



## **REPORT ON PESTICIDES AND HIGHLY HAZARDOUS PESTICIDES (HHPs) IN NIGERIA**



**SUSTAINABLE ENVIRONMENT DEVELOPMENT INITIATIVE (SEDI)**

**May 2021**

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## List of Acronyms

AI	Active Ingredient
CRIN	Cocoa Research Institute of Nigeria
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organization of the United Nations
FEPA	Federal Environmental Protection Agency
FCT	Federal Capital Territory
FME <sub>env</sub>	Federal Ministry of Environment
GDP	Gross Domestic Product
GHS	Globally Harmonized System of Classification and Labeling of Chemicals
HHPs	Highly Hazardous Pesticides
IPEN	International Pollutants Elimination Network
ITCZ	Inter-Tropical Convergence Zone
IPM	Integrated Pest Management
LGAs	Local Government Areas
LMICs	Low and Middle-Income Countries
NAFDAC	National Agency for Foods and Drugs Control
NGO	Non-Governmental Organization
NOSDRA	National Oil Spill Detection and Response Agency
NESREA	National Environmental Standards Regulatory and Enforcement Agency
NCS	Nigeria Custom Service
NIFOR	Nigerian Institute for Oil-palm Research
NSPRI	Nigeria Stored Products Research Institute
ODS	Ozone-Depleting Substances
PAN	Pesticide Action Network
PECAN	Pest Control Association of Nigeria
PIC	Prior Informed Consent
POPs	Persistent Organic Pollutants
SAICM	Strategic Approach to International Chemicals Management
SDGs	Sustainable Development Goals
SEDI	Sustainable Environment Development Initiative
SRAD <sub>ev</sub>	Sustainable Research and Action for Environmental Development
TDS	Total Dissolved Solids
UNEP	United Nations Environment Programme
USD	United States Dollar
WAAPP	West African Agricultural and Productivity Programme
WHO	World Health Organization

## Executive Summary

Highly hazardous pesticides (HHPs) continue to pose unacceptable risks and disproportionately account for the negative impacts of pesticides on human health and environment, particularly in low and middle-income countries (LMICs) including Nigeria, where they are a barrier to sustainable development. The challenge of highly hazardous pesticide management in Nigeria is enormous. Indiscriminate use and over reliance on pesticides has been linked to increased risks to food safety, health of consumers and agricultural workers. Evidence indicates that reducing the use of HHPs would significantly reduce the negative impacts from pesticides. Concerted actions are, therefore, required to mainstream the regulation and sound management of HHPs and contribute to the achievement of the Sustainable Development Goals by 2030.

To this effect, the International Pollutants Elimination Network (IPEN) supported Sustainable Environment Development Initiative (SEDI) for this country situation report on Pesticides and HHPs in Nigeria. This report aims at informing the current situation of specific issues of concern, based on a review of published evidence and stakeholder discussions towards progressive elimination of poisoning and contamination of HHPs, and progressive replacement of HHPs by appropriate alternatives. It also seeks to facilitate and inform discussions about chemicals and waste management and thus support local, national, regional and global actions.

This report highlights a significant increase in the import and use of HHPs since 2009, with high costs and negative effects on human health and the environment that resulted because of unsound chemicals management.

Implementation gaps remain, even as some concerted actions have been taken through multilateral treaties on hazardous chemicals. Key challenges include: a lack of momentum on awareness raising activities, resulting in poor progress towards legislation; poor compliance and regulation of existing legislation; and lacking or inadequate data on HHPs import and use. Addressing very limited capacity gaps to monitor and address environmental and health impacts of pesticides should be a priority.

This report outlines priorities that support national HHPs phase out and calls for national and international action, guidance and support of all relevant stakeholders in addressing HHPs, which would contribute to achieving many Sustainable Development Goals.

