especially Facebook, whereby subscribers are able to share experiential knowledge relevant to techniques of agricultural production and agricultural products. These virtual activities operate in various forms (open/closed/free) and are coordinated by individuals/groups. Most members share similar

interests in production, consumption, information exchange and trading associated with agriculture.

A statistical report demonstrates that highly-frequent keywords searched on Google are relevant to Viet-GAP, safe agriculture, high-tech agriculture, organic standards, high quality agriculture, agriculture chemical, ecological agriculture,…, in which the 'Vietnamese' keyword obtains the highest frequency (**Figure 23**). According to IRC (retrieved on December 20, 2019), VietGap is a shortened form of Vietnamese Good Agricultural Practices issued by the Ministry of Agriculture and Rural Development for each type of agriculture, aquaculture, horticulture and husbandry products. This is the key tool that allows the central government to standardize the safety standards in agricultural products to ensure food safety, product quality, social welfare, customers' health, environment and product traceability.

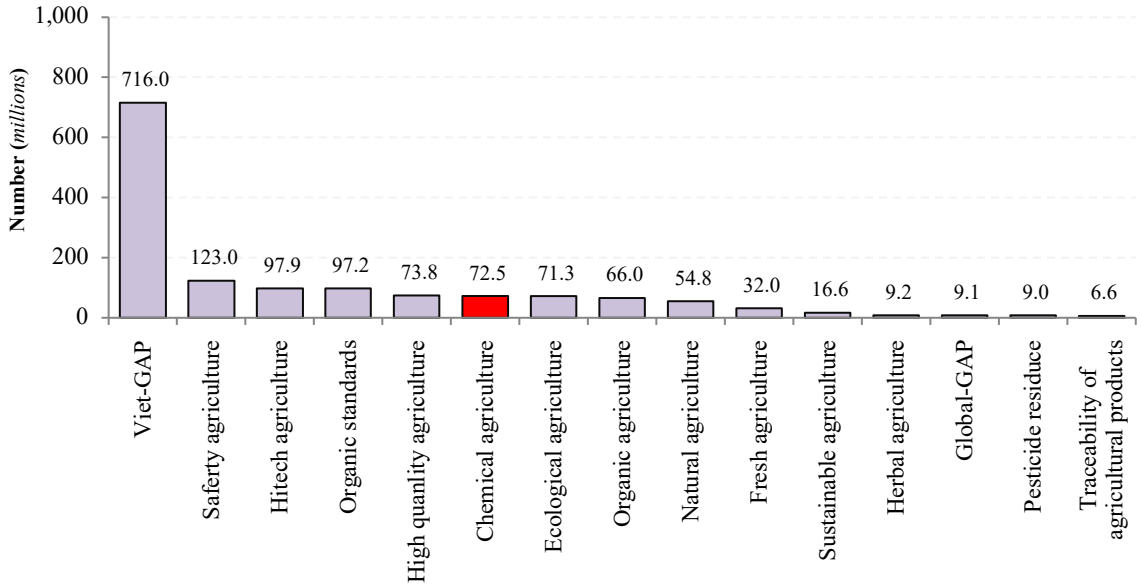


Figure 23. Common keywords relevant to agriculture searched in the Google tools in Vietnam.

The launching of the Green Swiftlet Campaign jointly organized by the Center for Social Initiatives Promotion (CSIP), United Nations Development Programs (UNDP), Vietnam Chamber of Commerce and Industry (VCCI), and Vietnam Union of Science and Technology Associations (VUSTA) in 2019 aims to seek business initiatives in contributing to social challenges, protecting environments, and achieving sustainable development objectives. Initiatives of five key areas will be considered, including: (1) agriculture, (2) tourism, (3) environment, (4) climate change, (5) women's rights and business diversity, and integration. More than 300 businesses, individuals, and organizations from 33 provinces and cities in Vietnam were involved in the event. There were 140 initiatives honored with three highest awards granted. The event suggested the emergence of new generations with start-ups initiatives, businesses, and elites that are keen to move forward for the sake of community benefits, environment protection, and sustainable development in agriculture and other sectors.

ACKNOWLEDGEMENTS

We would like to gratefully acknowledge the financial support from IPEN (International Pollutants Elimination Network) to make this report possible.

We would also like to extend our gratitude to Pesticide Action Network – Asia and the Pacific (PAN AP), Centre for Sustainable Rural Development (SRD), and Research Centre for Gender, Family and Environment in Development (CGFED), and for giving us permission to use their research findings on *"Knowledge, attitude and practice (KAP) towards the use of chlorpyrifos and paraquat and their impact on human health and the environment",* which was jointly undertaken with Research Centre for Rural Development (RCRD).

Lastly, we thank PAN AP for providing us with additional documents on pesticide application in Vietnam and the Mekong Delta, Vietnam.

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APPENDICES

Appendix 1. List of PAN HHPs prohibited in Vietnam and other countries.

