Highly Hazardous Pesticides in Jamaica

Sherika Whitelocke- Ballingsingh

Caribbean Poison Information Network
CARPIN

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The Caribbean Poison Information Network (CARPIN) has been operating for 16 years in the College of Health Sciences, University of Technology, Jamaica. The mission is to prevent poisonings through public education and advocacy to protect the most vulnerable and at-risk populations' health and welfare and work with stakeholders to build regional cooperation in poison prevention and management. https://www.utech.edu.jm/academics/colleges-faculties/cohs/carpin.

About the Author

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Table of Contents

Acronyms

EU	European Union
FAO	Food and Agriculture Organization
GHS	Global Harmonized System of Classification and Labelling of Chemicals
HHPs	Highly Hazardous Pesticides
MOHW	Ministry of Health and Wellness
PAN	Pesticides Action Network
PCA	Pesticides Control Authority
PIC	Prior Informed Consent
RADA	Rural Agriculture Development Authority
UK	United Kingdom
WHO	World Health Organization

Executive Summary

Jamaica is the largest island in the English-speaking Caribbean, with 2,969,340 people. There are three government arms in Jamaica; namely, the Executive, Legislature, and Judiciary, and seventeen government ministries. The constitution reflects the British socio-political models, which means the citizens can choose the officials to govern the country.

The Rural Agricultural Development Authority is a statutory body under the Ministry of Agriculture and acts as the driving force behind Jamaica's agricultural production. The Pesticides Control Authority is a statutory body of the Ministry of Health and Wellness, mandated through the Pesticides Act of 1975 to regulate, manage and control pesticide usage in Jamaica. Jamaica is a signatory and Party to the Basel, Stockholm, and Rotterdam Conventions, and the Montreal Protocol on Ozone Depleting Substances

There are 187 active ingredients for 458 formulated products of different categories of pesticides registered in Jamaica. Our comparison with the most recent PAN International List of Highly Hazardous Pesticides (HHPs) found HHPs used in agricultural, public health, and non-agricultural settings. HHPs active ingredients account for 32% of the registered active ingredients in Jamaica. In formulated products used in agriculture, the highest numbers of HHPs active ingredients are 111 insecticides, 50 herbicides, and 37 fungicides. Syngenta and AG Chem Plant are the leading manufacturers of HHPs used in Jamaica, followed by Bayer and BASF.

Analysis of the human and environmental effects of registered HHPs in Jamaica shows that most HHPs are associated with long-term toxicity in humans and the environment (group categories 2 &3). Notably, 13 active ingredients that are, according to GHS, fatal if inhaled, are known or presumed human carcinogens, according to EU GHS regulation. Thirteen (13) HHPs are presumed reproductive toxicants, according to EU GHS, 15 are probable likely carcinogens, according to the US Environmental Protection Agency (EPA), and 24 active ingredients have high-level toxicity for bees; see details in Annex III.

In our comparation with the Pesticide Action Network International Consolidated List of Banned Pesticides, March 2021 we found that 66 pesticide active ingredients registered in Jamaica are banned in other countries; including three pesticides not approved in the European Union. From the total of pesticides banned in other countries and registered in Jamaica, 42 are HHPs; see details in Annex IV.

All humans desire the right and opportunity to have good health and a toxic-free environment for quality of life; unfortunately, this is not the present reality. Research has shown that poorer countries are often not given this right due to hazards introduced into their environment through chemical trade with more prosperous countries. The call for international policies mandatory to all countries to negate the unequivocal health burdens on different populations is urgently needed.

Conclusion and Recommendations

The use of HHPs in agriculture has been shown to have deleterious impacts on humans and the environment. Jamaica has a strong legal framework and policy to control pesticide sale and use, but the high number of HHPs registered in the country, especially those banned in other countries, requires urgent action. Amidst all that is in place in the country, there is still the need for a shift to a more sustainable agricultural practice that can enhance human health and the environment while simultaneously creating an appreciable economic gain. The recommendations below will assist with the phasing out of HHPs:

1. The Pesticides Control Authority and Rural Agriculture Development Authority to ensure the proper use of the selected pesticide products for approved applications and comply with national regulations and international conventions.
2. Governments, industries, and users of pesticides to be guided by the International Code of Conduct on Pesticide Management throughout the manufacture, sale, and handling of pesticides.
3. The Pesticides Control Authority and the Rural Agriculture Development Authority to implement an agroecology approach to phase out both the use of HHPs and pesticides banned in other countries from entry into Jamaica. Participation of experts and farmers' organizations with experience in Integrated Pest Management (IPM), agroecology, and organic farming should be encouraged. Concerted efforts should be made by regulators to expand the use of organic agriculture for national consumption.
4. The Pesticides Control Authority to conduct a regular toxicological review of active ingredients for registered pesticides before approval or re-registration. Priority should be given to phasing out HHPs and pesticides banned in other countries, according to PAN international lists, with scientists' participation, and no conflict of interest with industry.
5. Through its associated committees within CARICOM, the Pesticides Control Authority to develop regional standards in the absence of Codex standards to establish acceptable limits for all agricultural products used locally, considering the most vulnerable population.
6. Implement a sustainable monitoring system for the environment; to include periodic testing of soil and water bodies (well, harbours, springs, stream, groundwater) through locally approved and certified laboratory/ies.
7. The Pesticides Control Authority, in collaboration with the Surveillance Unit in the Ministry of Health and Wellness and CARPIN, to implement a sustainable health surveillance programme on pesticide exposure with accurate documentation, including poison cases/incidences, through the utilization of the Severely Hazardous Pesticide Formulation (SHPF) tool kit. There is an urgent need to commence mandatory reporting through the Designated National Authority to the Rotterdam Convention in submitting reports on pesticide poisoning in Jamaica to effect alerts for noticeable toxicity trends for associated active ingredients.

8. All relevant entities to take coordinated action to produce and disseminate relevant and explicit mass public educational material through all available media to extension services, agriculture sectors, public health advisory services, farmers and farmers' organizations, pest control operators, public health workers, and others as appropriate. This material should include advice on pesticide management and its effects on health and the environment.

The recommendations presented will contribute significantly in achieving eight Sustainable Development Goals; namely, SDG 2: Zero hunger; SDG 3: Good health and wellness; SDG 6: Clean water and sanitation; SDG 11: Sustainable cities and communities; SDG 12: Responsible consumption and production; SDG 13: Climate action; SDG 14: Life below water; and SDG 16: Life on land.

1.0 Introduction

Pesticides, when applied, act to destroy, mitigate and prevent pests ranging from insects, animals, and weeds to microorganisms. They contribute mainly to the areas of agriculture and public health in protecting plants and humans from vector-borne diseases. There are different categories of pesticides, which include insecticides, fungicides, herbicides, rodenticides, and plant growth regulators, to name a few (Bonner et al 2017). Pesticides usage is twofold, where on the one hand there are benefits to the increase in quality and quantity of fruits and vegetables, while on the other hand there are negative public health implications, especially to vulnerable sub-populations (Bonner et al 2017). Pesticides' toxicity is often underestimated, especially when commercialized as a mixture with different ingredients, but only one ingredient regulated and tested for human health effects (Mesnage and Séralini 2018).

The use of pesticides in developing countries or countries with economies in transition like Jamaica creates an environment for its increased importation and massive use, exposing handlers and other members of the population to unique risks that are associated with each active ingredient. As tropical countries are considered the breadbasket for the world (Bonner et al 2017)(Alavanja, 2009), this has resulted in the increased volume in use of pesticides over decades, concurrently causing a gradual increase in incidences of poisoning and adverse health effects being experienced through the agricultural and other populations. Global data revealed that 25 million agricultural workers experience unintentional poisoning annually (Alavanja, 2009) (Alavanja, 2009); contributing factors being the lack of regulatory oversight of pesticide sales and responsible usage in developing countries, although quantitative risk assessment is deemed complicated (Bonner et al 2017).

This report provides details on the use and consumption of pesticides in Jamaica. An evaluation of the active ingredients of locally registered pesticides guided by PAN's HHPs list for 2021 showed the total number of pesticides that are HHPs in Jamaica. The importance of preserving health and the environment are discussed, with a look at alternatives to HHPs and the application of the precautionary principle. Implementation of the recommendations given from lessons learnt through programmes to phase out HHPs in other countries will contribute to mitigate their debilitating effects on health and the environment.

2.0 General Overview of Jamaica

Figure 1: Map of Jamaica

Jamaica is the largest island in the English-speaking Caribbean, and the most populated, with 2,969,340 people (Jamaica's Team 2008; Worldometer 2021). The island is divided into three counties – Cornwall, Middlesex, and Surrey – which are subdivided into fourteen parishes: Kingston, St. Andrew, St. Catherine, Clarendon, Manchester, St. Elizabeth, Westmoreland, Hanover, St. James, Trelawny, St. Ann, St. Mary, Portland, and St. Thomas. Each parish has a capital town, which is typically the centre of commerce, and two parish capitals, Montego Bay in St. James and Kingston, have city status. Kingston, located on the island's southeast end, is Jamaica's capital. Like its neighbors, Jamaica is vulnerable to natural disasters - such as hurricanes and flooding - and the effects of climate change. It is an upper-middle-income economy that is nevertheless struggling due to low growth, high public debt, and exposure to external shocks (World Bank 2021).

The Ministries of focus for this report are the Ministry of Health and Wellness, for which the Pesticides Control Authority (PCA) is the statutory body to regulate pesticides, and the Ministry of Agriculture, for which the Rural Agriculture Development Authority (RADA) is the statutory body and Jamaica's chief agricultural extension and rural development agency. The Ministry of Health and Wellness (MOHW) is the pre-eminent government organization, whose mandate is "To ensure the provision of quality health services and promote healthy lifestyles and environmental practices."

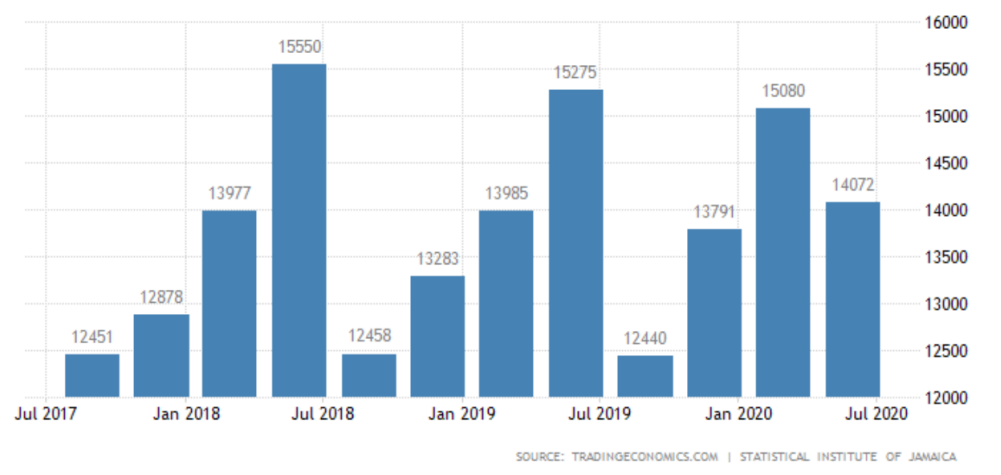
The Ministry of Agriculture and Fisheries aims to be the catalyst for the Jamaican agricultural sector's sustainable development and natural resources. The Ministry has taken up the mantle to advance the development of a modern, efficient, and internationally competitive agricultural sector and the sustainable management of fishery resources to promote food security and food safety and contribute to the development and well-being of every Jamaican.

2.1 Agricultural Activities

Agriculture plays a significant role in Jamaica's development and sustenance, and includes, but is not limited to, animal breeding and cultivation of land and plants, providing food and other products for the population.

The impact of climate change on agriculture has tampered with GDP growth recovery, such as severe droughts coupled with dry conditions in 2014, resulting in a 0.5% decrease in agricultural value-added. From 2017 to 2020, Jamaica's GDP fluctuated throughout the period. There was a growing trend from July 2017 – January 2018, giving an increase of 526 million USD. The first quarter of January 2020 commenced with 13791 million USD, then there was a sharp increase to 15080 million USD mid-quarter, and a slight decrease to 14072 million USD in July 2020, as shown in Figure 3 below (Trading Economics, 2020).

Figure 2: Agriculture GDP 2017-2020



Agriculture is an essential income source for the rural population, with a share of total employment a little under 20%, which is higher than the regional average (IDB 2017).

The male to female ratio for the agricultural labor force in Jamaica for the period 2019-2020 shows a decline in males and an increase in females embracing the agriculture industry (see Table 2 for details). The World Bank 2016 global report on the feminization of agriculture discussed factors surrounding the decrease in the male population in farming. Technological innovations coupled with changes in the farming system have the potential for a decreased demand in men's labour for agriculture, which results in men diversifying from agriculture. It was also observed that labour-saving technologies that are adopted by large farmers and are not accessible to small farmers can cause displacement, leading to a loss in male farming wages which forces men to look for alternate employment (World Bank 2016).

Table 1: Agriculture Labour Force for Forestry & Fishing

Agriculture: Forestry and Fishing				
Gender	**Jul 2019**	**Oct 2019**	**Jul 2020**	**Oct 2020**
Male	147,600	142,600	143,000	142,800
Female	45,600	47,600	49,100	51,500
Total	193,200	190,200	182,100	194,300

Source: Statistical Institute of Jamaica 2017

2.1.1 Agricultural Programmes and Activities

The Rural Agricultural Development Authority (RADA) is a statutory body under the Ministry of Agriculture and acts as the driving force behind Jamaica's agricultural production. The authority is engaged in widespread agricultural activities spanning from small and large-scale farming, training, and cultivation practices to support systems and networks for enhancing the industry.

Numerous agricultural programs and activities implemented to further develop farming in Jamaica include: Livestock and Animal Husbandry, Land Husbandry, Crop Care Programme/Integrated Pest Management, FAO Cassava Project, Irish Potato Production, Capacity Building for Farmers and the Integration of Social Service such as Home Economics.

2.1.2 Livestock and Animal Husbandry

The farmers participated in practical applications of animal husbandry practices through on-farm monitoring visits. The programme guided the deworming of animals, animal housing construction, care of young animals, and general farm maintenance, emphasizing animal nutrition. Farmers received an introduction to various available forage suitable for their animals and their geographical location (RADA 2014-2015 Annual report). The most common farm animals are chicken and goats, raising goats for their milk and meat, and other dairy products. Cattle, and the sixty percent (60%) owned by smallholder farmers (Protius-Coutsoukis, 2004-2020). This activity is critical in educating farmers since chemical usage is not limited to crops but is also used on livestock.

2.1.3 Land Husbandry

Land Husbandry is one of the technologies used for the improvement of soil, water, and vegetation. It can reduce land degradation and address global water scarcity concerns, land use conflict, climate change (through carbon sequestration), biodiversity conservation, and poverty alleviation. Land Husbandry was confined to watershed areas, emphasizing soil treatment and best practices such as check dams, alley cropping, mulching, vegetative and stone barriers, minimum tillage, individual basins, and agroforestry. This project area included Portland, St. Thomas, St. Andrew, and Clarendon (RADA Annual Report 2016-2017). The use of this technology can contribute to pesticide use reduction.

2.1.4 Crop Care Programme/ Integrated Pest management

The Crop Care Programme focused on plant health and food safety and aimed to promote and encourage best practices for the containment/suppression of pests and diseases that adversely affect crops' production and saleability. A core part is pest surveillance, which provides information to monitor pesticide use in the field (RADA Annual Report 2011-2012). The pest surveillance strategy identified pests as a threat to plants, and an example was a finding of the Forestry Pod Rot disease, which activated a Pest Emergency Response Team along with the Plant Health Committee.

2.1.5 The FAO Cassava Project

Information on cassava production was collected through the pilot project as a precursor to stimulate the local cassava industry. The project area was northeast St. Elizabeth and entailed manually establishing two acres of cassava, utilizing 4-node cutting, and introducing the CM 849 variety. There was no published information available on the project outcomes or its use for pesticide reduction; further research is encouraged in this area.

2.1.6 The FAO Caribbean HHP Risk Reduction Action Plan

In March 2021, the Caribbean Group of Pesticide Control Boards endorsed an HHP Risk Reduction Action Plan for the region in its role as the executive agency of a GEF-FAO project: “Disposal of Obsolete Pesticides including POPs, Promotion of Alternatives and Strengthening Pesticides Management in the Caribbean.” The regional action plan covers Antigua and Barbuda, Bahamas, Barbados, Dominica, Dominican Republic, Guyana, Jamaica, Saint Kitts, and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago.
(FAO http://www.fao.org/gef/projects/detail/es/c/1056800/ consulted June 15, 2021).

The HHP Risk Reduction Action Plan has not yet been published at the date of this report (June 15, 2021), but advance details of it were outlined by the Pesticide Action Network UK on May 2021 in a stakeholder meeting presentation. The plan includes three outputs: 1) pesticide container management; 2) a Knowledge Attitude Practice (KAP) survey and consultations on options for risk reduction in Barbados, and the University of West Indies collaboration as a partner on incidents of acute pesticide poisoning in Jamaica and Trinidad, and 3) the prioritization of HHPs and identifying alternatives. Guidance documents have been completed for IPM alternatives to HHPs in banana, coffee, and sugar cane; HHP insecticides for: Lepidopteran pests in tomato and pepper; aphids and defoliating lepidopteran in Brassicas and leafy vegetables; HHP fungicides in onion, cucurbits, tomato, and potato, and HHPs for key domestic pests. (Source: PAN UK "The Caribbean HHP Risk Reduction Action Plan," personal communication by Dr. Alexander Stuart).