There is a need to invest in developing safe alternatives for chemicals of concern, eliminating unacceptable risks from HHPs and promoting agro-ecology, integrated pest and vector management as tools to reduce use of HHPs. There should also be stricter laws that look into registration of new pesticides in the country. This report, therefore, recommends policy and special financial incentives (subsidies) geared towards boosting local production of biopesticides and promotion of agro-ecology. It also advocates that the government should review pesticide laws to facilitate the effective supervision and enforcement of pesticide use, especially in the agriculture and health sectors. Cooperation within the ECOWAS would strengthen the management of HHPs in individual countries in the region, through activities on risk reduction, including the progressive ban of HHPs and promoting agricultural best practices such as agro-ecology.



## 1.0 Introduction

The FAO/WHO International Code of Conduct on Pesticide Management [1] defines highly hazardous pesticides (HHPs) as those pesticides that are “acknowledged to present particularly high levels of acute or chronic hazards to health and/or the environment according to internationally accepted classification systems such as the World Health Organization (WHO) or the Global Harmonized System of Classification and Labeling of Chemicals (GHS) or their listing in relevant binding international agreements and 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.”

Nigeria is the most populous country in Africa and heavily polluted. The challenge of hazardous pesticides management in Nigeria is enormous. There is abundant evidence of poor pesticide education leading to extensive misuse in Nigeria [2]. The practical absence of effective regulatory policies and monitoring systems, and the lack of an agency on hazardous waste management and other environmental issues after independence, made Nigeria a susceptible recipient of exported trans-boundary hazardous waste dumped by waste merchants from industrialized nations. The first recorded incidence was in 1988 when about 4,000 tonnes of toxic waste from Italy was dumped in Koko port in Nigeria.

Prior to 1988, the government of Nigeria had no meaningful environmental policy [3]. In response to the 1988 dumping, the government made the harmful waste (Special Criminal Provision, etc.) Decree 42 of 1988. By this Decree, the federal government enacted the Federal Environmental Protection Agency (FEPA) Act, which brought about the creation of the FEPA [4]. However, prior to an amendment by FEPA - (Amendment) Decree No. 59 of 1992 - industries were established without any Environmental Impact Assessment (EIA) report. FEPA had to make it compulsory for all existing industries to carry out comprehensive environmental audit of plants for the Agency [5-6].

The concern by the government to protect the environment gave rise to the creation of the Federal Ministry of Environment (FMEnv) in 1999 from FEPA, to ensure effective coordination of all environmental matters [7]. The ministry oversees agencies, including the National Oil Spill Detection and Response Agency (NOSDRA) created in 2006 [8] and the National Environmental Standards Regulatory and Enforcement Agency (NESREA) created in 2007 (with mandates that cover hazardous waste [9]). As a Federation, environmental regulations in the country concern the thirty-six (36) states and the federal capital territory. States are mainly responsible for their own environmental issues under various environmental and planning laws. The apex executive body in Nigeria is the Federal Ministry of Environment, with the NESREA as the main enforcement body [9].

The objective of this project is to identify highly hazardous pesticides (HHPs) in Nigeria in consultation with the main stakeholders. The methodology involved identifying HHPs used in Nigeria and assessing their risks. The project would provide needed information on HHPs in order to generate global and national environmental benefits by effective management of HHPs in

Nigeria through engagement with relevant stakeholders. It will also create awareness amongst the population on the dangers of HHPs, causing a positive multiplier effect. Multiple data sources were used, including: general scientific data bases; an online search engine (Google scholar); global, regional and national specialist data bases; institutional websites; journal websites and subject experts/researchers. Interviews were used to engage policy makers and stakeholders.

### 1.1 General Overview of Nigeria and its Agriculture Activities

Nigeria has a total area of 923,768 sq. km, of which the total land area is 913,768 sq. km while 10,000 sq. km is water. Administratively, Nigeria is a federation, with 36 federating units (states) and the Federal Capital Territory (FCT). The federating states are divided into Local Government Areas (LGAs). Presently, there are 774 LGAs in Nigeria. Synoptically, Nigeria is divided into six different geopolitical zones (Figure 1); these are North-west, North-east, North-central, South-east, South-west, and South-south.