N	Code	Active ingredients	Other countries	Vietnam
1	15972-60-8	ALACHLOR	94	1
2	116-06-3	ALDICARB	103	1
3	7778-39-4	ARSENIC COMPOUNDS	10	1
4	86-50-0	AZINPHOS-METHYL	80	1
5	17804-35-2	BENOMYL	34	1
6	2425-06-1	CAPTAFOL	124	1
7	1563-66-2	CARBOFURAN	63	1
8	57-74-9	CHLORDANE	141	1
9	2921-88-2	CHLORPYRIFOS	4	1
10	50-29-3	DDT	135	1
11	17109-49-8	EDIFENPHOS	31	1
12	115-29-7	ENDOSULFAN	115	1
13	13194-48-4	ETHOPROPHOS / ETHOPROP	8	1
14	106-93-4	ETHYLENE DIBROMIDE / EDB / 1,2-DIBROMOETHANE	124	1
15	107-06-2	ETHYLENE DICHLORIDE / 1,2-DICHLOROETHANE	112	1
16	75-21-8	ETHYLENE OXIDE	102	1
17	120068-37-3	FIPRONIL	37	1
18	640-19-7	FLUOROACETAMIDE	122	1
19	118-74-1	HEXACHLOROBENZENE / BENZENE HEXACHLORIDE (HCB/BHC)	128	1
20	319-84-6; 319-85-7	HEXACHLOROCYCLOHEXANE (HCH)	132	1
21	58-89-9	LINDANE	120	1
22	7439-97-6	MERCURY COMPOUNDS	129	1
23	10265-92-6	METHAMIDOPHOS	83	1
24	2032-65-7	METHOMYL	12	1
25	6923-22-4	MONOCROTOPHOS	112	1
26	4685-14-7; 1910-42-5	PARAQUAT; PARAQUAT DICHLORIDE	46	1
27	56-38-2	PARATHION (ETHYL)	113	1
28	87-86-5	PENTACHLOROPHENOL (PCP) AND SALTS	113	1
29	13171-21-6	PHOSPHAMIDON	51	1
30	24017-47-8	TRIAZOPHOS	40	1
31	numerous	TRIBUTYLTIN COMPOUNDS	56	1
32	52-68-6	TRICHLORFON	52	1
	Total			**32**

Appendix 2. List of PAN HHPs prohibited in some countries but used in Vietnam.

No	Code	Active ingredients	Number of countries	PAN HHPs – 2019	Vietnam
1	30560-19-1	ACETOCHLOR	38	X	X
2	20859-73-8	ALUMINIUM PHOSPHIDE	1	X	X
3	1912-24-9	ATRAZINE	37	X	X
4	41083-11-8	AZOCYCLOTIN	28	X	X
5	82560-54-1	BENFURACARB	28	X	X
6	82657-04-3	BIFENTHRIN	2	X	X
7	10043-35-3	BORIC ACID	28	X	X
8	56073-10-0	BRODIFACOUM	30	X	X
9	28772-56-7	BROMADIOLONE	2	X	X
10	23184-66-9	BUTACHLOR	31	X	X
11	63-25-2	CARBARYL	35	X	X
12	55285-14-8	CARBOSULFAN	41	X	X
13	122453-73-0	CHLORFENAPYR	28	X	X
14	71422-67-8	CHLORFLUAZURON	28	X	X
15	1897-45-6	CHLOROTHALONIL	3	X	X
16	5836-29-3	COUMATETRALYL	28	X	X
17	65731-84-2	CYPERMETHRIN, BETA	28	X	X
18	80060-09-9	DIAFENTHIURON	29	X	X
19	60-51-5	DIMETHOATE	4	X	X
20	165252-70-0	DINOTEFURAN	28	X	X
21	82-66-2	DIPHACINONE	29	X	X
22	330-54-1	DIURON	1	X	X
23	133855-98-8	EPOXICONAZOLE	1	X	X
24	13356-08-6	FENBUTATIN OXIDE	29	X	X
25	122-14-5	FENITROTHION	28	X	X
26	39515-41-8	FENPROPATHRIN	28	X	X
27	51630-58-1	FENVALERATE	28	X	X
28	90035-08-8	FLOCOUMAFEN	31	X	X
29	69806-50-4	FLUAZIFOP-P-BUTYL	1	X	X
30	85509-19-9	FLUSILAZOLE	28	X	X
31	133-07-3	FOLPET	2	X	X
32	77182-82-2	GLUFOSINATE (INC AMMONIUM)	28	X	X
33	72619-32-0	HALOXYFOP-METHYL	1	X	X
34	36734-19-7	IPRODIONE	29	X	X
35	881685-58-1	ISOPYRAZAM	1	X	X
36	14112-29-0	ISOXAFLUTOLE	1	X	X
37	12057-74-8	MAGNESIUM PHOSPHIDE	1	X	X
38	8018-01-7	MANCOZEB	1	X	X
39	2212-67-1	MOLINATE	28	X	X
40	300-76-5	NALED	28	X	X
41	150824-47-8	NITENPYRAM	28	X	X
42	19666-30-9	OXADIAZON	29	X	X
43	42874-03-3	OXYFLUORFEN	1	X	X
44	40487-42-1	PENDIMETHALIN	1	X	X
45	253180	PHENTHOATE	32	X	X
46	41198-08-7	PROFENOFOS	29	X	X
47	2312-35-8	PROPARGITE	29	X	X
48	60207-90-1	PROPICONAZOLE	28	X	X
49	12071-83-9	PROPINEB	28	X	X
50	114-26-1	PROPOXUR	29	X	X
51	34643-46-4	PROTHIOFOS	29	X	X
52	123312-89-0	PYMETROZINE	30	X	X
53	13593-03-8	QUINALPHOS	30	X	X
54	83-79-4	ROTENONE	28	X	X
55	7696-12-0	TETRAMETHRIN	28	X	X
56	59669-26-0	THIODICARB	29	X	X
57	137-26-8	THIRAM	28	X	X
58	129558-76-5	TOLFENPYRAD	28	X	X
59	1582-09-8	TRIFLURALIN	28	X	X
60	37248-47-8	VALIDAMYCIN	28	X	X
61	81-81-2	WARFARIN/COUMAPHENE	28	X	X
62	12122-67-7	ZINEB	32	X	X
		TOTAL	**62**	**62**	**62**