The Caribbean HHP Risk Reduction Plan goal is to articulate the priorities of experts and key stakeholders across the region concerning reducing the risks from pesticides, HHPs in particular. The Plan outline also includes National Action Plans with priorities that will accelerate momentum in areas to reduce the reliance on pesticides, selection of pesticides with the least risk, and proper usage of the selected products. These risk reduction activities will contribute to legislative and monitoring actions in preventing the use of HHPs within farming communities (íbid).

2.1.7 Irish Potato Production Programme

The programme target was to meet local demand of 17,000 tonnes for the season plus export to the Caribbean region. To accomplish this, farmers were planting a minimum of 1200 hectares. Programme stakeholders were the Potato and Onion Producers Association (POPA), Promotion of Regional Opportunities for Produce through Enterprises and Linkages (PROPEL), and Seminar Sponsors H&L Agro and Newport Fersan. There was no disclosure as to the use of pesticides for the production programme.

2.1.8 Capacity Building for Farmers

The farmers' training program emphasized acceptable agricultural practices and assisted in providing linkages between farmers, buyers, exporters and importers, and weekly farm gate prices via the Jamaica Marketing Information System (JAMIS). The training focused on methods of integrated pest management and fertilizer with new technological practices used in agriculture. The training was given to farmers and farm families to enhance their livelihoods, improve agricultural practices, broaden their income basis and build their productive capacity (RADA Annual Report 2016-2017).

2.1.9 Social Services/ Home Economics

The Social Services/Home Economics Unit advances the social, economic, and well-being of the rural farm family by providing its members with practical knowledge, competencies, and skills related to their quality of life and well-being. The program's scope helps families help themselves and makes interventions in family life education, personal development, home management, and employment creation through several individuals and/or group-based micro-enterprises (RADA Annual Report 2011-2012). This is an established program with secondary schools throughout Jamaica. Organic farming is mainly practiced within the school setting.

Of the five agricultural programs mentioned above, the Crop Care Programme was the only one that focused on the knowledge and use of pesticides.

3.0 Main crops produced in the country

The sugar industry is the third-largest earner of foreign exchange and the single most important agricultural crop in the Jamaican economy. Crops grown by Jamaican farmers include bananas, coffee, cocoa, coconuts, citrus fruits, pimento, tobacco, ginger, sisal, and rice. Small cultivators primarily grow the most crops. Citrus fruits grown include oranges, lemons, and grapefruit (Ask Media Group, 2021).

Data from the RADA annual reports showed that domestic food crop production for 2006 increased by 19.6% compared with 2005. Total production increased from 391,707 tonnes in the earlier period to 467,802.1 tonnes in the latter period. Domestic crop production grew by 22.4% during 2009, with production moving from 400,110 tonnes in 2008 to 489,672 tonnes in 2009. Vegetables, yams, and potatoes accounted for over 70% of the overall production, with vegetables being the best performing crop group, contributing approximately 38% for overall production for 2011. All crop groups recorded an increase except for yams, with a marginal decline of 1.6%. The outstanding production performance for 2011 was attributed to favorable weather and the impact of enabling interventions under various programs and special projects.

For 2012-2013, RADA reported that the crop that showed the highest production increase was sorrel (22.3%). The top three crops - vegetables, yams, and potatoes - accounted for over 70% of the overall production, with a 4.3% decline in yam production. There were still challenges with random pest and disease outbreaks, limited resources, and occasional drought incidents (RADA Annual Report 2012-2013). The overall Domestic Crop Production for 2016 stood at 660,671 tonnes. This amount represents an increase of 14.9% over the 2015 production, when approximately 574,925.2 tonnes of agricultural produce was reaped (refer to Table 2) (RADA Annual Report 2016-2017).

Table 2: Categories of Crops Grown

Tonnes									
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Vegetables	144,595.6	173,588.6	165,456.8	223,545.2	224,130.8	233,226.8	209,082.9	20,1558.5	240,785.1
Condiments	26,280.5	34,313.0	34,705.7	44,712.0	46,853.7	52,294.8	44,580.2	44439.8	50,062.0
Fruits	42,257.1	46,768.4	38,001.7	38,741.9	45,023.4	46,325.1	45,351.0	45512.2	5,2295.1
Cereals	1,896.9	2,359.0	2626.4	2,968.0	3,120.6	2,995.8	60,571.4	2278.4	2,469.4
Plantains	15,034.9	24,621.1	29,826.4	35,334.8	36,202.7	30,937.3	39,050.8	38,320.4	44,447.0
Potatoes	30,325.3	42,937.3	45,734.2	5,7423.9	57,560.5	61,644.5	60,571.4	59,412.7	61,430.3
Yams	102,283.5	124,516.0	136,785.0	134,619.7	145,069.3	138,833.9	137,2772	136,363.4	156,131.0
Other tubers	3,1870.7	34,936.1	42180.8	48,458.7	4,712.8	41,670.0	42,947.9	4,128.4	46.159.2
Sorrels	707.5	811.5	1,057.1	1,210.4	1,212.6	1,483.3	1,595.8	1,279.8	1,348.8
Total	**400,109.5**	**489,671.5**	**500,304.3**	**592,108.1**	**610,137.8**	**614,911.7**	**643,730.7**	**574925.2**	**660,671.1**

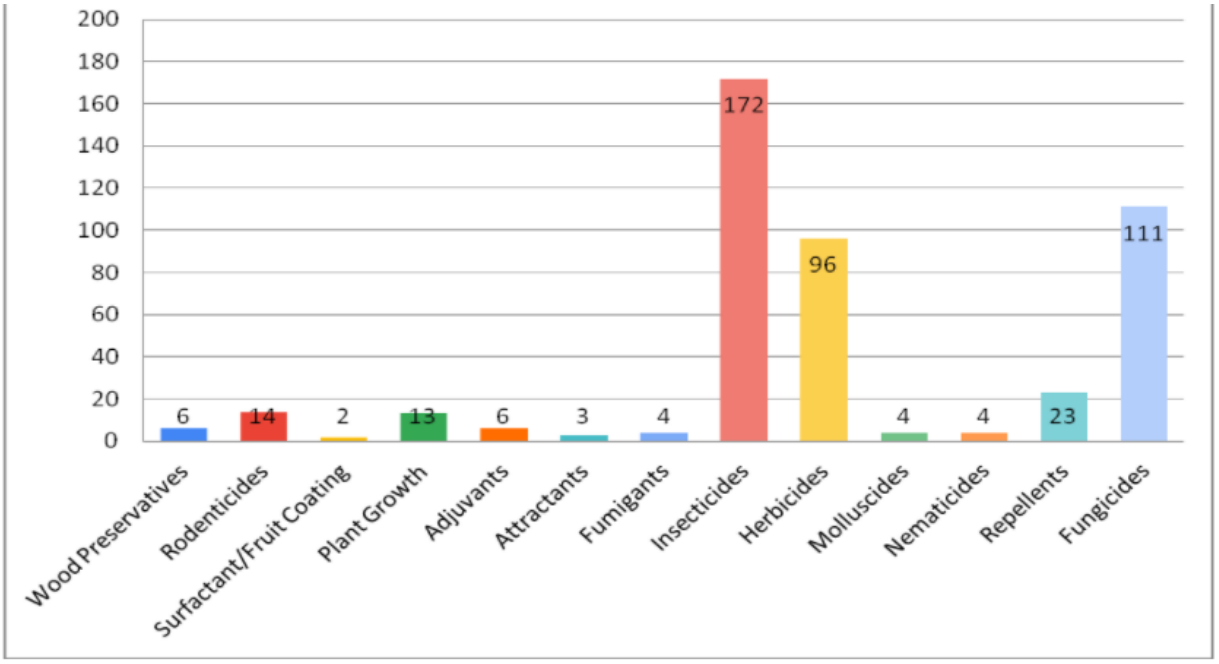
Source: RADA annual report 2008 – 2016

There were missing data on crop production for 2006- 2007 and 2017-2019. Also, there were discrepancies in the report of volume of crops production (Annual Reports 2013-2014 and 2012 - 2014)

4.0 Pesticides Use and Governance

The agricultural sector accounts for the majority of pesticide usage in Jamaica. Figure 3 below shows the categories and number of pesticides (formulated products) registered in Jamaica. There are 458 pesticides registered in Jamaica (PCA Registered list 2021), categorized as Wood preservative (6), Rodenticides (14), Surfactant/Fruit Coating (2), Plant Growth (12), Adjuvants (6), Attractants (3), Fumigants (4), Insecticides (172), Herbicides (90), Molluscicides (4), Nematicides (4), Repellants (23) and Fungicides (111).

Figure 3: Categories of Registered Pesticides as of January 2021

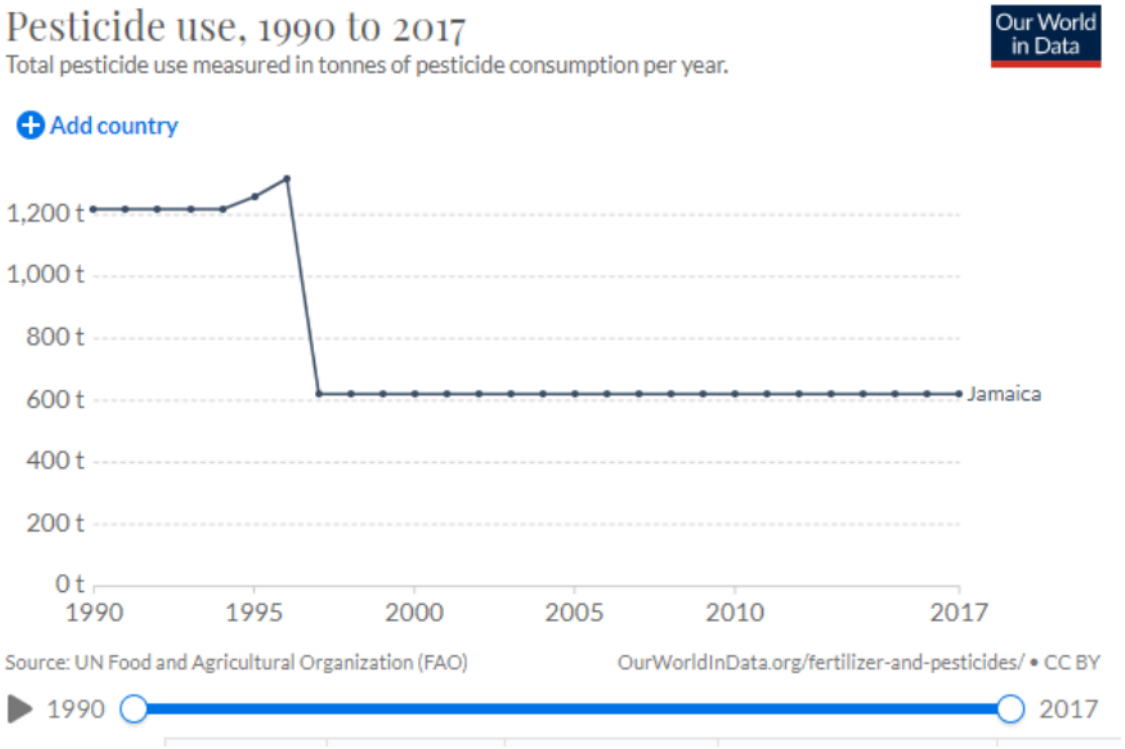


Collated from the Registered Pesticide List (Pesticides Control Authority Jamaica 2021)

There are 73 restricted or managed pesticides in Jamaica (See Annex V for details). “Restricted” refers to pesticides that are used by or under the direct supervision of a registered pest control operator or another specified person (Pesticide Act 1987).

Figure 4 shows the trend in pesticide consumption in Jamaica. The period 1990 to 1994 had a consistent trend of 1,217 tonnes, with a slight increase to 1316 tonnes in 1997 and a drastic decrease to 621 tonnes in 1997, which stayed constant over ten years. There was no available documentation on the cause for the drastic decrease.

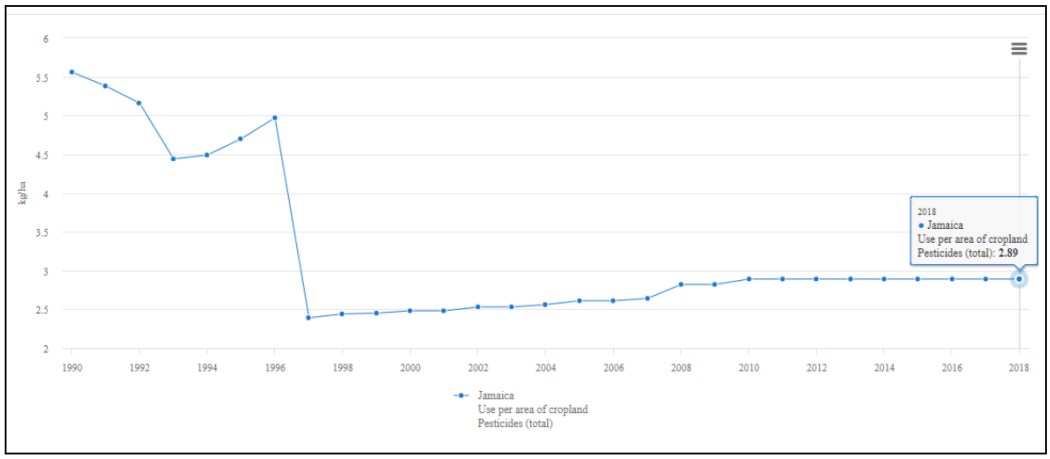
Figure 4: Pesticide Consumption for 1990-2017



Source: Our World in Data (ND)

The application rate of pesticides for 2010-2017 was 2.89 kg per hectare of land, a minimal increase from 2.82 kg during 2008. Notably, this is almost 50% less than the application rate for 1990, which was 5.56 kg, and which had a dramatic decrease to 2.39 kg – 2.45 kg for the period 1997-1999 (Our World in Data (ND).

Figure 5: Pesticide Application Rate per hectare (FAO 2021)



Source: Our World in Data (ND)

Three thousand one hundred and six (3,106) tonnes of pesticides with a Cost Insurance and Freight (CIF) value of US$ 15,498,586 were imported into Jamaica for the period April 2012 to March 2013. Compared to previous years, the quantities of insecticides imported substantially increased; overall, imports were up by 12%. More recent data on the tonnes of pesticides imported was unavailable.

Table 3 below shows the volume of imported pesticides in Jamaica for the period 2008-2013. In 2008-2010 there was a decrease in the imported volume of pesticides, and there was a gradual increase for 2011-2013. There was no available data for the 2014-2020 calendar years. The highest volume of agricultural pesticides imported was 3,105,578 tonnes in 2012-2013, and the lowest was 2,451,306.4 tonnes in 2009-2010. Herbicides accounted for the majority, followed by insecticides then fungicides for the period.

Table 3: Volumes (Kg) of imported Pesticides for 2008-2013

Category	2008-2009	2009-2010	2011-2012	2010-2011	2012-2013
Herbicides	1396222.5	1200091.9	1629386.8	1603327.8	1677769
Insecticides	1203601.3	730447.8	630935.1	913889.2	971953
Fungicides	343393.5	406738.8	328319	243568	270884
Rodenticides	50506	61154.8	58245.6	50171.6	70611
Surfactant/Fruit Coating	24495.8	7254.5	72138	23147.1	57233
Nematicides	8320	12499.4	25125	16923.4	19937
Molluscicides	15610.8	7574.4	7590.7	8109.6	12402
Adjuvants	3765.7	8293	11900	9691.8	10067
Repellents	8791.3	8209.9	4768.6	12138.8	9584
Fumigants	247.5	4657.2	5397.6	4139.6	4395
Plant Growth	1336.3	4373.2	810.2	1040	696
Attractants	24.5	11.5	1.8	3.1	47
Total	3056315.2	2451306.4	2774618.4	2886150	3105578

Collated from the annual reports of the Pesticides Control Authority of Jamaica
Source PCA Report 2008-2013

Farmers use various pesticides on their crops based on the purpose or function of these pesticides. The findings from the comparative review of HHPs with registered pesticides in Table 5 suggest that many crops are treated with HHPs. Compounded with the use of HHPs is that of registered ingredients that are banned and restricted in other countries.

The volume of imported pesticides for 2009-2013 showed a fluctuation, with minimal increase in 2009-2010 and the highest volume of 1,558,900 kg in 2012-2013.