Figure 1: Map of Nigeria showing the 6 geopolitical zones with the 36 states and FCT

Presently, Nigeria is one of the seven most populous countries, and the most populous black nation in the world, with an estimate of 206,139,589 people [10] and an average population density of 226 persons per Sq. km. The median age in Nigeria is 18 years old, with an annual growth rate of 2.6%. The increase in the population and annual growth rate is attributed to a high fertility rate. The real significance of Nigeria’s demographic situation is that it simultaneously has a large population and one of the highest rates of growth in the world.

The estimated land area of Nigeria is 923,768 km<sup>2</sup>. Land use varies based on location and the needs of the community. However, the different uses of land revolve around agriculture, industry and

social needs such as the provision of infrastructure. Recent information shows that between 50% - 60% of the land area of Nigeria is under various forms of intensive rainfed, small holder agriculture (crop and animal) production and forest plantation.

The Nigerian economy rests on two pillars: oil/gas and agriculture. Both sectors contribute 65% – 70% of gross domestic product (GDP), while the secondary sector (manufacturing) contributes about 7% and the tertiary sector (transport, trade, housing, etc.) contributes about 25%. Nigeria's major industries are located in Lagos, Agbara and Sango Ota, Port Harcourt, Ibadan, Aba, Onitsha, Calabar, Kano, Jos and Kaduna.

## 1.2 Main Crops Produced in Nigeria

Agriculture in Nigeria is largely subsistence and is characterized by intensive small holder rainfed farming and extensive grazing. Various schemes had been put in place to further boost agricultural production; these include medium-to-large irrigation schemes, FADAMA projects, grazing zones/routes, and agro-allied business such as fertilizer production. In addition to fish farming activity, some coastal/riverine communities also engage in fishing activities and other aquatic resources. Agricultural produce in Nigeria varies from one region to the other. Major produce in the north are cereals such as millet, rice, maize, beans, soya beans and vegetables. Irish potato, yam, and potato are the main agricultural products in the middle belt, while cassava, cash crops such as cocoa, coffee, cola nuts and cashew nuts are grown in south-western Nigeria. Also, red oil production and cassava are exceptionally produced at the south-eastern region.

Nigeria has a variety of crops and they vary depending on the climate/agroecological region. The major crops, mostly cultivated, can be classified into three (3) categories, which are:

- Staple food crops: Cassava, sorghum, maize, millet, rice, yam, etc.
- Horticulture crops: Pepper, tomatoes, onion, *etc.*
- Cash crop (trees): Oil palm, cocoa, kola, coffee, cashew, etc.

The top agricultural commodities produced and traded mostly in Nigeria are cassava, yam, maize, fruits, cocoa, coffee, cashew, beans, and sesame seed [11]. Food crops such as cassava, cocoyam, and yam can be further classified into roots and tuber crops, which are mainly grown in areas with humid climates such as the savannah and rainforest regions of the country. Yam, cassava, maize, cocoyam, oil palm, rice, etc. are dominant crops cultivated in the eastern and western region of the country. Other crops like cowpea, millet, sorghum are classed under cereals and legumes, and they are largely cultivated in the northern parts of the country. The products of these crops are processed into a variety of food items [12].

The production of rice and cassava is mainly done by small scale farmers and this account for 80% of total production, while only 20% is consumed. Nigeria is among the highest producers and importers of rice in Africa and also the largest producer of cassava in the world [12]. Cassava is the main staple food crop, while oil palm is the major cash crop (Table 1). Cocoa-beans are mainly produced in the western region, while coffee, palm oil, palm kernel, rubber and timber are majorly grown in the mid-west zones of Nigeria.

**Table 1: Major Crops Cultivated in Nigeria**

<b>Crop Classification</b>	<b>Crop Name</b>	<b>Area Harvested (hectares)</b>	<b>Yield (Kg/ha)</b>	<b>Production (tonnes)</b>
Staple crops	Millet	2795829	8015	2240744
	Maize	4853349	20924	10155027
	Rice	3345969	20351	6809327
	Yam	5990184	79351	47532615
	Cassava	6852857	86789	59475202
	Sorghum	6125132	11204	6862343
Horticulture crops	Pepper	40225	17619	70871
	Tomatoes	608116	64363	3913993
	Onion	16232	151057	245201
Cash crop	Coffee	1483	12465	1849
	Oil palm	3015530	26032	7850000
	Cashew nut	61248	15978	97863
	Kola nut	258755	5380	139216
	Cocoa	1181625	2818	332927