Appendix 3. List of PAN HHPs without ban notice in some countries.

No	Code	Active ingredients	PAN HHPs 2019	Vietnam
33	71751-41-2	ABAMECTIN	X	X

34	348635-87-0	AMISULBROM	X	X
35	500008-45-7	CHLORANTRANILIPROLE	X	X
36	210880-92-5	CLOTHIANIDIN	X	X
37	76703-62-3	CYHALOTHRIN, GAMMA	X	X
38	52315-07-8	CYPERMETHRIN	X	X
39	94361-06-5	CYPROCONAZOLE	X	X
40	52918-63-5	DELTAMETHRIN	X	X
41	66230-04-4	ESFENVALERATE	X	X
42	80844-07-1	ETOFENPROX; ETHOFENPROX	X	X
43	134098-61-6	FENPYROXIMATE	X	X
44	272451-65-7	FLUBENDIAMIDE	X	X
45	101463-69-8	FLUFENOXURON	X	X
46	98886-44-3	FOSTHIAZATE	X	X
47	For CAS number, please refer to the list of pesticides	GLYPHOSATE	X	X
48	86479-06-3	HEXAFLUMURON	X	X
49	78587-05-0	HEXYTHIAZOX	X	X
50	138261-41-3	IMIDACLOPRID	X	X
51	173584-44-6	INDOXACARB	X	X
52	140923-17-7	IPROVALICARB	X	X
53	143390-89-0	KRESOXIM-METHYL	X	X
54	91465-08-6	LAMBDA-CYHALOTHRIN	X	X
55	139968-49-3	METAFLUMIZONE	X	X
56	9006-42-2	METIRAM	X	X
57	21087-64-9	METRIBUZIN	X	X
58	51596-10-2	MILBEMECTIN	X	X
59	23103-98-2	PIRIMICARB	X	X
60	29232-93-7	PIRIMIPHOS-METHYL	X	X
61	139001-49-3	PROFOXYDIM	X	X
62	96489-71-3	PYRIDABEN	X	X
63	179101-81-6	PYRIDALYL	X	X
64	119738-06-6	QUIZALOFOP-P-TEFURYL	X	X
65	187166-15-0	SPINETORAM	X	X
66	168316-95-8	SPINOSAD	X	X
67	148477-71-8	SPIRODICLOFEN	X	X
68	946578-00-3	SULFOXAFLOR	X	X
69	112281-77-3	TETRACONAZOLE	X	X
70	111988-49-9	THIACLOPRID	X	X
71	153719-23-4	THIAMETHOXAM	X	X
72	55219-65-3	TRIADIMENOL	X	X
73	99387-89-0	TRIFLUMIZOLE	X	X
74	137-30-4	ZIRAM	X	X
75	137-30-4	ZIRAM	X	X
	TOTAL		**43**	**43**