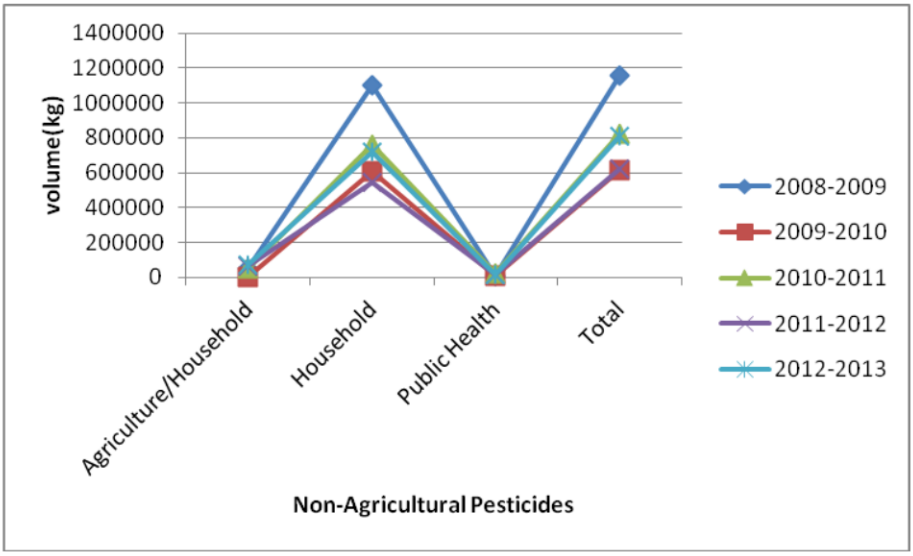
Imported pesticides for non-agriculture use have shown a fluctuation throughout the period 2009 to 2013 (Table 4). There was a dramatic decrease from 2008/09 to 2009/10, and a drastic increase from 2011/12 to 2012/13. For the listed category of non-agriculture pesticides, the household had the highest importation, followed by agriculture/household and public health with the least (Table 4 and Figure 6).

Table 4: Volume of Non-Agriculture Pesticides imported from 2008-2013

Category	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Agriculture/Household	50,504.2	1250	46,935.6	6,2836.9	71,100
Household	1,099,388.1	60,8701.5	756,879.6	543,806.4	719,000
Public Health	6,506.1	6,064.5	18,648.3	13,544.2	16,500
Total	1,156,398.4	616,016	822,463.5	620,187.5	806,600

Collated from the annual reports of the Pesticides Control Authority of Jamaica

Figure 6: Comparative Volume of Non-Public Health Pesticides Imported from 2008-2013



Collated from the annual reports of the Pesticides Control Authority of Jamaica 2008-2013

Agricultural pesticides accounted for the highest volume of pesticide importation when compared to non-agricultural pesticides.

4.1 Pesticides Registration and Policy Framework

The use of pesticides is significant to the agricultural industry and public sector. Documentation shows that pesticide usage or its residue has affected the environment and its users in ways that have profound public health significance. Jamaica is no exception to this issue and has regulatory and monitoring bodies that serve as a reference for pesticide management and control.

The Pesticides Control Authority (PCA) is a statutory body of the Ministry of Health and Wellness, mandated through the Pesticides Act of 1975 to regulate, manage and control pesticide usage in Jamaica (PCA Report, 2012-2013). The Authority operates within the gambit of the Regulations and Amendments done in 2004, 2009, and 2011.

Its core functions are to deal with applications for registration of pesticides and premises to sell restricted pesticides, licenses to import, manufacture, and operate companies along with certification of their Pest Control Applicators and Servicemen, as well as conducting public education activities on pesticide safety (PCA Annual Report 2012-2013).

There is an appointed Board by the Minister of Health and Wellness, which comprises members from public and private sector organizations with the expertise required for pesticide-related matters. The Board's role is to set policies to regulate the industry concerning the importation, manufacture, use, distribution, and control of pesticides, among other things.

4.2 Pesticide Residual Monitoring

The Pesticide Control Authority facilitates a monitoring programme for residue in food crops produced and imported to Jamaica. The Pesticides Control Authority, in collaboration with the UWI Pesticide Research Laboratory, conducts residue analysis. A sampling of local produce is chosen strategically from local markets within different parishes, such as fruits and vegetables sold in Coronation Market located in the country's capital Kingston (PCA Annual Report 2011-2012). Sample testing of imported products is done through the Plant Quarantine Division of the Ministry of Agriculture and Fisheries. Examples of imported products tested include fresh produce such as apples, strawberries, red grapes, and white grapes (PCA annual report 2009 -2010).

The Pesticides Control Authority does residual pesticide monitoring both for local and imported agricultural produce. For example, tetrahydro-phthalimide residue found met the acceptable limit using the Codex Alimentarius maximum residual limit standard as a reference. There was no standard to guide residual findings for the permethrin and tetracholor-isophthalonitrile (PCA annual Report 2009-2010). A report for 2012 showed detected residue on cauliflower (3-indolyacteonitrile) and red cabbage (fenamidone and permethrin). Detection found in 2013 on seven samples of imported produce gave the following results: tomato (no detected residue), strawberry (tetrahydrophthalime, cyprodinil, fludioxonil, etoxiazole), onion (chlorpropham), Irish potato (chlorprophams), peach (pyrimethanil, thiabendazole, fludioxonil, boscalid), pear (diuron metabolite 3,4 dichlorophenyalisocyanate) and sweet pepper (cyhalothrin 33µg/kg, which was acceptable).

Although tetrahydro-phthalimide was within Codex Maximum Residual Limits, Captan is a by-product widely used as an antifungal pesticide that has a potential to cause cancer in humans. An agriculture study done to investigate cancer incidence among Captan applicators revealed that of the 48,986 applicators who participated in the study, 4,383 (9%) had applied Captan. A follow-up time of 9.14 years was used to estimate relative risks (RR) for cancer subtypes by tertiles. The risk for all cancers combined and cancer sites showed that at least 15 cases occurred among Captan-exposed applicators (Greenburg et al. 2008). It is important to note that Captan is listed as a HHP on the PAN HHP list (March 2021 version).

Residual testing of the imported products in 2008-2009 showed permethrin and tetrachloro isophthalonitrile for tomatoes, with no standard available to determine the acceptable limit.

Tetrahydrophthalimide found in strawberries was within the CODEX MLS acceptable limit. Sweet pepper, grapes, and lettuce had no residue present (PCA Annual Report, 2008-2009).

Local residual testing for the period 2009-2010 showed pesticide residue in the following crops: tomatoes (diazinon 0.06mg/kg, which is significantly lower than the Codex MRL of 5mg/kg), scallion (chlorophenol, but there were no chemical standards to determine the levels), and callaloo (diazinon 1.78 mg/kg- no Codex MRL standard for callaloo to assess if the level was acceptable). Other crops such as onion, watermelon, okra, thyme, cabbage, pak choi, and cauliflower had residues of pesticides for which active ingredients were not explicitly reported (PCA Annual report 2009-2010).

4.3 International Conventions

Jamaica is signatory and Party to the following protocols and conventions geared towards the sound management of chemicals: Basel Convention on the Control of the Transboundary Movements of Hazardous Wastes and their Disposal, Stockholm Convention on Persistent Organic Pollutants, Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Montreal Protocol on Ozone Depleting Substances (UNITAR, 2006). Also, Jamaica participates in the Strategic Approach to International Chemicals Management (SAICM).

The Rotterdam Convention (Jamaica ratified on 28.08.2002 and entry into force was on 24.02.2004) is a global treaty that provides an early warning to countries on a broad range of hazardous chemicals that have been banned or severely restricted in other countries to protect human health and the environment. The Convention can be used to prevent unwanted international trade for chemicals. The Stockholm Convention on Persistent Organic Pollutants (POPs) (Jamaica ratified on 23.05.2001 and entry into force was on 30.08.2007) addresses the production, use, and release of POPs. The Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal (Jamaica ratified on 23.01.2003 and entry into force was on 30.08.2007) ensures the application of robust controls from the moment of generation of hazardous waste to the storage, transport, treatment, reuse, recycling, recovery, and final disposal. The three agreements provide an overall framework to assist Jamaica in addressing pesticides throughout its life cycle.

Parties are countries or regional economic integration organizations that have ratified, accepted, approved, or acceded to the Conventions. Designated National Authorities (DNAs) are the primary contact points for matters related to the Convention's operation and are authorized to perform the administrative functions required by the Convention (Annex 1).

The above conventions and other agreements contribute to managing pesticide use against harm to humans and the environment. Countries that are Parties to the Rotterdam Convention are encouraged to share information on:

- National ban or severe restriction of a chemical
- Whether they are experiencing problems caused by a severely hazardous pesticide formulation under conditions of use in its territory.
- Plans to export a banned or severely restricted chemical.

Apart from the Conventions are other International agreements (including CARICOM, CBI, FAO PIC, and Cotonou) to regulate trade among Caribbean nations and other countries and influence agricultural land practices. These agreements also determine agrochemical use and thus potentially affect environmental pollution (UNITAR, 2006). There are collaborative efforts amongst Jamaica's Customs, National Ozone Unit, Trade Board, and The Ministry of National Security to manage the chemical life-cycle's import stage and facilitate trade (UNITAR, 2006).

According to PAN International, it is agreed within the international community that pesticides listed in the Stockholm POP and Rotterdam PIC Conventions and the Montreal Protocol on Ozone Depletion should qualify as highly hazardous pesticides, as well as active pesticide ingredients and formulations that have shown a high incidence of severe or irreversible adverse effects on human health or the environment (PAN 2017).

Strategic Approach to International Chemicals Management

The Strategic Approach to International Chemicals Management is a global, multi-sectoral and multi-stakeholder policy framework working to promote the sound management of chemicals across their life-cycle. Adopted by the First International Conference on Chemicals Management (ICCM1) on 6 February 2006 in Dubai, the SAICM is a policy framework to promote chemical safety around the world. SAICM provides a valuable multi-stakeholder forum to discuss and address the many challenges facing the adoption and implementation of national policies to safely manage chemicals. The Caribbean Poison Information Network, through the Poison Information Coordinator, has been participating as a stakeholder in the SAICM discussion. SAICM's overall objective is the achievement of the sound management of chemicals throughout their life-cycle so that by the year 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health (SAICM 2006).

4.4 Stakeholders of the Pesticides Industry

The chemical industry in Jamaica is diverse, representing importers/manufacturers, importers/distributors, and manufacturers/distributors. According to the 2006 National Profile for the Management of Chemicals in Jamaica, the chemicals imported in the country are at different chemical life stages, such as raw materials, intermediaries, and finished products. The imports are mainly for petrochemicals, paints, bauxite mining, agricultural industries, and industrial and domestic cleaning compounds. Most of the imported chemicals are from the USA. However, Europe, the United Kingdom, and the Far East are also suppliers to local distributors (UNITAR, 2006).

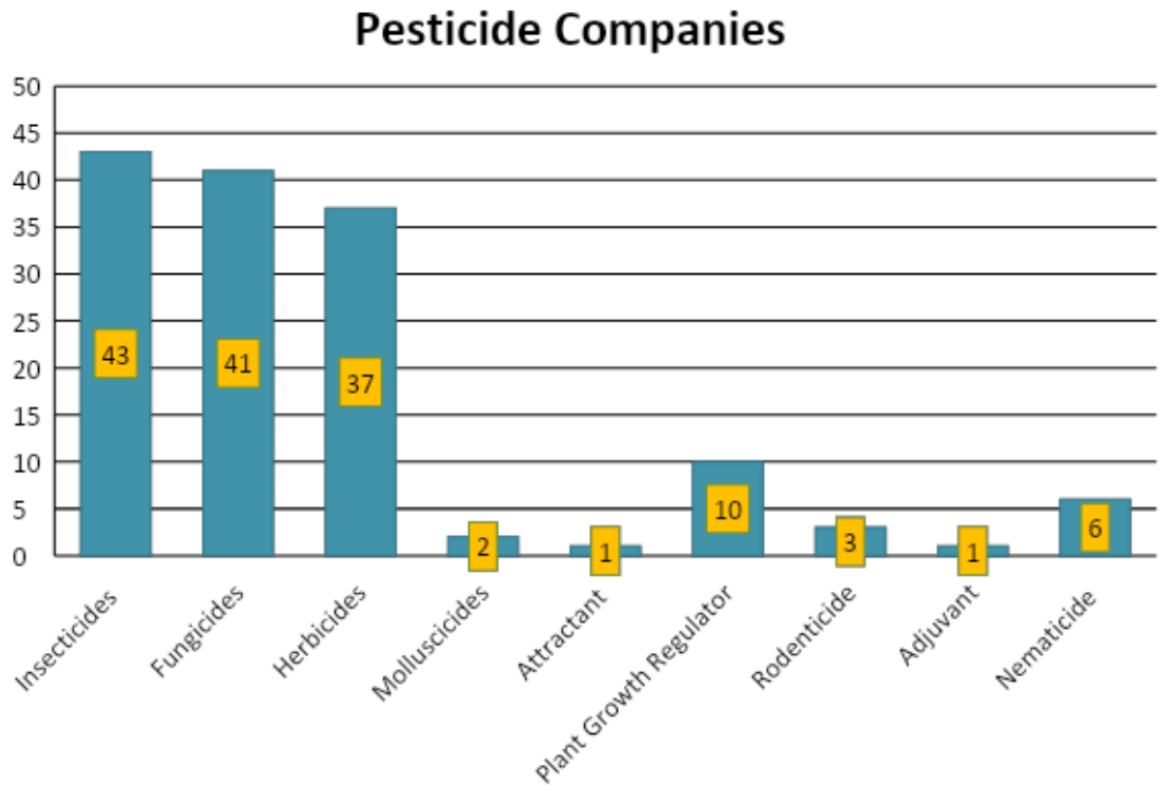
A review of published documents from the Pesticide Control Authority in Jamaica showed that 160 documented registered premises or persons are licensed to sell restricted pesticides in Jamaica. According to the Third Schedule of the Pesticides Act 1975, premises that wish to sell restricted pesticides are required to register and get approval by the PCA, which is valid for three years (PCA, Annual Report 2011-2012).

4.5 Pesticide Companies Registered in Jamaica

The majority of the pesticides used for agriculture in Jamaica are insecticides, herbicides, and fungicides produced and exported from many countries. There are 144 pesticides companies in Jamaica, of which thirty percent (30%) produce insecticide, twenty-nine percent (29%) fungicide and twenty-six percent (26%) herbicide (See Figure 7). Details of pesticide companies are in Annex I and Annex VI shows a comparative view of companies that produce HHPs and pesticides that are banned in other countries.

Syngenta and AG Chem Plant are the main companies that produce/import/distribute HHPs, followed by Bayer and BASF.

Figure 7: Number of Pesticide Companies



Collated from PCA list of Registered Companies updated January 2021

4.6 Farmers Associations in Jamaica

Jamaica has many structured associations/groups of farmers with special interests and concerns with developed structures, formal membership, status and functions for its members, and sets of regulations and rules. These groups are actively involved in the formulation and implementation of policies and agricultural development actions and their members' advocacy and training. The seven leading associations discussed below are the primary agricultural stakeholders, with the umbrella organization being the Jamaica Agricultural Society (JAS).

4.6.1 Jamaica Agricultural Society (JAS)

The JAS is an agency of the Ministry of Agriculture and Fisheries. It serves as an umbrella organization consisting of various affiliated commodity boards and associations, which include: Jamaica Citrus Growers Association, Pimento Growers Association, Cocoa Industry Board, All Island Cane Farmers Association, Coconut Industry Board, All Island Banana Growers Association, Coffee Industry Board, Jamaica Livestock Association, Ministry of Agriculture Export Division and Sugar Industry

Board. A fundamental role of JAS is to stimulate interest for all categories of farmers in agricultural pursuits, providing a forum for farmers to meet, discuss problems, and initiate plans. It is the oldest, most deeply rooted organization in rural agricultural development in the Caribbean (JAS, 2014).

4.6.2 Jamaica Pig Farmers' Association

The Jamaica Pig Farmers' Association is a non-profit organization with a mandate to lobby for the pig/pork industry's interest, improve the product's quality through partnerships and training, and develop its members' knowledge and skills. It is involved in initiatives such as the Newport genetics projects (Nugen) and is a Caribbean Broilers Group member. The project was geared to improve the breed stock by developing F1 Gilts through Artificial Insemination (A1). The JPFA facilitates the technology transfer to its members to provide high-quality local pork (Jamaica Pig Farmers Association).

4.6.3 All-Island Jamaica Cane Farmers' Association

The All-Island Jamaica Cane Farmers' Association was founded in 1941 as a body incorporated by the Cane Farmers (Incorporation and Cess) Act, 1941 (SCF Act). The Association has autonomy over its assets as stipulated under the Act, which provides that they can buy, sell, transfer or dispose of assets as they see fit. In general, the role of the AIJCFA is to promote the interests of its members and operate and efficiently sustain itself.

4.6.4 Jamaica Cocoa Farmers Association (JCFA)

The JCFA is a twelve-year-old non-profit organization with a farmer-centered approach towards the cocoa sector's sustainable development. JCFA has developed a plan to empower cocoa communities to participate in a deregulated cocoa industry. The USAID funded the project to establish cocoa fermenting and drying facilities ("FSD's") in selected communities. It also relates to the development of protocols for the traceable acquisition, fermentation, and drying of wet cocoa. JCFA implemented a community-based management structure for the operation at each of the processing facilities and trained stakeholders in the facilities' use, management, and maintenance. Farmers assisted with the rehabilitation of their cocoa fields, which stimulated a renewed interest in the cocoa farm (Source: Jamaica Cocoa Farmers Association). There is no available published report on the outcome of this project.

4.6.5 Coffee Growers Association

The Jamaica Coffee Growers Association is a non-governmental organization that operates independently of the government. It was initially formed in 1997 and rebranded in 2011. The organization's roles evolve in response to emerging needs. These range from licensing to trade coffee, defending the rights of lease-holding farmers to remain on their leased land, and enabling the upliftment of farmers through sustainable agricultural technology to improve communication with its members about best farming practices, to ensuring the receipt of the best outcome for their efforts (The Jamaica Coffee Growers Association, 2019).