Source [13]: FAO, 2018

## 1.3 National Pesticide Registration and Control Policy Framework

### 1.3.1 Extant Laws of Nigeria on Pesticides Management

A number of legislations and institutional frameworks are available, using five main organizations for the regulation of the distribution and use of pesticides in Nigeria. These include: Federal Ministry of Environment (FMEnv); Federal Ministry of Agriculture and Rural Development (FMARD); Federal Ministry of Health (FMH); National Agency for Food and Drug Administration and Control (NAFDAC); and Federal Ministry of Labour and Productivity (FMLP). The existing legislative tools are: Federal Ministry of Agriculture & Rural Development (1988); National Policy on the Environment (1989); FEPA Decree 58 of 1988 as amended by Decree 59 of 1992 and 1999, but complemented by rules and regulations such as FEPA S.1.5 and FEPA S.1.9 dealing with disposal and distribution/use of pesticides; NAFDAC Decree 15 of 1993, as amended by Decree 19 of 1999; The Factories Acts 1990 being implemented by the Factories Inspectorate Division of FMLP; The Harmful Waste (Special Criminal Provisions, etc.) Decree 42 of 1988 being implemented by FMEnv; and Nigerian Agricultural Policy (1988).

The general pest control objectives in the existing (1988) agricultural policy for Nigeria are to:

Control, and/or eradicate and maintain good surveillance of the major economic pests whose outbreaks are responsible for large-scale damage/loss to agricultural production; and Provide protection to man and animals against vectors of deadly diseases.

#### **1.3.1.1 National Policy on the Environment 1989**

This Policy aims to achieve sustainable development in Nigeria, and in particular to: Secure a quality of environment adequate for good health and wellbeing; Conserve and use the environment and natural resources for the benefit of present and future generations; Restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere to preserve biological diversity and the principle of optimum sustainable yield in the use of living natural resources and ecosystems; raise public awareness and promote understanding of the essential linkages between the environment, resources and development, and encourage individuals and community participation in environmental improvement efforts; and Co-operate with other countries, international organizations and agencies to achieve optimal use of trans-boundary natural resources and effective prevention or abatement of trans-boundary environmental degradation.

#### **1.3.1.2 Federal Environmental Protection Agency Act 58 of 1988 as Amended by Decree 59 of 1992**

This Act specifies the guidelines and rules related to the distribution, use and disposal of pesticides in Nigeria. The Act also mandates the agency to establish instruments for air quality standards, water quality standards, atmospheric protection and ozone layer protection. In discharging the mandate, FEPA, in 1991, published a number of regulations for the protection of the environment, including the Waste Management and Hazardous Waste Regulation, which provides a comprehensive list of chemicals and chemical wastes by toxicity classification.

#### **1.3.1.3 National Environmental Standards and Regulations Enforcement Agency (NESREA) Act 2007**

NESREA is charged with the responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general, and environmental technology, including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines.

#### **1.3.1.4 The National Agency for Food and Drug Administration and Control (NAFDAC)**

NAFDAC was established by Decree 15 of 1993 as amended by Decree 19 of 1999 and now Act Cap N1 Laws of the Federation of Nigeria (LFN) 2004, to regulate and control the manufacture, importation, exportation, distribution, advertisement, sale and use of food, drugs, cosmetics, chemicals, medical devices and packaged water in Nigeria for the protection of human health. In discharge of its statutory responsibility, NAFDAC has approved the list of chemicals allowed in Nigeria for the control of pests (Appendix II).

#### **1.3.1.5 The Factories Act 1990**

The Factories Decree 1990 was a landmark in legislation in occupational health in Nigeria. It provides a substantial revision of the colonial legislation, Factories Act 1958, in which the definition of a factory was changed from an enterprise with 10 or more workers to a premise with

one or more workers, thereby providing oversight for the numerous small-scale enterprises that engage the majority of the workforce in Nigeria. It stipulates the enforcement of compliance on factories, industries and organizations that employ labour and the protection of the right of workers to a friendly environment, health and safety.