Appendix 4. List of PAN HHPs and their status in Vietnam and some countries

No	Code	Active ingredients	Countries that ban the HHPs	PAN HHPs Updated in 2019	PAN HHPs	Status in Vietnam		
						Prohibited	Allowed	Not present
1	542-75-6	1,3-DICHLOROPROPENE	29		X			X
2	94-82-6	2,4-DB	1		X			X
3	71751-41-2	ABAMECTIN	n/a	X	X		X	
4	30560-19-1	ACEPHATE	32		X			X
5	30560-19-1	ACETOCHLOR	38		X		X	
6	101007-06-1	ACRINATHRIN	n/a	X	x			X
7	107-02-8	ACROLEIN (2-PROPENAL)	29		X			X
8	15972-60-8	ALACHLOR	94		X	X		
9	83130-01-2	ALANYCARB	28		X			X
10	116-06-3	ALDICARB	103		X	X		
11	319-84-6	ALPHA-BHC; ALPHA-HCH	n/a	X	X			X
12	96-24-2	ALPHA-CHLOROHYDRIN	n/a	X	X			X
13	20859-73-8	ALUMINIUM PHOSPHIDE	1		X		X	
14	61-82-5	AMITROLE	34		X			X
15	348635-87-0	AMISULBROM	n/a	X	X		X	
16	90640-80-5	ANTHRACENE OIL	28		X			X
17	84-65-1	ANTHRAQUINONE	28		X			X
18	7778-39-4	ARSENIC COMPOUNDS	10		X	X		
19	1912-24-9	ATRAZINE	37		X		X	
20	68049-83-2	AZAFENIDIN	29		X			X
21	35575-96-3	AZAMETHIPHOS	28		X			X
22	2642-71-9	AZINPHOS-ETHYL	35		X			X
23	86-50-0	AZINPHOS-METHYL	80		X	X		
24	41083-11-8	AZOCYCLOTIN	28		X		X	
25	22781-23-3	BENDIOCARB	29		X			X
26	82560-54-1	BENFURACARB	28		X		X	
27	17804-35-2	BENOMYL	34		X	X		
28	741-58-2	BENSULIDE	29		X			X
29	177406-68-7	BENTHIAVALICARB ISOPROPYL	n/a	X	X			X
30	68359-37-5	BETA-CYFLUTHRIN; CYFLUTHRIN	n/a	X	X			X
31	319-85-7	BETA-HCH; BETA-BCH	n/a	X	X			X
32	82657-04-3	BIFENTHRIN	2		X		X	
33	28434-01-7	BIORESMETHRIN	28		X			X
34	2079-00-7	BLASTICIDIN-S	28		X			X
35	1303-96-4	BORAX; BORATE SALTS	n/a	X	X			X
36	10043-35-3	BORIC ACID	28		X		X	
37	56073-10-0	BRODIFACOUM	30		X		X	
38	28772-56-7	BROMADIOLONE	2		X		X	
39	63333-35-7	BROMETHALIN	29		X			X
40	1689-84-5	BROMOXYNIL	n/a	X	X			X
41	56634-95-8	BROMOXYNIL HEPTANOATE	n/a	X	X			X
42	1689-99-2	BROMOXYNIL OCTANOATE	2		X			X
43	23184-66-9	BUTACHLOR	31		X		X	
44	34681-10-2	BUTOCARBOXIM	28		X			X
45	34681-23-7	BUTOXYCARBOXIM	28		X			X
46	95465-99-9	CADUSAFOS	31		X			X
47	592-01-8	CALCIUM CYANIDE	n/a	X	X			
48	2425-06-1	CAPTAFOL	124		X	X		
49	63-25-2	CARBARYL	35		X		X	
50	10605-21-7	CARBENDAZIM	29		X			X
51	16118-49-3	CARBETAMIDE		X	X			X
52	1563-66-2	CARBOFURAN	63		X	X		
53	55285-14-8	CARBOSULFAN	41		X		X	
54	2439-01-2	CHINOMETHIONATE / OXYTHIOQUINOX / QUINOMETHIONATE	29		X			X
55	500008-45-7	CHLORANTRANILIPROLE	n/a	X	X		X	
56	57-74-9	CHLORDANE	141		X	X		
57	54593-83-8	CHLORETHOXYFOS	29		X			X
58	122453-73-0	CHLORFENAPYR	28		X		X	
59	470-90-6	CHLORFENVINPHOS	35		X			X