4.6.6 Jamaica Organic Agriculture Movement Limited (JOAM)

The Jamaica Organic Agriculture Movement is a twenty-year-old non-governmental organization run by volunteers. It is operated by a Board of seven members, with an open membership policy for both individuals and groups. Membership can be corporate or supporting businesses that are able to contribute and collaborate through activities implementation. Its mission is to facilitate the development of a sustainable and economically viable organic agriculture sector in Jamaica. Since its inception, JOAM has run many training programs for farmers, such as hosting three Independent Organic Inspectors Association crop production and inspector training (JOAM).

The achievements of JOAM include: publishing an organic farming handbook, partnering with the Bureau of Standards (Jamaica) to develop the CARICOM Code of Practice for Organic Production and Processing, training organic inspectors, and launching a local certification programme in 2004. There is inadequate information on its crop production volume for the country; however, sweet peppers, jackfruits, and natural hair oil from honey are a few crops and products produced. The number of practicing organic farmers varies, with participants spanning from individuals to corporate bodies, groups, and practicing farmers.

4.6.7 Jamaica Livestock Association

The Jamaica Livestock Association is one of the oldest operating associations in the country and was established in 1941. It is the main provider of agricultural support and services to independent farmers. It currently serves the farming community through thirteen (13) retail stores strategically located across Jamaica. Their product range includes animal feeds, animal health care products, day-old chicks, agricultural chemicals, herbicides, pesticides, hardware items, and farm and garden supplies (JLA).

4.6.8 Westmoreland Organic Farmers' Society

This society aims to promote sustainable organic farming, improve livelihood opportunities for its members, and contribute to community development; it is a One for Jamaica Organic Network for Environmental Education. There is no available data on crop production and membership.

5.0 HHPs Usage amongst Registered Pesticides

Highly Hazardous Pesticides are so-called because of the high levels of acute or chronic hazards to health or the environment, according to internationally accepted classification systems such as the WHO-recommended classification of pesticides and Globally Harmonized System (GHS), or listing in relevant binding international agreements or conventions.

According to FAO & WHO, the eight criteria used to identify HHPs are:

1. Pesticide formulation, pesticide active ingredients, that meet the criteria of Classes 1A or 1B of the WHO-recommended classification of pesticides hazards;
2. Pesticide active ingredients and their formulation that meet the criteria of carcinogenicity categories 1A and 1B of the globally harmonized system of classification and labeling of chemicals (GHS);
3. Pesticide active ingredients and their formulations that meet the criteria of mutagenicity 1A and 1B of the GHS of classification and labeling of chemicals;
4. Pesticide active ingredients and their formulations that meet the criteria of reproductive toxicity categories 1A and 1B of the GHS of classification and labeling of chemicals;
5. Pesticide active ingredients listed by the Stockholm Convention in its Annexes A and B, and those meeting all the criteria in paragraph 1 of Annex D of the Convention;
6. Pesticide active ingredient and formulations listed by the Rotterdam Convention in its Annex III;
7. Pesticides listed under the Montreal Protocol; or
8. Pesticides active ingredients and formulations that have a high incidence of severe or irreversible adverse effects on human health or the environment.

(Source FAO & WHO 2017)

The criteria and sources used by PAN International to identify HHPs are:

High acute toxicity

Extremely hazardous (Class Ia) according to WHO-Recommended Classification of Pesticides by Hazard; or Highly hazardous (Class Ib) according to WHO-Recommended Classification of Pesticides by Hazard; or Fatal if inhaled (H330) according to the Globally Harmonized System (GHS).

Long term toxic effects

Carcinogenic to humans according to the International Agency for Research on Cancer (IARC), US EPA, or “Known or presumed human carcinogens” (Category I) according to the Globally Harmonized Systems (GHS); or Probable/likely carcinogenic to humans according to the IARC or US EPA; or Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans; Substances known to induce heritable mutations in the germ cells of humans (Category I) according to the Globally Harmonized System (GHS); or Known or Presumed human reproductive toxicant (Category I) according to the EU or the Japan Globally Harmonized System (GHS).

Endocrine disruptor

EU interim criteria as laid down in Reg. (EC) No 1107/2009 “Suspected human reproductive toxicant” (Category 2) AND Suspected human carcinogen (Category2) according to the EU or Japan Globally Harmonized System (GHS). Pesticides identified as endocrine disrupters in the EU according to Reg. (EU) 2018/605.

High environmental concern

Pesticides listed in Annex A & B of the Stockholm Convention; or meeting the Conventions’ criteria; or Ozone-depleting pesticides according to the Montreal Protocol.

High environmental concern-where two of the three following criteria are met:
P= “very persistent” half-life> 60 days in marine – or freshwater or half-life > 180 days in soil (typical half-life), marine or freshwater sediment) (indicators and thresholds according to the Stockholm Convention); and/or

B= “very bioaccumulative” (BCF >5000) or Know logP >5 (existing BCF data supersede Kow log P data) (Indicators and thresholds according to the Stockholm Convention); and/or
T= very toxic to aquatic organisms (LC/EC 50 [48h] for Daphnia spp. < 0,1 mg/l)

Hazard to ecosystem services
“Highly toxic for bees” according to US EPA (LD50, ug/bee <2)

Known to cause a high incidence of severe or irreversible adverse effects
Pesticides listed in Annex III of the Rotterdam Convention or meeting the Convention’s criteria

A comparative analysis of active ingredients for registered pesticides and HHPs using the PAN’s March 2021 HHPs list and the online-published list for registered pesticides in Jamaica updated on January 21, 2021 showed registered active ingredients for 458 formulated products for different categories of pesticides. The findings showed 187 active ingredients registered for the formulated pesticides sold in Jamaica, consisting of 60 active ingredients for HHPS registered for use in agricultural, public health, and non-agricultural settings. (Details of registered active ingredients, formulated products, and toxicity are in Annex II.) HHPs active ingredients account for 33% of the registered active ingredients, as shown in Figure 9.

Formulated products used in agriculture had the highest number of HHPs active ingredients for 111 insecticides, 50 herbicides, and 37 fungicides.

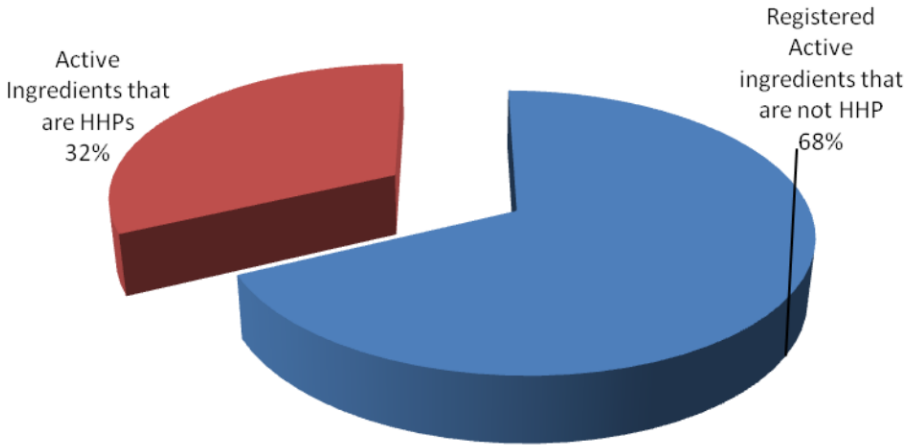
Further analysis of the human and environmental effects of registered HHPs summarized in Table 7 below revealed that most HHPs were associated with long-term toxicity in humans and the environment (group categories 2 &3). Notably, 13 active ingredients are fatal if inhaled, according to GHS, and are known or presumed human carcinogens, according to EU GHS regulation. Thirteen (13) are presumed reproductive toxicants, according to EU GHS, and 15 are US EPA probable likely carcinogenic. “Environmental toxicity has a high level for bees” accounts for 40% of the total HHPs registered in Jamaica.

Table 5: Summary of Registered Pesticide Categories for HHPs

Group	Effects	Number of Active Ingredients	Percentage o total HHPs Registered (60)
1. Acute Toxicity	WHO 1a	7	11.67
	WHO1b	1	1.67
	H330	13	21.67
2. Long-term Effect	EPA carcinogen	0	0
	IARC carcinogen	1	1.67
	GHS carcinogen (1A, 1B)	0	0
	IARC probable carcinogen	1	1.67
	EPA probable likely carcinogen	15	25
	GHS mutagenic (1A, 1B)	1	1.67
	GHS reproductive toxicity (1A, 1B)	13	21.67
	EU endocrine disruptor	1	1.67
	GHS C2 &R2	8	13.33
3. Environmental toxicity	Very bio accumulative	5	8.33
	Very persistent - water, soil or sediment	4	6.67
	Very toxic to aquatic organisms	4	6.67
	Highly toxic to bees	24	40
4. Conventions	Montreal Protocol	1	1.67
	Rotterdam PIC	1	1.67
	Stockholm POPs	0	0

PAN HHPs list March 2021, and online registered pesticides list for Jamaica updated on 21. 2021

Figure 8: Percentage of HHPs in registered active ingredient



Collated using PAN HHPs list March 2021, and online registered pesticides list for Jamaica updated on January 21, 2021

5.1 Banned Pesticides Registered in Jamaica

A banned pesticide is one whose uses are prohibited by final regulatory action to protect human health or the environment. It includes a pesticide that has been refused approval for first-time use or withdrawn by industry either from the domestic market or from further consideration in the domestic approval process, and where there is clear evidence that such action taken is to protect human health or the environment (PAN, 2017).

A comparison using the PAN international consolidated list of banned pesticides (March 2021) and the list of registered pesticides for Jamaica (as of January 2021) was made to extract information on active ingredients banned in other countries and those registered for use in Jamaica. The findings revealed that of the 187 active ingredients registered for formulated pesticides in Jamaica, 66 are banned in other countries, including three not approved in the European Union (EU) (refer to Annex IV for details). Also, of the 66 active ingredients banned and unapproved in other countries, 42 are HHPs (refer to Figure 11 below) according to the PAN HHPs list for March 2021.

Figure 9: Percentage of banned active ingredients registered in Jamaica

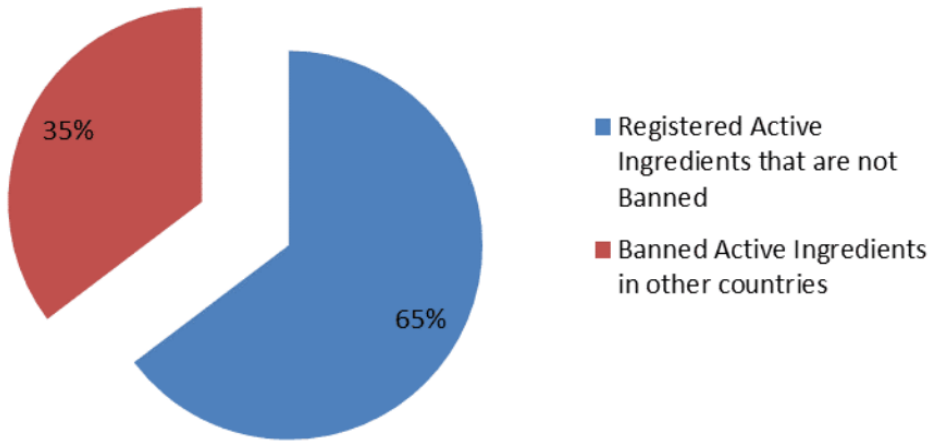
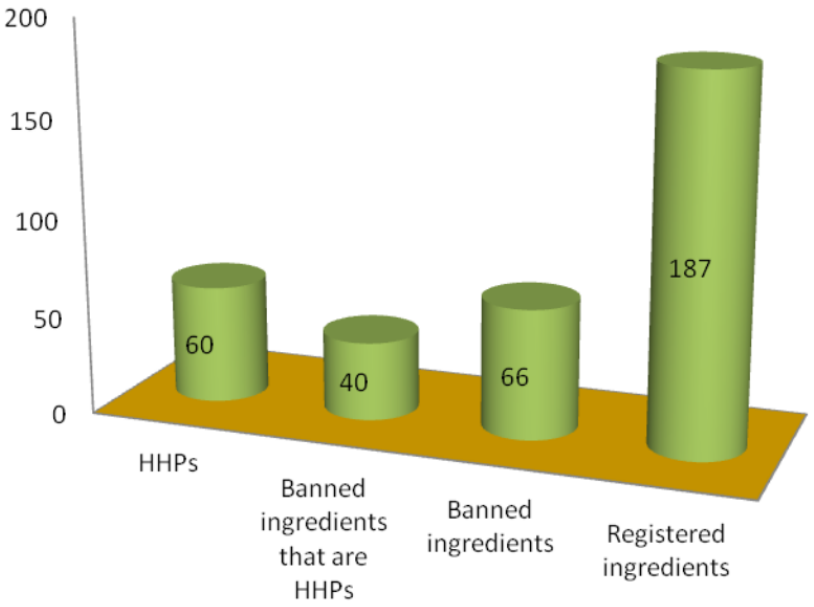


Figure 10: Comparative view of HHPs and banned active ingredients registered in Jamaica



6.0 Population Health and Environment

There is a growing concern about the impact that pesticides have on population health and environmental pollution. Research has shown the association of pesticides with health and environmental issues.

6.1 The Impact of Pesticide Usage on Health

The type of pesticide, the duration and route of exposure, and the individual health status (e.g., nutritional deficiencies and healthy/damaged skin) determine factors in the possible health outcome (McDuffie, 2001).

The impact of pesticide usage on health documented in Jamaica since the 1980s is scarce and provides inadequate information for poisoning incidents. Pesticide poisoning in Jamaica has occurred through intentional and unintentional exposures, resulting in hospitalization, fatality, and at-home self-treatment by the victims. According to the Ministry of Health and Wellness surveillance report, 2008-2015, pesticide is the third causative agent for accidental poisoning (MOH, 2014 & 2015). Reported agents were gramoxone, fungicide, weedicide, rat poison, malathion, lanate, flea powder, and insect repellent (formulation names missing for some products) (MOH, 2012 & 2014). However, there is limited data on the incidence of pesticide poisoning and its impact on the population. That said, anecdotal evidence from the 1980s to 1990s can give some background on the exposure narrative. For example, in 1997 an entire family became ill when their 82-year-old family member served meals contaminated with pesticide from its mistaken identity for baking powder; the older woman succumbed to the poisoning (Pragg, 1997). Review cases of a coroner autopsy series for the period 1980 – 1999 showed fatalities from pesticides (herbicides and insecticides) poisoning in nine cases; six associated with paraquat (Escoffery et al. 2004). Coroner data can help evaluate pesticide poisoning impact chronologically. Research done in northwestern Jamaica with 359 farmers revealed that 16% of the farmers experienced acute pesticide poisoning within two years (Ncube et al., 2011).

Some of the pesticides discussed below are registered and used in Jamaica, and their active ingredients are classified as highly hazardous according to PAN's HHPs 2021 list (refer to Annex 4 for a list of nationally registered pesticides).

A study done by Hopin et al. outlined four categories of insecticides and four herbicides that were significantly associated with prevalent chronic bronchitis. These pesticides were heptachlor, chlordane, DDT, lindane and toxaphene - all organochlorine insecticides. Organophosphates included coumaphos, diazinon, dichlorvos, malathion and parathion. Carbamates were carbaryl and carbofuran and permethrin. The herbicides included chlorophenoxy (2,4,5-T and 2,4,5-TP) and chlorimuron-ethyl and petroleum oil (Hopin et al. 2007).

Carbamate pesticides, such as aldicarb, carbofuran, and ziram, are another class of chemical pesticides associated with an endocrine-disrupting activity, possible reproductive disorders, and effects on cellular metabolic mechanisms and mitochondrial function (Nicolopoulou-Stamati et al. 2016). Carbaryl, which belongs to the family of carbamate pesticides, can act as a ligand for the hepatic aryl hydrocarbon receptor, a transcription factor involved in the mechanism of dioxin toxicity. There is also evidence for the ability of carbamate pesticides to cause neurobehavioral effects.

Triazines, such as atrazine, simazine, and ametryn, are another class of chemical pesticides related to endocrine-disrupting effects and reproductive toxicity. There is a possible statistical relationship between triazine herbicides and breast cancer incidence. Atrazine is the most known triazine, and it is a very widely used herbicide associated with oxidative stress, cytotoxicity, and dopaminergic effects. (McDuffie, 2001).

6.2 The Impact of Pesticides on the Environment

The environmental impacts of pesticides depend on their dispersion in the environment and their toxicological properties (Hayo 1996). Pesticides have harmful effects on the soil ecosystem, and when released into the water bodies, affect the aquatic systems. The water molecules in the river are affected by the accumulation of these toxic contaminants with its alkaline pH and heavy metals, which could adversely affect flora and fauna's health. (Rajmohan et al. 2020). In Jamaica, pesticides are introduced in the environment through various means such as dumping, seepage, and burning, to name a few. This section discusses the introduction of pesticides in the environment and laboratory analysis done to quantify pesticide residue.

Butho et al., in a 2006 study conducted in north-western Jamaica, alluded that the pesticide disposal practices by farmers included burning, burying, or dumping of unused pesticides or empty pesticide containers in the bushes, and this contributed to environmental contamination. Another study reported that 18% (65) of farmers washed pesticide application materials in streams. 30% of those in the study sample had experienced acute poisoning from pesticide usage. Eleven (3%) farmers reported using empty pesticide containers to collect or store farm water (Ncube et al. 2011); this presents a clear risk of pesticide poisoning.