No	Code	Active ingredients	Countries that ban the HHPs	PAN HHPs Updated in 2019	PAN HHPs	Status in Vietnam		
						Prohibited	Allowed	Not present
60	71422-67-8	CHLORFLUAZURON	28		X		X	
61	24934-91-6	CHLORMEPHOS	34		X			X
62	67-66-3	CHLOROFORM	n/a	X	X			X
63	3691-35-8	CHLOROPHACINONE	29		X			X
64	120-32-1	CHLOROPHENE; 2-BENZYL,4-CHLOROPHENOL	28		X			X
65	76-06-2	CHLOROPICRIN	34		X			X
66	1897-45-6	CHLOROTHALONIL	3		X		X	
67	15545-48-9	CHLOROTOLURON	n/a		X			
68	2921-88-2	CHLORPYRIFOS	4		X	X		
69	5598-13-0	CHLORPYRIFOS-METHYL	1		X			X
70	38083-17-9	CLIMBAZOLE	n/a	X	X			X
71	210880-92-5	CLOTHIANIDIN	n/a	X	X		X	
72	20427-59-2	COPPER (II) HYDROXIDE	n/a	X	X			X
73	56-72-4	COUMAPHOS	30		X			X
74	5836-29-3	COUMATETRALYL	28		X		X	
75	8001-58-9	CREOSOTE	n/a	X	X			X
76	156-62-7	CYANAMIDE, HYDROGEN	28		X			X
77	68085-85-8	CYHALOTHRIN	28		X			X
78	76703-62-3	CYHALOTHRIN, GAMMA	n/a	X	X		X	
79	13121-70-5	CYHEXATIN	42		X			X
80	52315-07-8	CYPERMETHRIN	n/a	X	X		X	
81	65731-84-2	CYPERMETHRIN, BETA	28		X		X	
82	94361-06-5	CYPROCONAZOLE	n/a	X	X		X	
83	1596-84-5	DAMINOZIDE	5		X			X
84	50-29-3	DDT	135		X	X		
85	52918-63-5	DELTAMETHRIN	n/a	X	X		X	
86	919-86-8	DEMETON-S-METHYL	32		X			X
87	80060-09-9	DIAFENTHIURON	29		X		X	
88	333-41-5	DIAZINON	32		X			X
89	62-73-7	DICHLORVOS / DDVP	33		X			X
90	51338-27-3	DICLOFOP / DICLOFOP-METHYL	2		X			X
91	115-32-2	DICOFOL	46		X			X
92	141-66-2	DICROTOPHOS	34		X			X
93	56073-07-5	DIFENACOUM	2		X			X
94	104653-34-1	DIFETHIALONE	30		X			X
95	60-51-5	DIMETHOATE	4		X		X	
96	149961-52-4	DIMOXYSTROBIN	n/a	X	X			X
97	39300-45-3	DINOCAP	28		X			X
98	165252-70-0	DINOTEFURAN	28		X		X	
99	1420-07-1	DINOTERB	32		X			X
100	82-66-2	DIPHACINONE	29		X		X	
101	85-00-7	DIQUAT (BROMIDE)	29		X			X
102	4032-26-2	DIQUAT DICHLORIDE	n/a	X	X			X
103	298-04-4	DISULFOTON / THIODEMETON	37		X			X
104	330-54-1	DIURON	1		X		X	
105	for CAS number see list of grouped pesticides	DNOC AND ITS SALTS	n/a	X	X			X
106	17109-49-8	EDIFENPHOS	31		X	1		
107	155569-91-8	EMAMECTIN BENZOATE	n/a		X			
108	115-29-7	ENDOSULFAN	115		X	X		
109	297-99-4	E-PHOSPHAMIDON	n/a	X	X			X
110	106-89-8	EPICHLOROHYDRIN	n/a	X	X			X
111	2104-64-5	EPN	37		X			X
112	133855-98-8	EPOXICONAZOLE	1		X		X	
113	66230-04-4	ESFENVALERATE	n/a	X	X		X	
114	29973-13-5	ETHIOFENCARB	29		X			X
115	23947-06-6	ETHIRIMOL	28		X			X
116	13194-48-4	ETHOPROPHOS / ETHOPROP	8		X	X		

No	Code	Active ingredients	Countries that ban the HHPs	PAN HHPs Updated in 2019	PAN HHPs	Status in Vietnam		
						Prohibited	Allowed	Not present
117	106-93-4	ETHYLENE DIBROMIDE / EDB / 1,2-DIBROMOETHANE	124		X	X		
118	107-06-2	ETHYLENE DICHLORIDE / 1,2-DICHLOROETHANE	112		X	X		
119	75-21-8	ETHYLENE OXIDE	102		X	X		
120	96-45-7	ETHYLENE THIOUREA	n/a	X	X			X
121	80844-07-1	ETOFENPROX; ETHOFENPROX	n/a	X	X		X	
122	52-85-7	FAMPHUR	29		X			X
123	22224-92-6	FENAMIPHOS	6		X			X
124	60168-88-9	FENARIMOL	29		X			X
125	120928-09-8	FENAZAQUIN	n/a	X	X			X
126	13356-08-6	FENBUTATIN OXIDE	29		X		X	
127	103112-35-2	FENCHLORAZOLE-ETHYL	n/a	X	X			X
128	122-14-5	FENITROTHION	28		X		X	
129	72490-01-8	FENOXYCARB	n/a	X	X			X
130	39515-41-8	FENPROPATHRIN	28		X		X	
131	134098-61-6	FENPYROXIMATE	n/a	X	X		X	
132	55-38-9	FENTHION	31		X			X
133	900-95-8	FENTIN ACETATE / TRIPHENYLTIN ACETATE	29		X			X
134	76-87-9	FENTIN HYDROXIDE / TRIPHENYLTIN HYDROXIDE	30		X			X
135	51630-58-1	FENVALERATE	28		X		X	
136	120068-37-3	FIPRONIL	37		X	X		
137	90035-08-8	FLOCOUMAFEN	31		X		X	
138	69806-50-4	FLUAZIFOP-P-BUTYL	1		X		X	
139	174514-07-9	FLUAZOLATE/ISOPROPOZOLE	28		X			X
140	272451-65-7	FLUBENDIAMIDE	n/a	X	X		X	
141	70124-77-5	FLUCYTHRINATE	n/a	X	X			X
142	101463-69-8	FLUFENOXURON	n/a	X	X		X	
143	62924-70-3	FLUMETRALIN	n/a	X	X			X
144	103361-09-7	FLUMIOXAZIN	n/a	X	X			X
145	640-19-7	FLUOROACETAMIDE	122		X	X		
146	951659-40-8	FLUPYRADIFURONE	n/a	X	X			X
147	85509-19-9	FLUSILAZOLE	28		X		X	
148	117337-19-6	FLUTHIACET-METHYL	n/a	X	X			X
149	133-07-3	FOLPET	2		X		X	
150	50-00-0	FORMALDEHYDE	29		X			X
151	22259-30-9	FORMETANATE	1		X			X
152	98886-44-3	FOSTHIAZATE	n/a	X	X		X	
153	65907-30-4	FURATHIOCARB	29		X			X
154	121776-33-8	FURILAZOLE	n/a	X	X			X
155	77182-82-2	GLUFOSINATE (INC AMMONIUM)	28		X		X	
156	for CAS number see list of grouped pesticides	GLYPHOSATE	n/a	X	X		X	
157	111872-58-3	HALFENPROX	n/a	X	X			X
158	72619-32-0	HALOXYFOP-METHYL	1		X		X	
159	23560-59-0	HEPTENOPHOS	28		X			X
160	118-74-1	HEXACHLOROBENZENE / BENZENE HEXACHLORIDE (HCB/BHC)	128		X	X		
161	86479-06-3	HEXAFLUMURON	n/a	X	X		X	
162	319-84-6; 319-85-7	HEXACHLOROCYCLOHEXANE (HCH)	132		X	X		
163	78587-05-0	HEXYTHIAZOX	n/a	X	X		X	
164	74-90-8	HYDROGEN CYANIDE	n/a	X	X			X
165	35554-44-0	IMAZALIL	n/a	X	X			X
166	138261-41-3	IMIDACLOPRID	n/a	X	X		X	
167	72963-72-5	IMIPROTHRIN	n/a	X	X			X