Other studies done detected pesticide residues in soil and water since the 1990s. Pesticide residues were frequently detected in soil, well water, spring water, sediment and fish/shrimp samples from rivers and sea coasts across Jamaica. Pesticides found included endosulfan, chlorpyrifos, diazinon and dieldrin, which exceeded LC50 (the lethal concentration of the chemical in the air or water that will kill 50% of the test animals with a single exposure) for many fish species. Mussels, sediment, and the water of Kingston Harbour had eight organochlorines' residues (Mansingh et al. 1997). Monthly monitoring of insecticide residue in water and sediment of four major rivers of the Hope River (Watershed-Hope River, Mammee River, Hog Hole River, Salt River) during 1989, 1990 and 1991 showed the presence of endosulfan, dieldrin and diazinon (Mansigh et al. 1995). Pesticide residue found in the Kingston Harbour (weekly sampling for a month in July 1992) revealed endosulfan, endosulfan sulfate, DDT, dieldrin, aldrin, endrin, lindane and diazinon. Oysters and fish are also contaminated with alpha endosulfan, diazinon and aldrin (Mansingh et al. 1995). Some pesticides detected have been phased out from Jamaica, including DDT and endosulfan (phased out in 2010). On the other hand, diazinon is an HHP currently registered to be used in Jamaica (refer to Annex 3).

6.3 The Precautionary Principle and HHPs

As defined in environmental science, the precautionary principle states that, when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically (Kriebel et al., 2001). The precautionary principle was demonstrated in the early 2000s through the monitor and control of pesticides in Jamaica. Two such examples were the obsolete pesticide stock programme and the phasing out of six pesticides in the 2010-2011 period.

In 2010- 2011 the Pesticides Control Authority phased out six HHPs: endosulfan, carbofuran (furadan), chlordecone, TBT, MSMA, and DDVP (dichlorvos and chlorpyrifos) (The Gleaner, 2010).

Applicable consideration for the Precautionary Principle can be evaluated within different scenarios as stated in the situation analysis below. The PCA annual report for 2011-2012 discussed a case of methomyl exposure, which occurred through ingestion of dumplings (flour mixture food) contaminated with the pesticide. The Authority stated there was no follow-through action. A review of toxicological information showed that methomyl is an HHP (refer to PAN 2019 list for HHPs), highly toxic by the oral route, and gives the clinical manifestation of acute poisoning through exposure. There is also a probable lethal oral dose in humans of 5-50 mg kg-1 (Pope, 2005), which warranted an investigation on the source and mode of contaminant to the food product (flour), which is not a crop (PCA Annual Report 2011-2012).

In instances where there are no standards to determine the acceptable pesticide residual limit for consumption of the tested products/crops, scientific evidence-based on associated harms to health- could be used as a precaution to protect the populace's health.

The diazinon and paraquat assessment followed by recommended continued approval for use in the country was based on the association of the chemical with suicide locally (PCA Annual Report 2009-2010). In this instance, other assessment criteria could include evidence-based studies done on health impacts, hazard toxicity classification using global data, and analysis from monitoring and residual testing done locally.

An unregistered pesticide, “Red O Pest,” was found on the market; the content was tested and the active ingredient was identified as 1,2,4-trimethyl benzene, a sterilizing agent. The PCA proposed action was to place an advertisement in the newspaper warning the public not to purchase this product and also including a list of other illegal ones seen on the market from time to time (PCA annual Report 2009-2010). Another action that could have been taken was to ensure the complete removal of the unregistered pesticide from the market and enforce compliance through sanctions.

7.0 Alternatives to the use of HHPs

The selected alternatives discussed are specific to crops grown in Jamaica or the region. The critical message published to farmers through the monitoring and regulating Authorities is that pesticides should be the last option. Inadequate documentation of programme effectiveness amidst the numerous programs and activities conducted is notable.

7.1 Local Practice

The Farm Enterprises Program has been in existence since 2014; it is the closest to an alternative for HHPs. The program aims to help build on ecologically-based organic food systems and develop market-driven organic value chain production, certification, and distribution systems for agricultural products, reducing food insecurity and poverty (Geirer, 2018).

Organic farming is a practice by JOAM and the Westmorland organic farmers society. There is no available data on the volume of main crops produced nor the number of participating farmers.

Jamaica presently has no formal land-use policy to support soil and land preservation. The absence of such a policy contributes to unsustainable land-use practices, which creates the full risk for soil erosion and landslides. The inadequate use of land results in degraded landscapes compromising agricultural production (FAO, 2020).

Presently there are no implemented policies or programs to continue in the phasing out of HHPs in Jamaica, even though the future implementation of the Caribbean HHP Risk Reduction Plan promoted by FAO and described in point 2.1.3 is promising. However, areas of agroecology practices are encouraged, such as crop rotation and mix crops using those that are resistant to pests with those that are not.

7.2 Accrued Benefits from Alternative to HHPs

Implementing agroecology programs as an alternative to HHPs has shown multiple benefits to health, the environment, and the economy. Important to note is that transitioning from HHPs to best practice alternatives in agroecology may not readily give an enormous economic benefit at the start. However, the long-term rewards and benefits outweigh the start-up setback. The accrued benefits detailed below are taken from countries (Africa and Asia region) of similar climatic context and cultural practices in agriculture like that of Jamaica.

7.2.1 Benefit to Health

A safer alternative to HHPs can contribute to the health and well-being of the population by eliminating the health risks associated with the use of HHPs. By using alternatives, the risks posed through the contamination of food, soil, and water via pesticides should be less. Acute and chronic poisoning incidents should gradually decrease and the cost for healthcare to treat associated pesticide exposure illnesses within the farming community eliminated—a gradual increase in quality of life through health, wellbeing, and longevity. The health sector's economic burden for treating poisoning and pesticide-related illness should reflect a dramatic decrease.

7.2.2 Benefit to the Environment

Implementing the Community Management Sustainable Approach (CMSA) system in farming has shown tremendous environmental benefits such as improved soil ecology, water conservation, pesticide-free groundwater, agri-biodiversity, a smaller carbon footprint from reduced inorganic fertilizer and pesticides, and more (Watt & Williamson, 2015).

7.2.3 Cost-Benefit

Gains to be accrued from the phase-out of HHPs must be calculated in terms other than economic profitability, and the hidden cost of pesticides on human health, the economy and the environment should be considered. As cited from Watt & Williamson 2015, a World Bank survey conducted with 400 households utilizing the CMSA method in 2008 revealed a reduction in the costs of cultivation and significant savings estimated at US $52 million for 2008-2009.

Cotton farmers in Africa had a gross margin of cotton revenue, minus pest control and fertilizer application costs were highest in the organic cotton managed with food sprays (US $207/ha) followed by the conventional cotton (US $148/ha) and then the organic cotton with neem alone (US $132/ha) (Watt & Williamson, 2015).

8.0 Human Rights Issues and Pesticides

All humans desire the right and opportunity to have good health and a toxic-free environment for quality of life; unfortunately, this is not the present reality. Research has shown that poorer countries are often not given this right due to hazards introduced into their environment through chemical trade with more prosperous countries. A call for international laws mandatory to all countries to negate the unequivocal health burdens on different populations is needed.

In Jamaica, studies have shown pesticide exposure to be associated with the inappropriate handling of pesticides, non-compliance regarding personal protective equipment, soil contamination, water, and crop contamination. The onus to negate exposure is oftentimes placed on the users of pesticides. The need to understand human error and accidents when handling pesticides should stir the cause for stringent enforcement of policies to protect the population's health, specifically vulnerable groups such as the farming community. Access to HHPs in Jamaica is an infringement upon the rights to users' good health and the affected population. The government must ensure that HHPs are not allowed in the country to protect the health of farmers and the broader population that will experience the ripple effect from these toxic chemicals.

The UN Special Rapporteur's report to the Human Rights Council on January 24, 2017, alluded to the associated cost to government and the negative impact that pesticides have on both the environment and human health. Particular emphasis was placed on elevating the rights to health through alleviating the risk for exposure (UN, 2017). The rights to health can only be exercised if the risk through access to HHPs is removed It can be concluded that, with or without protective gear in using pesticides, the health risk is evident from the toxic nature of the chemical being used.

9.0 Conclusion

The use of pesticides has contributed significantly to food production in Jamaica; however, the use of HHPs in agriculture has deleterious impacts on humans and the environment. The morbidity and mortality that have been associated with the use of highly toxic pesticides, and the associated burden to society, families, public health systems, and economies, do not give a complete picture of the magnitude of the effect. Jamaica has a robust legal framework and policy to control pesticide sale and use, but the high number of HHPs registered in-country and those banned in other countries requires urgent action.

Amidst all that is in place in the country, there is still the need for a shift to a more sustainable agricultural practice that can enhance human health and the environment while simultaneously creating an appreciable economic gain.

10.0 Policy Recommendations

Current agricultural practices include the vast production and extensive use of chemicals known for their ability to cause adverse health effects in humans and wildlife and degrade the natural environment (Nicolopoulou-Stamati et al. 2016). This has created a global awareness for the introduction of best practices, which can supplement the use of harmful substances. Some frameworks can be used in the implementation of programs to phase out the use of HHPs in Jamaica. The following recommendations are contextual to Jamaica's present modus operandi.

1. The Pesticides Control Authority and Rural Agriculture Development Authority ensure the proper use of the selected pesticide products for approved applications and comply with national regulations and international conventions.

2. Governments, industries, and users of pesticides be guided by the International Code of Conduct on Pesticide Management throughout the manufacture, sale, and handling of pesticides.

3. The Pesticide Control Authority and the Rural Agriculture Development Authority implement an agroecology approach to phase out both the use of HHPs and pesticides banned in other countries from entry into Jamaica. Participation of experts and farmers' organizations with experience in Integrated Pest Management (IPM), agroecology, and organic farming should be encouraged. Concerted efforts should be made by regulators to expand the use of organic agriculture for national consumption.

4. The Pesticides Control Authority conducts a regular toxicological review of active ingredients for registered pesticides before approval or re-registration. Priority should be given to phasing out HHPs and pesticides banned in other countries, according to PAN international lists, with scientists' who have no conflict of interest with industry participation.

5. Through its associated committees within CARICOM, the Pesticides Control Authority should develop regional standards in the absence of Codex standards to establish acceptable limits for all agricultural products used locally, considering the most vulnerable population.

6. Implement a sustainable monitoring system for the environment; to include periodic testing of soil and water bodies (well, harbours, springs, stream, groundwater) through locally approved and certified laboratory/ies.

7. The Pesticides Control Authority, in collaboration with the Surveillance Unit in the Ministry of Health and Wellness and CARPIN, implement a sustainable health surveillance programme on pesticide exposure with accurate documentation, including poison cases/incidences, through the utilization of the Severely Hazardous Pesticide Formulation (SHPF) tool kit. There is an urgent need to commence mandatory reporting through the Designated National Authority to the Rotterdam Convention by submitting reports on pesticide poisoning in Jamaica to effect alerts for noticeable toxicity trends for associated active ingredients.

8. All relevant entities to take coordinated action to produce and disseminate relevant and explicit mass public educational material through all available media to extension services, the agriculture sector, public health advisory services, farmers and farmers' organizations, pest control operators, public health workers, and other entities with advice on pesticide management and their effects on health and the environment.

The recommendations presented will contribute significantly in achieving eight Sustainable Development Goals, namely SDG 2: Zero hunger; SDG 3: Good health and wellness; SDG 6: Clean water and sanitation; SDG 11: Sustainable cities and communities; SDG 12: Responsible consumption and production; SDG 13: Climate action; SDG 14: Life below water; and SDG 16: Life on land.

Glossary

Active Ingredient: The part of the product that provides the pesticidal action.

Banned pesticides: A pesticide that has had all uses prohibited by final regulatory action, in order to protect human health or the environment. It may include a pesticide that has been refused approval for first-time use, or has been withdrawn by industry either from the domestic market or from further consideration in the domestic approval process, and where there is clear evidence that such action has been taken in order to protect human health or the environment.

Highly Hazardous Pesticides: Pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or the environment according to internationally accepted classification systems such as the WHO-recommended classification system or GHS or their listing in relevant binding international agreements or conventions. In addition, pesticides that appear to cause severe or irreversible harm to health or the environment under conditions of use in a country may be considered to be and treated as highly hazardous.

Pesticides: Any substance or mixture of substances of chemical or biological ingredients intended for repelling, destroying, or controlling any pest or regulating plant growth.

Poison: A substance that can cause disturbance of structure or function, leading to illness, injury, or death when absorbed in relatively small amounts by human beings, plants, or animals.

Poisoning: Occurrence of damage or disturbance caused by a poison, including intoxication.

Toxicity: A physiological or biological property that determines the capacity of a chemical to do harm or produce injury to a living organism by other than mechanical means.

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Annex I: Pesticide Companies Registered in Jamaica

Pesticide Companies Registered in Jamaica (manufacturers, formulatprs, retailers)		
Registered Companies	**Registered Companies**	**Registered Companies**
Cheminova Inc	Dow Agrosciences De Colombia	United Phosphorus Ltd
Syngenta S.A. UK	Syngenta UK	Syngenta S.A.
Bayer Corporation USA	Nippon Soda Comp. Ltd	Syngenta S.A. UK
Certis USA	Thor G.M.B.H	Syngenta S.A. Switzerland
Albrosco L	Syngenta S.A	Syngenta Agro S.A.De. C.V.
Valent Biosciences cooperation	Chevron Chemical	Agro-Grace
Fumakilla	Kocide LLC	Bayer Cropscience
AG Chem Plant Ltd	Gowan Company	AG Chem Plant Ltd
Nippon Soda Comp. Ltd	Gowan Milling	Ishihara Sangyo Kaisha Ltd
F.Joh Kwizda Gesellschaft (Syngenta)	Olympic Horticultural Products	Van Diest Supply Company
Vi AGta (Europe) Ltd	Indofil Chemicals Company	Bayer Corporation USA
F.A. Richard & Company Ltd.	Bayer S.A Guatemala	Cipla Ltd.
Latin America Exporters Ltd (Carlo)	Syngenta Crop Protection Inc.	Marketing Arm Panama
Marketing Arm International	Sulcosa-Sulfato DE Cobre S.A.	Nufarm America Inc.
Marketing Arm Panama	Basf Quimica Bogota	Pilarquim (shanghai) Co. Ltd
Latin America Exporters Ltd (Carlo)	Syngenta Crop Protection Inc.	Marketing Arm Panama
Marketing Arm International	Sulcosa-Sulfato DE Cobre S.A.	Nufarm America Inc.
Marketing Arm Panama	Basf Quimica Bogota	Pilarquim (shanghai) Co. Ltd
Syngenta Chemical B.V.	Scotts-Sierra Crop Protection Company	Kumiai Chemical Industry Co. Ltd.
Dow Agrosciences	Fomesa Fruitech S.L.	Agan Chemical manufacturers Ltd.
OHP Inc.	Coromandel International Inc.	Shandong Weifang Rainbow Chemicals Company Ltd.
Bayer Cropscience	Bayer Cropscience	Simonis BV
Syngenta S.A. Switzerland	Basf AG	FMC Corporation
Rotram Agro Chemical Company Ltd.	Rotram Agro Chemical Company Ltd.	Basf SE
Jiangsu Rotam Chemistry Co. Ltd.	Total Petrochemicals & Refining USA INC	Syngenta Crop Protection Inc
Hebei-Van Bio-Chemicals Co, Ltd	Quimetal Industrial S.A.	Zhejiang Zhongshan Chem Indus Group Ltd.
Agrocare Chemical Industry Group Ltd.	Basf Espanola A.L.	Bayer Cropscience S.A.
Basf Espanola S.A.	Fomesa Fruitech S.L.	Ningbo Generic Chemical Co. Ltd
Disinfecto Chemical Industries	Bayer S.A. Guatemala	Jiangsu Rotam Chemistry

Bio-Pharmachemie	Bayer De Mexico SA	Bayer Environmental Science
Vetanco S.A.	Dow Agro Dow Agro Sciences	Great Lakes IPM Inc.
Agricultural Chemical Plant	Bayer Cropscience S.A.	
Ningbo Generic Chemical Co. Ltd		

Pesticide Companies Registered in Jamaica (manufacturers, formulators, retailers)		
Registered Companies	**Registered Companies**	**Registered Companies**
Detia Degesch GMBH	Basf Espanola S.A	Bayer Environmental Science
Natural Insecticide Products	VTA (IPT) Pergande GMBH	Sichuan Leshan Fuhua Tongda Agrochem Tec
Parijat Industries (India) PVT Ltd.	Agrocare Chemical Industry Group Ltd	Agrocare Chemical Industry Group Ltd.
Nihon Nohyaku Company Ltd.	Celagri , Spain SL	Amvac Chemical Co-operation
Lam International Cooperation	Basf Cooperation. USA	Shanghai Mio Chemical Ltd.
Tagros Chemicals India Ltd.	Jiangsu Wintafone Cropscience Co. Ltd	Anhui Guangxin Agrochemical Co.Ltd
Haili Guixi Chemical Pesticide Co. Ltd	Leir Cropscience Co. Ltd China	Jiangsu Wintafone Cropscience Co. Ltd
Jiangsu Sword Agrochemicals Co. Ltd	Jiangsu Greencie Chemical Co. Ltd.	Hardware & Lumber Ltd China
Bayer Cropscience LP USA	Parijat Industries (India) PVT Ltd	Shandong Lubei Chemical Co. Ltd
Rainbow Agrosciences Panama	Shandong Kangqiao Biotechnology Co. Ltd.	Leir Cropscience Co. Ltd China
Bayer AG	Liad Agro Ltd -Isreal	Adama Agan Ltd
Nanjing RedSun Co. Ltd	Parijat Industries (India) PVT Ltd.	AG Chem Plant Ltd
Amvac Chemical Co-operation	Marketing Arm Panama	Marketing Arm Panama
Smc Co-operation	Amvac Chemical Cooperation	Bayer Cropscience
Dupont Agricultural Products	Southern Agricultural Insecticides	Olympic Horticultural Products
Bayer S.A Guatemala	Marketing Arm International	Syngenta UK
Bayer Cropscience	PRV Trading INT	Sepro Cooperation
Xuzhou Nuote Chemical Co. Ltd	Syngenta Crop Protection Inc	Dip'N Grow, Inc
Bayer Cropscience AG	Trade Winds citrus Ltd	Agricultural Sciences Inc
AG Chem Plant Ltd	Syngenta UK	Basf AG

Source: Registered Manufacturer for Pesticide List, Pesticides Control Authority Jamaica 2021.

Annex II: List of Nationally Registered Pesticides

Active Ingredients	Brand Names of Commercial Products	Toxicity
2, 4-D	2,4-D Amine 480 G/L	Class II
2, 4-D	Actril DS 70 EC	Class II
2, 4-D	Arton 72 SL	Class II
2, 4-D	Bugband Insect Repellent Band	Class IV
2, 4-D	Nufarm Solution Water Soluble Herbicide	Class II
2,4-D	Amine 6D	Class III
2,4-D	Dimaxine 86 SL	Class II
2-Methyl-4-Isothiazolin-3-One	Acticide MBS 2550	Class III
2-N-Octyl-4-Isothiazolin-3-One	Acticide OTW 45	Class II
2-N-Octyl-4-Isothiazolin-3-one	Acticide OTW	Class III
2-Phenethyl Propionate	Natureganic Aerosol Spray flying insect killer	Class IV
2-Phenethyl Propionate	Natureganic Lotion Insect Repellent	Class IV
3-Iodo-2-Propynyl Butyl Carbamate	Polyphase AF1	Class II
3-Iodo-2-Propynyl Butyl Carbamate	Polyphase 588	Class III
3-Iodo-2-Propynyl Butyl Carbamate	Polyphase P20T	Class III
4- Dimethyloxazolidine	Mergal 186	Class IV
4, 5-Dichloro-2-Octyl-Isothiazolone (DCOI)	Acticide DT	Class II
Chloro-2-Methyl-4-Isothiazolin-3-One	Acticide BX (N)	Class IV
5-Chloro-2-Methyl-4-Isothiazolin-3-One	Acticide La 1206	Class II
5-Chloro-2-Methyl-4-Isothiazolin-3-One	Acticide SPX	Class II
5-Chloro-2-Methyl-4-Isothiazolin-3-One	Cleanwood AC	Class II
5-Chloro-2-Methyl-4-Isothiazolin-3-One	Acticide CB	Class III
5-Chloro-2-Methyl-4-Isothiazolin-3-One	Acticide CBM 2	Class III
5-Chloro-2-Methyl-4-Isothiazolin-3-One	Mergal 128	Class II
5-Chloro-2-Methyl-4-Isothiazolin-3-One	Mergal 758	Class IV

5-Chloro-2-Methyl-4-Isothazolin-3-One	Acticide CBM 2	Class III
5-Chloro-2-Methyl-4-Isothazolin-3-One	Mergal 128	Class II
5-Chloro-2-Methyl-4-Isothazolin-3-One	Mergal 758	Class IV
5-Chloro-2-Methyl-4-Isothazolin-3-One	Mergal K12N	Class III
5-Chloro-2-Methyl-4-Isothazolin-3-One	Mergal K14	Class III
5-Chloro-2-Methyl-4-Isothazolin-3-one	Acticide HF	Class IV
Abamectin	Cure 1.8 EC	Class II
Abamectin	Kurmectin EC	Class II
Abamectin	Newmectin 1.8%	Class IV
Abamectin	Romite 1.8 EC	Class II
Abamectin	Vertimec 1.8 EC	Class II
Alcohol Ethoxylate	Protox Protect	Class IV
Alcohol Ethoxylate	Surf –AC 820	Class IV
Alkyl Polyethoxyethanol	Surf Ac 820	Class ?
Alpha-Cypermethrin	Steadfast 5%	Class IV
Alpha-Cypermethrin	T-Ton 10%	Class IV
Aluminium Tris (O-Ethyl Phosphate)	Aliette WDG	Class IV
Aluminium Phosphide	Phostoxin Pellets	Class I
Aluminium Phosphide	Phostoxin Tablets	Class I
Ametryn	Amepax 90 WG	Class III
Ametryn	Ametryn 50 SC	Class III
Ametryn	Krismat 75 WG	Class IV
Ametryn	Pilarmetryn SC	Class III
Ametryn	Sellapax 50 SC	Class III
Amitraz	Amitic	Class III
Amitraz	A-Mtirazz EC	Class II
Ancymidol	A-Rest Plant Growth Regulator	Class III
Anhydrous Disodium Octabourate (Borax)	Bor 8 Rods	Class IV
Asulam	Asulox 40 SL	Class IV
Asulam	Aulam 40 Sl	Class IV
Azadirachtin	Bioneem 0.4%	Class III
Azadirachtin	Neem-X- 0.4%	Class IV
Azadirachtin	Neem-X	Class IV

Azoxystrobin	Parador 25 SC	Class IV
Azoxystrobin	Amistar 50 WG	Class IV
Azoxystrobin	Bankit AZ 25 SC	Class IV
Azoxystrobin	Ultra 32 SC	Class III
Azoxystrobin	Xstrata 25 SC	Class IV
Azoxystrobin	Xstrata Cold 24 SC	Class III
Bacillus Thuringiensis Subsp Aizawai	Xentari	Class IV
Bacillus ThuringiensisSubspaizawai	Dipel DF	Class IV
Bacillus Thuringiensis, Subspaizawai	Agree 50 WP	Class IV
Beauveria Bassiana	Botanigard ES	Class IV
Beauveria Bassiana	Botanigard ES	Class IV
Benzalkonium Chloride	Acticide 50X	Class IV
Bifenthrin	Bithor SC	Class IV
Bifenthrin	Maxxthor SC	Class III
Bifenzate	Floramite SC	Class IV
Bioallethrin	Quikcide Aerosol	Class IV
Bispyribac-Sodium	Bispiron 40 SC	Class IV
Bispyribac-Sodium	Nominee 40 SC	Class IV
Boric Acid (Orthoboric acid)	Niban Granular Bait	Class IV
Boric Acid (Orthoboric Acid)	Niban-FG	Class III
Boric Acid (Orthoboric Acid)	Pole Wrap CB	Class IV
Boscalid	Bellis 38 WG	Class II
Boscalid	Bosbel 38 WG	Class IV
Boscalid	Bulletproof WDG	Class IV
Boscalid	Cumora 50 SC	Class III
Boscalid	Supermectin 1.8 EC	Class II
Brodifacoum	Detia Professional Bait, Brodirat Blocks	Class IV
Brodifacoum	Detia Professional Bait, Brodirat Pellets	Class IV
Brodifacoum	Klerat Pellet	Class IV
Brodifacoum	Klerat Wax Blocks	Class IV
Brodifacoum	Raticate Brodifacoum Bait Block	Class I
Bromadiolone	Brigand Bromadiolone	Class I
Bromadiolone	Liquid Bromatrol	Class II
Bromadiolone	Rodenthor Block Bait	Class IV
Bromadiolone	Rodenthor Soft Bait	Class IV
Bromoxynil Octanoate	Bromaxx 22.5 EC	Class II

Bronopol	Acticide L 30	Class II
Carbaryl	Carbamide	Class II
Carbaryl	Carbaryl 80% WP	Class III
Carbaryl	Carbaryl 85% WP	Class III
Carbaryl	Sevin 80 S	Class II
Carbaryl	Sevin 80 WP	Class IV
Carbaryl	Silverstone Flea Powder	Class III
Carbendazim	Carbendazim 50 SC	Class IV
Carbendazim	Derozan 50 SC	Class IV
Carbendazim	Konsevan ZS	Class IV
Carbendazim	Polyphase 678	Class III
Carbendazim	Rodazim 50 SC	Class III
Carfentrazone-Ethyl	Aim EC	Class IV
Caridin	Vape premium skin mist	Class IV
Chlorfluazuron	Requiem Termite Bait Powder	Class IV
Chlorfluazuron	Requiem Termite Bait Tablet	Class IV
Chlormequat Chloride	Cycocel Plant Growth Regulator	Class IV
Chlorophacinone	Ratgard Was Block	Class II
Chlorothalonil	Bravo 720 SC	Class IV
Chlorothalonil	Dacomax Forte 90 WG	Class IV
Chlorothalonil	Glider 72 SC	Class IV
Chlorothalonil	Daconil Ultrex Turf & Nursery Ornamental	Class IV
Chlorothalonil	Dacomax 72 SC	Class IV
Citric Acid and Components	Biolife 20 SL	Class IV
Citronella Oil	Blue Mountain Extra Strength Mosquito Candle	Class IV
Citronella Oil	Blue Mountain Mosquito Repellant Candle	Class IV
Citronella Oil	Mosquito Magician	Class III
Citronella Oil	MosquitoPaq No-Baite / Burn Anytime lotion Sunscreen RE	Class IV
Citronella Oil	MosquitoPaq No-Baite Anytime lotion insect repellent	Class IV
Citronella Oil	Spotlight "Keep Off" Mosquito Aroma Candle	Class IV
Copper Carbonate	MP 200-A	Class III
Copper Hydroxide	Champ DP 37.5 WG	Class III
Copper Hydroxide	Kocide 200	Class III
Copper Hydroxide	Sulcox-OH 50	Class III
Copper Sulphate Pentahydrate	Phyton-27-SC	Class IV

Cyantraniliprole	Mainspring Insecticide	Class IV
Cyfluthrin	Baygon Aerosol against flying & crawling insects	Class IV
Cypermethrin	Aerox Aerosol Insect Killer	Class IV
Cypermethrin	Carlo Screw Worm & Ear Tick Killer	Class III
Cypermethrin	Demon Max	Class III
Cypermethrin	Demon WP	Class III
Cypermethrin	Raid Ant & Roach Killer 17	Class IV
Cypermethrin	Raid Ant & Roach Killer 26 (Fragrance Free)	Class IV
Cypermethrin	Smartline Dip for Dogs, Cattle and Horses	Class III
Cypermethrin	Smartline Pet Products Yard and Kennel Spray	Class III
Cypermethrin	Supremethrin 5% EC	Class III
Cypermethrin	Vetancid Powder A	Class IV
Cyphenothrin	Vape Aerosol	Class IV
Cyromazine	Trigard 75 WP	Class III
D-Allethrin	Bug off Mosquito Coils	Class IV
D-allethrin	Flamingo Mosquito Coil	Class IV
D-allethrin	Katori Mosquito Coil	Class IV
D-allethrin	Pyro Mosquito Coil	Class IV
D-Allethrin	Vape Mosquito Coils	Class III
Daminozide	B-Nine WSG	Class IV
DEET	Bunny's Insect Repellent	Class IV
DEET	Go! Insect Repellent	Class IV
DEET	Go! Insect Repellent (Pump Spray)	Class IV
DEET	Go! Insect Repellent- Just 4 Kids (aerosol)	Class IV
DEET	Go! Insect Repellent- Just 4 Kids (Pump Spray)	Class IV
DEET	Off! Deep Woods Insect Repellent VIII (aerosol)	Class IV
DEET	Off! Family Care Insect Repellent III	Class IV
DEET	Off! FamilyCare Insect Repellent IV	Class IV
DEET	Sawyer Family Insect Repellent Controlled Release	Class IV
DEET	Vape skin mist	Class IV
Deltamethrin	Definite 2.5 EC	Class II

Deltamethrin	Delta-M 2.5 EC	Class IV
Deltamethrin	Deltamethrin 1.25% ULV	Class III
Diafenthiuron	Pegasus 500 SC	Class III
Diazinon	Dianex 60EC	Class III
Diazinon	Diazinon 48% EC	Class II
Dicamba	Weedmaster 46.4 SL	Class III
Dicloran	Botran 75W	Class III
Diethyl Toluamide	Shoo Insect Repellent	Class IV
Difenacoum	Farco Rapid Kill Rat & Mouse Bait Pellets	Class IV
Difenacoum	Farco Rapid Kill Rat & Mouse Bait Wax Blocks	Class IV
Difenacoum	Liquid Fentrol	Class II
Difenoconazole	Sigil 25 EC	Class IV
Difenoconazole	Fenoco 25 EC	Class III
Difenoconazole	Score 250 EC	Class III
Dimethoate	Dimethoate 40EC	Class II
Dimethomorph	Cabrio Team 18.7 WG	Class II
Dimethomorph	Zampro DM 52.5 SC	Class IV
Dimethyl Tetrachloroterephthalate	Dacthal Flowable	Class IV
Diquat (Dibromide)	Cleanout 20 SL	Class II
Diquat (Dibromide)	Reglone	Class II
Disodium Octaborate Tetrahydrate	Bora-Care	Class IV
Disodium Octaborate Tetrahydrate	Nibor-D	Class IV
Disodium Octabourate Tetrahydrate	Hollow Heart CB	Class III
Diuron	Acticide EPW	Class IV
Diuron	Acticide EPW2	Class IV
Diuron	Algon Paste	Class IV
Diuron	Armuron 80 SC	Class III
Diuron	Diupax	Class IV
Diuron	Diupax 80 SC	Class III
Diuron	Diuron 80% SC	Class IV
Diuron	Karmex 80 WG	Class IV
Diuron	Karmex XP	Class IV
Diuron	Karmuron 80 SC	Class III
Diuron	Pilardir WDG	Class III
Diuron	Polyphase 663	Class IV
D-Trans Allethrin	Grand Lion Mosquito Coil	Class IV
D-Trans Allethrin	Vape all insect killer	Class IV

Fenitrothion	Sumithion 50 EC	Class II
Epoxiconazole	Opera 18.3	Class II
Epoxiconazole	Insignia Super 42 SC	Class II
Ethephon	Ethrel	Class IV
Ethephon	Florel Plant Growth Regulator	Class IV
Ethoprophos	Mocap 10 G	Class II
Ethoprophos	Mocap 15 G	Class II
Ethyl Butylacetylaminopropionate	Pigeon Anti-mosquito Wet Tissue	Class IV
Fenoxaprop-P-Ethyl	Mapcid 12.5 EC	Class IV
Fenpropathrin	Danitol 10 EC	Class II
Fenpropathrin	Suldan	Class II
Fenpropimorph	Volley 88 OL	Class III
Fipronil	Frontline Plus for Cats	Class II
Fipronil	Blattathor Ultra Gel Cockroach Bait	Class IV
Fipronil	Broadline Spot On Solution for Cats	Class II
Fipronil	Ectoline Spray	Class III
Fipronil	Frontline Top Spot	Class II
Fipronil	Frontline Plus for Dogs	Class II
Fipronil	Frontline Spray	Class II
Fipronil	Masterline Bifenthrin 7.9 Termiticide	Class III
Fipronil	Panzer 20 SC	Class III
Fipronil	Protekto Spray	Class II
Fipronil	Protektor Spot On	Class III
Fipronil	Ultrathor water Based Termiticide	Class IV
Flazasulfuron	Katana 25 WG	Class IV
Flocoumafen	Storm Rodenticide	Class IV
Fluazifop-Butyl	Flufop 150 G/L EC	Class III
Fluazifop-Butyl	Fusilade	Class III
Flubendiamide	Phoenix 20 WG	Class IV
Fludioxonil	Medallion WDG	Class IV
Fludioxonil	Scholar	Class III
Fludioxonil	Scholar 230 SC	Class IV
Fluopicolide	Trivia 72.7 WP	Class IV
Fluopyram	Verango 50 SC	Class III
Flupyradifurone	Sivanto Prime 20 SL	Class III
Foramsulfuron	Revolver Herbicide	Class IV
Foramsulfuron	Tribute Total	Class IV

Gibberellic Acid	Fascination PRG	Class IV
Glufosinate Ammonium	Detia Diatomaceous Algae	Class IV
Glufosinate-Ammonium	Carista 20% SL	Class III
Glufosinate-Ammonium	Carista GA SL	Class III
Glufosinate-Ammonium	Finale 15 SL	Class III
Glufosinate-Ammonium	Finish 20 SL	Class IV
Glufosinate-Ammonium	Oreka 20 SL	Class III
Glufosinate-Ammonium	Pilarstar 20 SL	Class III
Glufosinate-Ammonium	Zipper 20 SL	Class IV
Glyphosate	Bunna 62 SL	Class IV
Glyphosate	Ciphosate	Class II
Glyphosate	Credit 41 Extra	Class IV
Glyphosate	Glyphos Maxx	Class IV
Glyphosate	Glyphos-AG- 41 SL	Class IV
Glyphosate	Glyphosate 41% SL	Class IV
Glyphosate	Kartac 41 SL	Class III
Glyphosate	Ridown 48 SL	Class IV
Glyphosate	Ridown Xtra 88.8 SG	Class IV
Glyphosate	Wopro-Glyphosate 480G/L SL	Class IV
Halosulfuron Methyl	Sedgehammer Herbicide	Class III
Hexazinone	Pinaplus	Class IV
Hexazinone	Hexone	Class III
Hexazinone	Kometa 60 WG	Class IV
Hexazinone	Velzone 25 SL	Class IV
Hexythiazox	Nissorun 10% WP	Class IV
Imazalil	Fruitfog-I	Class II
Imidacloprid	Confidor 70 WG	Class II
Imidacloprid	Centerfire 75 WSP	Class IV
Imidacloprid	Imaxi 70 WG	Class IV
Imidacloprid	Invict Gold Cockroach Gel	Class IV
Imidacloprid	Kaindor 70 WG	Class III
Imidacloprid	Masterline Imaxxpro 2F	Class IV
Imidacloprid	Prothor SC 2	Class IV
Imidacloprid	Prothor WSP	Class IV
Imidacloprid	Protox Mosquito coils	Class IV
Imidacloprid	Rotaprid 35 SC	Class II
Indaziflam	Specticle Flo	Class IV
Indaziflam	Specticle Herbicide	Class IV
Indole -3-Butyric Acid	Hormodin 3	Class III