No	Code	Active ingredients	Countries that ban the HHPs	PAN HHPs Updated in 2019	PAN HHPs	Status in Vietnam		
						Prohibited	Allowed	Not present
168	173584-44-6	INDOXACARB	n/a	X	X		X	
169	1689-83-4	IOXYNIL	28		X			X
170	36734-19-7	IPRODIONE	29		X		X	
171	140923-17-7	IPROVALICARB	n/a	X	X		X	
172	881685-58-1	ISOPYRAZAM	1		X		X	
173	14112-29-0	ISOXAFLUTOLE	1		X		X	
174	18854-01-8	ISOXATHION	30		X			X
175	143390-89-0	KRESOXIM-METHYL	n/a	X	X		X	
176	91465-08-6	LAMBDA-CYHALOTHRIN	n/a	X	X		X	
177	58-89-9	LINDANE	120		X	X		
178	330-55-2	LINURON	31		X			X
179	103055-07-8	LUFENURON	n/a	X	X			
180	12057-74-8	MAGNESIUM PHOSPHIDE	1		X		X	
181	121-75-5	MALATHION	2		X			X
182	8018-01-7	MANCOZEB	1		X		X	
183	12427-38-2	MANEB	29		X			X
184	2595-54-2	MECARBAM	28		X			X
185	110235-47-7	MEPANIPYRIM	n/a	X	X			X
186	7439-97-6	MERCURY COMPOUNDS	129		X	X		
187	139968-49-3	METAFLUMIZONE	n/a	X	X		X	
188	137-41-7	METAM-POTASSIUM	n/a	X	X			X
189	137-42-8	METAM SODIUM	2		X			X
190	18691-97-9	METHABENZTHIURON	28		X			X
191	10265-92-6	METHAMIDOPHOS	83		X	X		
192	950-37-8	METHIDATHION	33		X			X
193	2032-65-7	METHIOCARB	4		X			X
194	2032-65-7	METHOMYL	12		X	X		
195	72-43-5	METHOXYCHLOR	35		X			X
196	74-83-9	METHYL BROMIDE	35		X			X
197	9006-42-2	METIRAM	n/a	X	X		X	
198	21087-64-9	METRIBUZIN	n/a	X	X		X	
199	7786-34-7	MEVINPHOS	36		X			X
200	51596-10-2	MILBEMECTIN	n/a	X	X		X	
201	2212-67-1	MOLINATE	28		X		X	
202	71526-07-3	MON 4660; AD 67	n/a	X	X			X
203	6923-22-4	MONOCROTOPHOS	112		X	X		
204	300-76-5	NALED	28		X		X	
205	54-11-5	NICOTINE	29		X			X
206	150824-47-8	NITENPYRAM	28		X		X	
207	98-95-3	NITROBENZENE	n/a	X	X			X
208	27314-13-2	NORFLURAZURON	29		X			X
209	1113-02-6	OMETHOATE	31		X			X
210	19044-88-3	ORYZALIN	n/a	X	X			X
211	19666-30-9	OXADIAZON	29		X		X	
212	23135-22-0	OXAMYL	3		X			X
213	301-12-2	OXYDEMETON-METHYL	30		X			X
214	42874-03-3	OXYFLUORFEN	1		X		X	
215	64741-88-4	PARAFFIN OILS (11)	28		X			X
216	4685-14-7; 1910-42-5	PARAQUAT; PARAQUAT DICHLORIDE	46		X	X		
217	56-38-2	PARATHION (ETHYL)	113		X	X		
218	298-00-0	PARATHION-METHYL	n/a	X	X			X
219	40487-42-1	PENDIMETHALIN	1		X		X	
220	87-86-5	PENTACHLOROPHENOL (PCP) AND SALTS	113		X	X		
221	52645-53-1	PERMETHRIN	29		X			X
222	253180	PHENTHOATE	32		X		X	
223	298-02-2	PHORATE	38		X			X
224	732-11-6	PHOSMET	n/a	X	X			X
225	13171-21-6	PHOSPHAMIDON	51		X	X		
226	7803-51-2	PHOSPHINE / PHOSPHANE /HYDROGEN PHOSPHIDE	1		X			X
227	5145	PICLORAM	3		X			X
228	23103-98-2	PIRIMICARB	n/a	X	X		X	