Indole-3-Butyric Acid	Dip N Grow Liquid Rooting Concentrate	Class III
Indole-3-butyric acid	Dynaroot No.3	Class IV
Indole-3-Butyric Acid	Iba 98 SP	Class IV
Indoxacarb	Ferstrike	Class III
Indoxacarb	Hoprole 30WG	Class III
Indoxacarb	Indicarb 14.5% SC	Class III
Indoxacarb	Indo-X 15 SC	Class IV
Indoxacarb	Metripax 75 WG	Class III
Lambda Cyhalothrin	Icon 5 EC	Class IV
Lambda Cyhalothrin	Obulus 5 EC	Class II
Lambda-Cyhalothrin	Caratrax 5EC	Class II
Lambda-Cyhalothrin	Demand CS	Class II
Lambda-Cyhalothrin	Engeo	Class II
Lambda-Cyhalothrin	Flash 5%EC	Class II
Lambda-Cyhalothrin	Karate Zeon 5 CS	Class II
Lambda-Cyhalothrin	Rapid 5EW	Class II
Lazasulfuron	Match 050 EC	Class IV
Magnesium Phosphide	Degesch Fumi-cell/Fumi-strip	Class I
Malathion	Malathion 50EC	Class IV
Malathion	Malathion 50% EC	Class III
Malathion	Malathion 57 EC	Class IV
Mancozeb	Acrobat MZ 69 WP	Class III
Mancozeb	Clear-weh	Class III
Mancozeb	Dithane M-45 NT	Class IV
Mancozeb	Impetu 69 WP	Class IV
Mancozeb	Indofil Mancozeb 82 WP	Class IV
Mancozeb	Macozeb 75 WG	Class IV
Mancozeb	Nufarm Mancozeb 80% WP	Class IV
Mancozeb	Sancozeb 80WP	Class IV
Mancozeb	Zyban WSB	Class IV
Mandipropamid	Revus 250 SC	Class IV
Metaflumizone	Alverde 24 SC	Class III
Metalaxyl	Diligent 72 WP	Class IV
Metalaxyl	Ridomil Gold MZ 68 WP	Class IV
Metaldehyde	Deadline M-PS Mini –pellets	Class III
Metaldehyde	Farco Rapid Kill Insecticide Powder	Class III
Metaldehyde	Meta-Bait	Class III

Metaldehyde	Plantgard Slug & Snail Liquid	Class II
Metaldehyde	SluggOff	Class II
Methyl Bromide	Mebrom 100	Class I
Methyl Ester of Fatty Acids	Vape flying insect Killer	Class IV
Methyl Esters of Fatty Acid #	Exit	Class IV
Methyl Esters of Fatty Acid #	Adigor Adjuvant	Class IV
Metolachlor	Metolachlor 960 EC	Class III
Metribuzin	Abax 48 SC	Class IV
Metribuzin	Carzone 75 DF	Class III
Metribuzin	Piarbuzin WP	Class IV
Metribuzin	Sencor DF 75	Class IV
Metsulfuron Methyl	Plot 60 WG	Class IV
Metsulfuron Methyl	Quali-Pro MSM Turf Herbicide	Class IV
Midacloprid	Masterline I Maxx Pro	Class IV
Mineral Oil	Primo Maxx 120.9 SL	Class IV
Mineral Oil	Suffoil-X	Class III
Mosquitopaq Outdoor Zone Spatial Attractant 15 day	Class IV	Citronella Oil #
Citronella Oil	Mosquitopaq Outdoor Zone Spatial Attractant 7 day	Class IV
Myclobutanil	Eagle 20 EW	Class IV
Neem Oil Extract	Blue Mountain Aromatics Mosquito Repellant	Class IV
Nicosulfuron	Nicogol 75 WG	Class IV
Octhilinone	Acticide 45	Class III
Octhilinone	Acticide EP Paste	Class IV
Octhilinone	Acticide EP Powder	Class IV
Octhilinone	Acticide MKX	Class IV
Octhilinone	Cleanwood 46-Plus	Class II
Octhilinone	Troysan S89	Class III
Octhilinone	Troysan S90	Class IV
Octylphenol	Spreader Sticker	Class III
O-Phenylphenol	Orodex	Class IV
Orthophosphuric Acid	PH-Plus	Class III
Oxadiazon	1% Oxadiazon	Class IV
Oxadiazon	Ronstar G	Class IV
Oxamyl	Vydate L Blue	Class I
Oxyfluorfen	Oxigol 24 EC	Class IV
Oxyfluorfen	Pilargola	Class IV

Paclobutrazol	Bonzi Ornamental Plant Growth	Class IV
Paraffinic Distillate (Mineral Oil)	Banole HV	Class III
Paraffinic Petroleum Oil	Spraytex-M	Class IV
Paraquat Dichloride	Gai-Quat 200 EC	Class II
Paraquat Dichloride	Gramocil 30 SC	Class II
Paraquat Dichloride	Gramoxone Super	Class III
Paraquat Dichloride	Paraquat 20% SL	Class II
Paraquat Dichloride	Paraquat Super SL	Class I
Paraquat Dichloride	Scorcher	Class II
Paraquat Dichloride	Lavax	Class II
Peipdronyls Butoxide	Farco Rapid Kill Arosol	Class II
Pendimethalin	Penzene	Class IV
Pendimethalin	Prowl	Class III
Pendimethalin	Spartanex 50 EC	Class III
Permethrin	Bio-Permet P DP	Class IV
Permethrin	Detia Professional Insecticide Powder	Class IV
Permethrin	Frontline Tri-act for dogs	Class II
Permethrin	Non-Flammable Aircraft Insecticide	Class IV
Permethrin	Prelude Termiticide/Insecticide	Class III
Permethrin	Silverstone Tick and Flea Powder	Class II
Permethrin	Tropi-Gro Insect Powder	Class IV
Picaridin	Go! Insect Repellent with Picaridin Aerosol	Class IV
Picaridin	Go! Insect Repellent with Picaridin Pump Spray	Class IV
Picaridin	Sawyer Premium Insect Repellent 20% Picaridin	Class IV
Picloram	Leanador 16 EW	Class IV
Pinoxaden	Manuscript	Class IV
Piperonly Butoxide	Farco Rapid Kill Aerosol	Class III
Piperonyl Butoxide	Sun Sect-o-cide	Class III
Piperonyl Butoxide	Clarke Anvil 2+2 ULV	Class IV
Piperonyl Butoxide	Fogicide	Class IV
Piperonyl Butoxide	Formula X-23 Aerosol	Class IV
Piperonyl Butoxide	Formula X-23 Insecticide (Bulk)	Class IV
Piperonyl Butoxide	Quickcide Bulk	Class II
Piperonyl Butoxide	Silverstone flea and tick dog shampoo	Class IV

Piperonyl Butoxide	Smart Line Tick & Flea Dog Shampoo	Class III
Piperonyl butoxide	Smartline flea & Tick Shampoo	Class IV
Pirimiphos-Methyl	Actellic	Class II
Plant Extract 620	Agrispon	Class IV
Poly-1-Menthene	Nu-Film-P	Class IV
Polydimethylsiloxane	Aquatain Amf	Class IV
Polyether Polymethyl Xiloxane#	Break-Thru 100 SL	Class IV
Potassium Oleate	Refas Insecticide EC	Class IV
Prallethrin	Pyro Mosquito Mats	Class IV
Prallethrin	Vape Liquid (60 days)	Class IV
Prallethrin	Vape Mosquito Coil Super	Class IV
Prallethrin	Vapemat Super	Class IV
Profenofos	Escolta 50 EC	Class II
Profenofos	Selecron 500 EC	Class II
Propamocarb Hydrochloride	Consento 45 SC	Class III
Propiconazole	Caprid 20 SL	Class II
Propiconazole	Eradicate	Class II
Propiconazole	Prodix 30 EC	Class III
Propiconazole	Tilt 250 EC	Class III
Propineb	Antracol 70 WP	Class IV
Propoxur	Kem Kill B Aerosol	Class IV
Propoxur	Kem Kill B Bulk	Class II
Pyraclostrobin	Cabrio Top 60 WG	Class III
Pyraclostrobin	Regnum 25 EC	Class II
Pyrimethanil	Signaex 60 SC	Class IV
Pyrimidine nucleotide	Mai-007 5% SL	Class IV
Pyriproxyfen	In2care Mix	Class IV
QST 713 Bacillus Subtilis	Serenade 1.34 SC	Class IV
S- Metolachlor	Dual Gold	Class III
Sethoxydim	Nabu-S EC	Class IV
Silicon Dioxide	Insecto	Class IV
S-Methoprene	Strike Ultra Profession Midge Control	Class IV
S-Metolachlor	Metomax 96 EC	Class III
Soxaflutole	Merlin 75 WDG	Class III
Soxaflutole	Profitol 75 WG	Class IV
Spinosad (Spinosyn A & Spinosyn D)	Natular DT	Class IV

Spinosad (Spinosyn A & Spinosyn D)	Tracer 120SC	Class IV
Spiromesifen	Judo Greenhouse & Nursery Ornamental	Class III
Spiromesifen	Oberon 24 SC	Class III
Spirotetramat	Movento 15 OD	Class III
Spiroxamine	Impulse 80 EC	Class II
Sulfentrazone	Dismiss South Herbicide	Class IV
Z-3-Dodecen-1-OL-E-2-Butanoate	Sweet Potato Weevil Pheromone	Class IV
Tau-fluvalinate	Apistan Anti Varrora Strips	Class IV
Tea Tree Oil	Cari Gold 22.3 EC	Class IV
Tea Tree Oil	Timorex Gold 22.3	Class IV
Tebuconazole	Nativo 75 WG	Class IV
Tebuconazole	Silvzole 43SC	Class IV
Tebufenozide	LLMIMIC	Class IV
Teramethrin	Ridokill Insecticide (Bulk)	Class IV
Terbutryn	Acticide MKT1	Class III
Terbutryn	Igran 500 SC	Class III
Terbutryn	Tergran	Class III
Terbutryn	Turbo-Tryn 500 G/L SC	Class III
Terbutryn	Terbutryn 500G/L SC	Class IV
Tetramethrin	Bop Insecticide Spray	Class III
Tetramethrin	Bug Off Aerosol insecticide	Class IV
Tetramethrin	Det Aerosol Insect Killer	Class IV
Tetramethrin	Det Citronella Aerosol	Class IV
Tetramethrin	Flamingo Aerosol Insecticide	Class IV
Tetramethrin	Kem Wasp & Hornet Killer aerosol	Class IV
Tetramethrin	Pyro Insect Killer	Class IV
Tetramethrin	Ridocide Aerosol Insecticide	Class IV
Tetramethrin	Ridocide Insecticide (Bulk)	Class IV
Tetramethrin	Ridokill Aerosol Insecticide	Class IV
Tetramethrin	Super Suretox All Insect Killer	Class IV
Thiabendazole	Mertect 220 SL	Class IV
Thiabendazole	Waterwax TTT21	Class III
Thiamethoxam	Actara 25 WG	Class IV
Thiamethoxam	Codigo 25 WG	Class IV
Thiocyclam	Tryclan 50 SP	Class III
Thiophanate-Methyl	Topsin-M- 70.0 OD	Class III

Thiophanate-Methyl	Topsin-M-70% WP	Class IV
Thymol	Apiguard Gel	Class IV
Topramezone	Convey 33.6 SC	Class III
Transfluthrin	Rambo Insecticide Paper	Class IV
Triadimenol	Silvacur Combi 30 EC	Class III
Trichoderma Harzianum	Rootshield Plus WP	Class III
Trifloxy sulfuron sodium (Trialsulfuron)	Monument 75 WG	Class IV
Trifloxystrobin	Compass O 50 WDG	Class IV
Triflumizole	Trifmine	Class IV
Total		**458**

Source: Registered Pesticide List , Pesticides Control Authority Jamaica 2021.

Annex III: HHPs Registered in Jamaica

No.	CAS Number	Pesticide Active Ingredients	Group 1 Acute Toxicity			Group 2 Long-term Effect									Group 3 Environmental toxicity				Group 4 Conventions		
			WHO Ia	WHO Ib	H330	EPA carc	IARC carc	GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	GHS muta (1A, 1B)	GHS repro (1A,1B)	EU EDC	GHS C2 & R2	very bio acc	very pers water, soil or sediment	very toxic to aq. organism	highly toxic bees	Montr Prot	PIC	POP
			7	1	13	0	1	0	1	15	1	13	1	8	5	4	4	24	1	1	0
1	71751-41-2	Abamectin		1	1													1			
2	20859-73-8	Aluminum phosphide			1													1			
3	82657-04-3	Bifenthrin												1				1			
4	10043-35-3	Boric acid										1		1							
5	56073-10-0	Brodifacoum	1		1							1									
6	28772-56-7	Bromadiolone	1		1							1									
7	1689-99-2	Bromoxynil octanoate										1			1		1				
8	63-25-2	Carbaryl								1				1				1			
9	10605-21-7	Carbendazim									1	1									
10	71422-67-8	Chlorfluazuron													1		1				
11	3691-35-8	Chlorophacinone	1																		
12	1897-45-6	Chlorothalonil			1					1											
13	20427-59-2	*Copper (II) hydroxide			1											1					
14	52315-07-8	Cypermethrin																1			
15	1596-84-5	Daminozide								1											
15	1596-84-5	Daminozide								1											
16	52918-63-5	Deltamethrin												1				1			
17	80060-09-9	Diafenthiuron																1			
18	56073-07-5	Difenacoum	1												1						
19	60-51-5	Dimethoate																1			
20	85-00-7	Diquat dibromide			1																
21	330-54-1	Diuron								1											
22	133855-98-8	Epoxiconazole								1		1									
23	13194-48-4	Ethoprophos; Ethoprop	1		1					1											

No.	CAS Number	Pesticide Active Ingredients	Group 1 Acute Toxicity			Group 2 Long-term Effect									Group 3 Environmental toxicity				Group 4 Convention		
			WHO Ia	WHO Ib	H330	EPA carc	IARC carc	GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	GHS muta (1A, 1B)	GHS repro (1A, 1B)	EU EDC	GHS C2 &R2	very bio acc	very pers w ater, soil or sediment	very toxic to aq. organism	highly toxic bees	Montr Prot	PIC	POP
24	120068-37-3	Fipronil																1			
25	90035-08-8	Flocoumafen	1		1	1						1									
26	69806-50-4	Fluazifop-butyl										1									
27	272451-65-7	Flubendiamide														1	1				
28	951659-40-8	Flupyradifurone																1			
29	77182-82-2	Glufosinate-ammonium										1									
30	-	Glyphosate					1														
31	78587-05-0	Hexythiazox								1											
32	35554-44-0	Imazalil								1											
33	138261-41-3	Imidacloprid																1			
34	173584-44-6	Indoxacarb																1			
35	91465-08-6	Lambda-cyhalothrin			1									1				1			
36	12057-74-8	Magnesium phosphide			1																
37	121-75-5	Malathion							1									1			
38	8018-01-7	Mancozeb								1		1	1	1							
39	139968-49-3	Metaflumizone														1	1	1			
40	74-83-9	Methyl bromide																	1		
41	21087-64-9	Metribuzin												1							
42	19666-30-9	Oxadiazon								1											
43	23135-22-0	Oxamyl	1		1													1			
44	42874-03-3	Oxyfluorfen																			
45	64741-88-4	Paraffin oils; mineral oils												1							
46	1910-42-5	Paraquat dichloride / Paraquat dichloride >276g/L			1															1	
47	40487-42-1	Pendimethalin														1	1				
48	52645-53-1	Permethrin								1								1			

No.	CAS Number	Pesticide Active Ingredients	Group 1 Acute Toxicity			Group 2 Long-term Effect									Group 3				Group 4		
			WHO Ia	WHO Ib	H330	EPA carc	IARC carc	GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	GHS muta (1A, 1B)	GHS repro (1A,1B)	EDU EDC	GHS C2 & R2	very bio acc	very pers w ater, soil or sediment	very toxic to aq. organism	highly toxic bees	Montr Prot	PIC	POP
49	29232-93-7	Pirimiphos-methyl																1			
50	23031-36-9	Prallethrin																1			
51	41198-08-7	Profenofos																1			
52	60207-90-1	Propiconazole										1									
53	12071-83-9	Propineb								1											
54	114-26-1	Propoxur								1								1			
55	168316-95-8	Spinosad																1			
56	7696-12-0	Tetramethrin																			
57	153719-23-4	Thiamethoxam																1			
58	23564-05-8	Thiophanate-methyl								1											
59	55219-65-3	Triadimenol										1									
60	99387-89-0	Triflumizole										1									