No	Code	Active ingredients	Countries that ban the HHPs	PAN HHPs Updated in 2019	PAN HHPs	Status in Vietnam		
						Prohibited	Allowed	Not present
229	29232-93-7	PIRIMIPHOS-METHYL	n/a	X	X		X	
230	299-45-6	POTASAN	n/a	X	X			X
231	32809-16-8	PRALLETHRIN	n/a	X	X			X
232	32809-16-8	PROCYMIDONE	28		X			X
233	41198-08-7	PROFENOFOS	29		X		X	
234	139001-49-3	PROFOXYDIM	n/a	X	X		X	
235	1918-16-7	PROPACHLOR	29		X			X
236	2312-35-8	PROPARGITE	29		X		X	
237	31218-83-4	PROPETAMPHOS	28		X			X
238	60207-90-1	PROPICONAZOLE	28		X		X	
239	12071-83-9	PROPINEB	28		X		X	
240	114-26-1	PROPOXUR	29		X		X	
241	75-56-9	PROPYLENE OXIDE, OXIRANE	n/a	X	X			X
242	34643-46-4	PROTHIOFOS	29		X		X	
243	123312-89-0	PYMETROZINE	30		X		X	
244	77458-01-6	PYRACLOFOS	28		X			X
245	129630-19-9	PYRAFLUFEN-ETHYL	n/a	X	X			X
246	6814-58-0	PYRAZACHLOR	n/a	X	X			X
247	13457-18-6	PYRAZOPHOS	29		X			X
248	108-34-9	PYRAZOXON	n/a	X	X			X
249	96489-71-3	PYRIDABEN	n/a	X	X		X	
250	179101-81-6	PYRIDALYL	n/a	X	X		X	
251	119-12-0	PYRIDAPHENTHION	29		X			X
252	13593-03-8	QUINALPHOS	30		X		X	
253	2797-51-5	QUINOCLAMINE	n/a	X	X			X
254	148-24-3	QUINOLIN-8-OL; 8-HYDROXYQUINOLINE	n/a	X	X			X
255	124495-18-7	QUINOXYFEN	n/a	X	X			X
256	119738-06-6	QUIZALOFOP-P-TEFURYL	n/a	X	X		X	
257	10453-86-8	RESMETHRIN	28		X			X
258	83-79-4	ROTENONE	28		X		X	
259	105024-66-6	SILAFLUOFEN	28		X			X
260	143-33-9	SODIUM CYANIDE	n/a	X	X			X
261	62-74-8	SODIUM FLUOROACETATE / 1080	38		X			X
262	187166-15-0	SPINETORAM	n/a	X	X		X	
263	168316-95-8	SPINOSAD	n/a	X	X		X	
264	148477-71-8	SPIRODICLOFEN	n/a	X	X		X	
265	57-24-9	STRYCHNINE	31		X			X
266	4151-50-2	SULFLURAMID	29		X			X
267	3689-24-5	SULFOTEP	32		X			X
268	946578-00-3	SULFOXAFLOR	n/a	X	X		X	
269	21564-17-0	TCMTB	28		X			X
270	96182-53-5	TEBUPIRIMFOS	29		X			X
271	79538-32-2	TEFLUTHRIN	1		X			X
272	3383-96-8	TEMEPHOS	28		X			X
273	149979-41-9	TEPRALOXYDIM	28		X			X
274	13071-79-9	TERBUFOS	34		X			X
275	886-50-0	TERBUTRYN	28		X			X
276	2593-15-9	TERRAZOLE; ETRIDIAZOLE	n/a	X	X			X
277	22248-79-9	TETRACHLORVINPHOS	28		X			X
278	112281-77-3	TETRACONAZOLE	n/a	X	X		X	
279	7696-12-0	TETRAMETHRIN	28		X		X	
280	111988-49-9	THIACLOPRID	n/a	X	X		X	
281	153719-23-4	THIAMETHOXAM	n/a	X	X		X	
282	59669-26-0	THIODICARB	29		X		X	
283	39196-18-4	THIOFANOX	28		X			X
284	640-15-3	THIOMETON	30		X			X
285	23564-05-8	THIOPHANATE-METHYL	n/a	X	X			X
286	62-56-6	THIOUREA	28		X			X
287	137-26-8	THIRAM	28		X		X	
288	330459-31-9	TIOXAZAFEN	n/a	X	X			X
289	129558-76-5	TOLFENPYRAD	28		X		X	
290	731-27-1	TOLYLFLUANID	28		X			X

No	Code	Active ingredients	Countries that ban the HHPs	PAN HHPs Updated in 2019	PAN HHPs	Status in Vietnam		
						Prohibited	Allowed	Not present
291	66841-25-6	TRALOMETHRIN	28		X			X
292	55219-65-3	TRIADIMENOL	n/a	X	X		X	
293	2303-17-5	TRI-ALLATE	n/a	X	X			X
294	24017-47-8	TRIAZOPHOS	40		X	X		
295	numerous	TRIBUTYLTIN COMPOUNDS	56		X	X		
296	52-68-6	TRICHLORFON	52		X	X		
297	81412-43-3	TRIDEMORPH	29		X			X
298	99387-89-0	TRIFLUMIZOLE	n/a	X	X		X	
299	1582-09-8	TRIFLURALIN	28		X		X	
300	37248-47-8	VALIDAMYCIN	28		X		X	
301	2275-23-2	VAMIDOTHION	30		X			X
302	50471-44-8	VINCLOZOLIN	31		X			X
303	81-81-2	WARFARIN / COUMAPHENE	28		X		X	
304	2655-14-3	XMC	28		X			X
305	52315-07-8z	ZETA-CYPERMETHRIN	n/a	X	X			X
306	1314-847	ZINC PHOSPHIDE	2		X			X
307	12122-67-7	ZINEB	32		X		X	
308	137-30-4	ZIRAM	n/a		X		X	
309	137-30-4	ZIRAM	n/a		X		X	
310	23783-98-4	Z-PHOSPHAMIDON	n/a	X	X			
	Total	**310**	**207**	**98**	**310**	**32**	**104**	**168**

Appendix 5. List of HHPs prohibited in Vietnam as of 2019.

No	Active ingredients	Kinds of pesticides	Trade names
1	Aldrin	Insecticide	Aldrex, Aldrite…
2	BHC, Lindane	Insecticide	Beta - BHC, Gamma - HCH, Gamatox 15EC, 20EC, Lindafor, Carbadan 4/4G, Sevidol 4/4G
3	Cadmium compound (Cd)	Insecticide	Cadmium compound (Cd)
4	Carbofuran	Insecticide	Kosfuran 3GR, Vifuran 3GR, Sugadan 30GR, Furadan 3GR
5	Chlordane	Insecticide	Chlorotox, Octachlor, Pentichlor...
6	Chlordimeform	Insecticide	Pesticides with Chlordimeform
7	DDT	Insecticide	Neocid, Pentachlorin , Chlorophenothane...
8	Dieldrin	Insecticide	Dieldrex, Dieldrite, Octalox...
9	Endosulfan	Insecticide	Cyclodan 35EC, Endosol 35EC, Tigiodan 35ND, Thasodant 35EC, Thiodol 35ND
10	Endrin	Insecticide	Hexadrin...
11	Heptachlor	Insecticide	Drimex, Heptamul, Heptox…
12	Isobenzen	Insecticide	Sobenzen compounds
13	Isodrin	Insecticide	Isodrin compounds
14	Lead (Pb)	Insecticide	Lead (Pb) compounds
15	Methamidophos	Insecticide	Dynamite 50SC, Filitox 70SC, Master 50EC, 70SC, Monitor 50EC, 60SC, Isometha 50DD, 60DD, Isosuper 70DD, Tamaron 50EC...
16	MethylPArathion	Insecticide	Danacap M 25, M 40; Folidol - M 50EC; Isomethyl 50ND; Metaphos 40EC, 50EC; (MethylPArathion) 20EC, 40EC, 50EC; Milion 50EC; Proteon 50EC; Romethyl 50ND; Wofatox 50EC ...
17	Monocrotophos	Insecticide	Apadrin 50SL, Magic 50SL, Nuvacron 40SCW/DD, 50SCW/DD, Thunder 515DD...
18	Parathion Ethyl	Insecticide	Alkexon, Orthophos, Thiopphos ...
19	Sodium Pentachlorophenate monohydrate	Insecticide	Copas NAP 90G, PMD_4 90 powder, PBB 100
20	Pentachlorophenol	Insecticide	CMM 7 (Oil type)
21	Phosphamidon	Insecticide	Dimecron 50 SCW/ DD...
22	Polychlorocamphene	Insecticide	Toxaphene, Camphechlor, Strobane
23	Trichlorfon (Chlorophos)	Insecticide	Biminy 40EC, 90SP; Acephate 90SP; Dilexson 90WP; Dip 80SP; Diptecide 90WP; Terex 50EC, 90SP; Medophos 50EC, 750EC; Ofatox 400EC, 400WP; Batcasa 700EC; Cylux 500EC; Cobitox 5GR
24	Arsenic (As)	Fungicide	Arsenic compounds (Liquid type) Arsenic compounds (others)
25	Captan	Fungicide	Captane 75WP, Merpan 75WP...
26	Captafol	Fungicide	Difolatal 80WP, Folcid 80WP... (For backpack spraying) Difolatal 80WP, Folcid 80WP... (Others)
27	Hexachlorobenzene	Fungicide	Anticaric, HCB... (For bottle spraying) Anticaric, HCB... (Others)
28	Mercury (Hg)	Fungicide	Mercury compounds
29	Selenium (Se)	Fungicide	Selen compounds
30	Talium	Raticide	Talium compounds (Tl)
31	2.4.5T	Herbicide	Brochtox, Decamine, Veon… (For backpack spraying) Brochtox, Decamine, Veon… (Others)