Categories	Explanatory Notes
WHO Ia	Extremely hazardous (Class 1a) according to World Health Organization
WHO Ib	Highly hazardous (Class 1b) according to World Health Organization
H330	*Fatal if inhaled*; hazard classification according to the EU or Japan Globally Harmonised System (GHS)
EPA carc	Human carcinogen according to US EPA
IARC carc	Human carcinogent according to IARC
GHS* carc (1A 1B)	Known or presumed human carcinogens (1A or 1B) according to EU Japan GHS
US EPA prog/likel carc	Probable/Likely carcinogen (including "Likely to be Carcinogenic to Humans: At High Doses" according to US EPA
IARC prob carc	Probable carcinogen according to IARC
GHS muta (1A, 1B)	Substances know to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans. Substnaces know to induce heritable mutations in the germ cells of humans (Category 1A or 1B) according to Japan's GHS

GHS repro (1A, 1B)	Known or presumed human reproductive toxicant according to EU or Japan's GHS
EU ED	Known as an endocrine disrupter according to EU assessment following commission Regulation (EU) 2018/605
GHS C2 & R2	Pesticides classified GHS carcinogen category 2 AND EU Reproductive Category 2
Very bio acc	Very bioaccumulative (BCF> 5000) or Kow logP >5 (BCF value supersede kow logP data)
Very persistent water, soil or sediment	Very persistent in water (half-life >60 dyas), soil or sediments (half-life >180days)
Very toxic to aq. Organism	Very Toxic to aquatic organisms (Acute LC/EC50 <0, 1 mg/l for Daphnia species)
Highly toxic bees.	Hazard to ecosystem services-Highly toxic bees (<2 µg/bee) according to US EPA as listed by FOOTPRINT data
Montr Prot	Ozone depleting chemical according to the Montreal Protocol
PIC	Listed in Annex III of the Rotterdam Convention or meeting the criteria for being listed
POP	Listed in Annex III of the Stockholm Convention or meeting the criteria for being listed

***Copper Hydroxide is the active ingredient for Jamaica**

Source: Pesticides Control Authority of Jamaica online registered list of pesticides January 2021 1/21/2021 www.caribpesticides.net/cp_report_pes2.asp

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PAN International list of Highly Hazardous Pesticides March 2021, see https://pan-international.org/wp-content/uploads/PAN_HHP_List.pdf

Annex IV: Banned Pesticides Registered in Jamaica

Active ingredients Registered in Jamaica	Number of countries Banned
2,4-D	3
Aluminium Phosphide*	1
Ametryn	29
Amitraz	35
Asulam	28
Bifenthrin*	29
Boric Acid (Orthoboric acid)*	28
Brodifacoum*	30
Bromadiolone*	2
Bromoxynil Octanoate*	2
Carbaryl*	40
Carbendazim*	32
Chlorfluazuron*	28
Chlorophacinone*	30
Chlorothalonil*	32
Cyfluthrin	30
Cyphenothrin	29
Daminozide*	6
Diazinon*	36
Diafenthiuron	30
Dicloran	30
Difenacoum	30
Difenoconazole	1
Dimethoate	33
Diquat (Dibromide)*	29

Diuron*	29
Epoxiconazole*	29
Ethephon	1
Ethoprophos*	37
Fenpropathrin*	29
Fipronil*	36
Flocoumafen*	31
Fluazifo-P-Butyl*	1
Fluopicolide	1
Glufosinate Ammonium*	28
Glyphosate*	3
Hexazinone	39
Imidacloprid*	28
Magnesium Phosphide*	1
Malathion*	32
Mancozeb*	29
Metalaxyl	1
Metaldehyde	1
Methyl Bromide*	34
Metolachlor	30

Metsulfuron Methyl	1
Oxadiazon*	29
Oxamyl*	3
Oxyfluorfen*	1
Paraquat Dichloride*	48
Pendimethalin*	1
Permethrin*	31
Picloram	3
Profenofos*	31
Propiconazole*	28
Propineb*	29
Propoxur*	31
Tebuconazole	1
Terbutryn	30
Tetramethrin	29
Thiabendazole	1
Thiamethoxam*	28
Thiocyclam	29
Thiophanate-Methyl*	28
Triadimenol*	28
Triflumizole*	28

***Explanatory notes**: * are active ingredients that are also on the HHPs list (PAN, 2021)*
Active ingredients in blue are those that have note been banned in any country but are HHPs accordin to PAN Criteria and are not approved in the EU

Source: Pesticides Control Authority of Jamaica online registered list of pesticides January 2021 1/21/2021 www.caribpesticides.net/cp_report_pes2.asp

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PAN International Consolidated list of Banned Pesticides March 2021 see https://pan-international.org/pan-international-consolidated-list-of-banned-pesticides/

Annex V: Restricted/Managed Pesticides in Jamaica

Pesticide Name	
1% OXADIAZON	A-MTIRAZ EC
ACTELLIC 50 EC	ACTICIDE 45
ACTICIDE 50X	ACTICIDE BX(N)
ACTICIDE CB	ACTICIDE CBM 2
ACTICIDE DT	ACTICIDE EP PASTE
ACTICIDE EP POWDER	ACTICIDE EPW
ACTICIDE EPW2	ACTICIDE HF
ACTICIDE L 30	ACTICIDE LA 1206
ACTICIDE MBS 2550	ACTICIDE MKT1
ACTICIDE MKX	ACTICIDE OTW
ACTICIDE OTW 45	ACTICIDE SPX
ADIGOR ADJUVANT	ALGON P PASTE
APIGUARD GEL	APISTAN ANTI-VARROA STRIPS
BITHOR SC	CENTERFIRE 75 WSP
CLARKE ANVIL 2+2 ULV	CLEANWOOD AC
DEGESCH FUMI-CELL/FUMI-STRIP	DEMAND CS
DEMON WP	DISMISS SOUTH HERBICIDE
FRUITFOG-I	ICON 5 EC
LIQUID BROMATROL	LIQUID FENTROL
MANUSCRIPT	MASTERLINE BIFENTHRIN 7.9 TERMITICIDE
MASTERLINE I MAXX PRO	MASTERLINE IMAXXPRO 2F
MAXXTHOR SC	MEBROM 100
MERGAL 128	MERGAL 186
MERGAL 758	MERGAL K12N
MERGAL K14	MONUMENT 75 WG
NATULAR DT	PANZER 20 SC
PHOSTOXIN PELLETS	PHOSTOXIN TABLETS
POLYPHASE 588	POLYPHASE 663
POLYPHASE 678	POLYPHASE AF1
PRELUDE TERMITICIDE/INSECTICIDE	PROTHOR SC 2
PROTHOR WSP	QUALI-PRO MSM TURF HERBICIDE
QUIKCIDE AEROSOL	REVOLVER HERBICIDE
RONSTAR G	SEDGEHAMMER HERBICIDE
SLUGOFF	SPECTICLE FLO
SPECTICLE HERBICIDE	TRIBUTE TOTAL
TROYSAN S89	TROYSAN S90
VETANCID POWDER A	

Source: Restricted and Managed Pesticides list for Jamaica; Pesticides Control Authority 2021

Annex VI: Pesticide Companies in Jamaica that sell HHPs and Ingredients banned in other countries

HHPs Active Ingredients	Banned	Number of Countries Banned	Manufacturing Company	Country of Origin	Formulation
Abamectin	-	-	Marketing Arm Panama	USA	Emulsifiable Concentrate
Aluminum phosphide	1	1	Degesch America Inc.	USA	generates Gas Chemical Reaction
Bifenthrin	1	30	Ensystex 111 Inc	USA	Emulsifiable Concentrate
Boric acid	1	28	Nisus Corp.	USA	A fine granule -size 300 to 2
Brodifacoum	1	30	Syngenta UK	UK	Bait Block, granule bait
Bromadiolone	1	2	Rentokil Initial UK Limited	UK	Bait Blocks
Bromoxynil octanoate	1	2	AG Chem Plant Limited	Jamaica	Emulsifiable Concentrate
Carbaryl	1	35	Bayer Corporation USA	USA	Wettable Powder
Carbendazim	1	29	Thor Specialities (UK) Limited	Germany	Powder Applied Undiluted
Chlorfluazuron	1	28	Ensystex 111 Inc	USA	Bait (Ready to use)
Chlorophacinone	1	29	AG Chem Plant Limited	Jamaica	Bait (Ready for use)
Chlorothalonil	1	3	Syngenta Crop Protection Inc.	USA	Water Dispersible Granule
Copper (II) hydroxide			Kocide LLC ; Quimetal Industrial S.A.	USA; Chile	Dry Flowable; Water Dispensable Granule
Cypermethrin	-	-	S C Johnson ; Latin American Exporters Limited (Carlo) ; Vetanco S.A ; Syngenta Crop Protection Inc ; It's A Dog's World ; S C Johnson & Son Inc ; Sengo Fine Chemical Co. Ltd	USA ; Jamaica ; Argentina ; Brazil ; China	Aerosol Dispenser ; Emulsifiable Concentrate ; Dustable Powder ;Wettable Powder
Cypermethrin, alpha			Agrocare Chemical Industry Group Limited	China	Suspension Concentrate
Daminozide	1	5	Olympic Horticultural Products	USA	Water Dispersible Granule
Deltamethrin			Marketing Arm Panama ; Agricultural Chemicals ; A G	Panama ; India ; Jamaica	Emulsifiable Concentrate ; ULV liquid

			Chem Plant Limited		
Diafenthiuron			Syngenta UK	Colombia	Suspension Concentrate
Difenacoum			Rentokil Initial UK Limited ; F. A Richard & Co. LTD.	UK ;	Bait Concentrate ; Granule Bait ; Bait Block
Dimethoate	1	33	A G Chem Plant Limited	Jamaica	Emulsifiable Concentrate
Diquat dibromide	1	29	Syngenta Agro S.A De CV	Mexico	soluble concentrate
Diuron	1	1	THor GMBH ; Troy Chemical ; Pilarquim (Shanghai) Co. Limited ; A G Chem Plant Limited ; Ningxia WYNCA Technology Co. LTD ; Shandong Weifang Rainbow Chemical Co. LTD ; Anhui Guangxin Agrochemical Co. LTD ; Adama Agan LTD ;	Germany ; USA ; China ; Jamaica ; Isreal;	Suspension Concentrate ; Liquid Concentrate ; Water Soluble Granule ; Dispersible Concentrate ; Water Dispensable Granule ;
Epoxiconazole	1	1	Basf Espanola S. L	Spain	Suspension Concentrate
Ethoprophos; Ethoprop	1	8	Amvac Chemical Corporation	USA	Granule
Fipronil	1	37	Merial Limited ; Cipla Limited ; Merial France ; Ningbo Generic Chemical Co LTD ; Merial Suade Animal LTD	USA ; France ; China ; Brazil	Spot on ; Ready to use liquid ; Suspension Concentrate;
Flocoumafen	1	31	Basf AG	Germany	Bait Block
Fluazifop-butyl	1	1	Syngenta Agro, S.A. De. C.V	Mexico	Emulsifiable Concentrate
Flubendiamide			Nihon Nohyaku Company Limited	Japan	Water Dispersible Granule
Flupyradifuron			Bayer Cropscience AG	Germany	Soluble Concentrate
Glufosinate-ammonium	1	28	A G Chem Plant Limited ; Shandong Weifang Rainbow Chemical C0. LTD;	Jamaica ; China	Soluble Concentrate ;
Glyphosate	1	not found on ban list 3	Agro-Grace ; A G Chem Plant	Jamaica ; India ; USA ;	Soluble Concentrate ;

			Limited ; Cipla Limited ; Nufarm America Inc ; Simonis B.V ; Zhejiang Jinfanda Biochemical Co. LTD ; Shandong Weifang Rainbow Chemical LTD	Netherlands ; China ;	
Hexythiazox			Nippon Soda Co. LTD	Japan	Wettable Powder
Imazalil			no information on this		
Imidacloprid	1	Not found on pan banned list 28	Rockwell Labs Limited ;Univar USA , Inc ; Enststex 111 Inc.; Jiangsu Rotam Chemistry Co. LTD. ; Bayer Environmental Science ; Bayer Cropscience AG ; Shandong Weifang Rainbow Chemical Co. LTD ;	USA; China ; Germany	Contact Liquid /Gel Direct Appl; Suspension Concentrate ; Wettable Powder ; Water Soluble Packets ; Water Dispersible Granule
Indoxacarb			Agrochemical Industry Group Limited ; Parijat Industries (India) PVT LTD ; Shandong Weifang Rainbow Chemical Co. Limited ; Nanjing Red Sun Co. LTD ;	China ; India ;	Suspension Concentrate ; Water Dispersible Granule ;
Lambda-cyhalothrin			Syngenta Chemicals B.V. ; Syngenta Brazil ; Agrocare Chemical Industry Group Limited ; Syngenta Crop Protection ,LLC ; Tagros Chemicals India Limited ; Jiangsu Sword Agrochemicals Co LTD ;	Belgium ; Brazil ; China ; USA ; India ;	Capsule Suspension ; Emulsifiable Concentrate ; Suspension Concentrate ; Emulsion, Oil in Water
Magnesium phosphide	1	1	D & D Holdings Inc.	USA ;	Vapor Releasing Product
Malathion	1	2	A G Chem Plant Limited ;	Jamaica	Emulsifiable Concentrate
Mancozeb	1	1	Dow Agrosciences de colombia ; Indofil Chemicals Company ; Basf QuiMica Bogotá ; Scotts-Sierra Crop Protection Company ; Shandong,Weifang Rainbow Chemical Co Ltd ; Parijat Industries (India) PVT LTD ;	Colombia ; India ; USA ; China ;	Wettable Powder ; Dispersible Granule ; Emulsifiable Concentrate

Metaflumizone			Basf Espanola S. A.	Spain	Suspension Concentrate
Methyl bromide	1	35	Mebrom N V ;	Belgium	Gas
Metribuzin			Bayer Corporation-USA ; Pilarquim (Shanghai) Co. Limited ; Shandong Weifang Rainbow Chemical Co LTD ; Jiangsu Rotam Chemistry Co. LTD ; A G Chem Plant Limited ;	USA ; China ; Jamaica	Water Dispersible Granule ; Wettable Powder ; Suspension Concentrate ; Dry Flowable
Oxadiazon	1	29	Bayer Environmental Science ; Sunniland Corporation	USA ;	Granule
Oxamyl	1	3	Dupont Agricultural Products	USA	Soluble Concentrate
Oxyfluorfen	1	1	Shandong Weifang Rainbow Chemical Co. LTD	China	Emuslifiable Concentrate
Paraffin oils; mineral oils		check on this , words in red	Total Petrochemicals & Refining USA Inc ; Bioworks Inc ;	USA ;	Ready-to -Use Gas ; Suspension Concentrate
Paraquat dichloride / Paraquat dichloride >276g/L	1	46	Syngenta UK ; Syngenta SA ; A G Chem Plant Limited ; Agro-Grace ; Shandong Weifang Rainbow Chemical Co. LTD	UK, Colombia ; Jamaica ; China ;	Capsule Suspension, Emulsifiable Concentrate; Soluble Concentrate ; Suspension Concentrate
Pendimethalin	1	1	Basf A G ; A G Chem Plant Limited ; Shandong Weifang Rainbow Chemical Co. LTD ; Deita Freyberg GMBH	USA ;China	Capsule Suspension; Emulsifiable Concentrate
Permethrin	1	29	F. A Richard & Co. LTD ; Amvac Chemical Corporation ; Bio-Pharmachemie ; A G Chem Plant LImited ; Merial Limited ; Fumakilla Indonesia	UK ; USA ; Vietnam ; Jamaica ; Indonesia ; Germany	Dustable Powder ; Aerosol Dispenser ; Spot-On ; Wettable Powder
Pirimiphos-methyl			Cheminova Inc	Denmark	Emulsifiable Concentrate
Prallethrin			Fumakilla ; A G Chem Plant Limited ; Foshan Nanhai Tanhui Daily Chemicals Co.	Japan ; Jamaica ; China	Liquid Vapourizer ; Vapour Releasing Product

Profenofos			Syngenta UK	Colombia	Emulsifiable Concentrate
Propiconazole	1	28	Syngenta UK	Colombia	Emulsifiable Concentrate
Propineb	1	28	Bayer Cropscience S.A	Guatemala	Wettable Powder
Propoxur	1	29	Chemical & Construction INT 'L (1958) LTD	Jamaica	Aerosol Dispenser
Spinosad			Dow AgroSciences ; Clarke Mosquito Control Products Inc;	Columbia ; USA	Suspension Concentrate ; Tablet for Direct Application
Tetramethrin		28	Mcbride Caribbean ; Albrosco LTD ; Advanced Chemicals Laboratory LTD	Barbados, Trinidad & Tobago ; Jamaica	Aerosol Dispenser ; Ready to Use Liquid
Thiamethoxam	1		F Joh Kwizda Gesellschaft (Syngenta) ; Jiangsu Rotam Chemistry Co LTD	Austria ; China	Water Dispersible Granule
Thiophanate-methyl	1		Nippon Soda Co. Ltd	Japan	Oil dispensable, Wettable powder
Triadimenol	1		Bayer S.A	Guatemala	Emusifiable Concentrate
Triflumizole	1		Nippon Soda Co LTD	Japan	Wettable Powder

Source: Registered Pesticide List for Jamaica Pesticides Control Authority Jamaica January 2021