#### **1.3.1.6 The Harmful Wastes (Special Criminal Provision) Act 42 of 1988**

This Act, which was established on the 25<sup>th</sup> of November 1988, was necessitated by the illegal use and dumping of toxic wastes in the port town of Koko in Southern Nigeria. The Act defines harmful waste to mean any poisonous or toxic substances that are capable of subjecting anybody to risks on their health. As contained in the section 1, it is an offence to purchase, sell, import, transit, transport, deposit and/or store any banned or obsolete chemical or any other form of wastes in the Nigeria territory or water.

### **1.3.2 National Environmental Guidelines**

The introduction of guidelines and standards was part of the implementation of the National Policy on Environment and the environmental pollution abatement strategy. The guidelines and standards relate to six areas of environmental pollution control: Effluent limitations; Water quality for industrial water uses at point of intake; Industrial emission limitations; Management of solid and hazardous wastes; and Pollution abatement in industries.

#### **1.3.2.1 National Environmental Protection (Effluent Limitation) Regulation S.I.6 (1991)**

This regulation was issued in 1991. It provides national guidelines and standards for industrial effluents, gaseous emissions, noise, air quality and hazardous wastes management.

#### **1.3.2.2 National Environmental Protection S.I.9 (Pollution and Abatement in industries in Facilities Producing Waste) Regulations, 1991**

This provides general guidelines for the containment of pollution in industries that generate harmful-wastes.

#### **1.3.2.3 National Environmental Protection (Management of Solid and Hazardous Wastes Regulation S.1. 15**

This provides general guidelines for the management of solid and hazardous wastes in Nigeria and emphasizes the following:

##### ***1.3.2.3.1 Waste Notification***

Industries are obliged to notify the FMEnv of all toxic hazardous and radioactive wastes which are stored on site or which are generated as part of operations (Regulations 1991, Article 2).

##### ***1.3.2.3.2 Waste Management***

With regard to waste management, a legal basis exists in Nigeria for the establishment and implementation of a 'cradle-to-grave' tracking system. Specifically, the Solid and Hazardous Wastes Management Regulations 1991 provide for the establishment of a documentation scheme to cover the generation, transport, treatment and disposal of hazardous wastes.



## **1.4 Authority Responsible for the Registration of Pesticides in Nigeria**

The federal government of Nigeria established the National Agency for Food and Drug Administration and Control (NAFDAC) by Decree 15 of 1993 as amended by Decree 19 of 1999 and now the National Agency for Food and Drug Administration and Control Act Cap N1 Laws of the Federation of Nigeria 2004 with the mandate to regulate and control the manufacture, importation, exportation, distribution, advertisement, sale and use of food, drugs, cosmetics, chemicals, detergents, medical devices and packaged water (known as “Regulated Products”). Oversight and supervisory functions are performed by the Federal Ministry of Health in collaboration with the Ministries of Agriculture, Environment and Interior.

NAFDAC’s mission is to safeguard public health by ensuring that only the right quality food, drugs and other regulated products are manufactured, imported, exported, distributed, advertised, sold and used in Nigeria. Core values include: Ensure availability of efficacious, safe and good quality NAFDAC-regulated products; Maintain reference laboratories of international standards; and promote an effective and efficient, well motivated and disciplined workforce.

In carrying out this mandate, the Agency has the following functions, amongst others: Conduct appropriate test and ensure compliance with standard specification; Compile standard specifications and guidelines for production, importation, exportation, distribution and sale of regulated products; undertake appropriate investigation into the production premises and raw materials for regulated products; Pronounce on the quality and safety of Regulated Products after appropriate analysis; control exportation and issue quality certification of Regulated Products intended for export purposes; undertake registration of Regulated Products; monitor advertisement of Regulated Products; establish and maintain relevant laboratories or other institutions in strategic areas of Nigeria; and undertake and co-ordinate research programmes on the storage, adulteration prevention and rational use of Regulated Products.

## **1.5 International Chemical Conventions and Agreements**

### **1.5.1 International Conventions & Treaties Relevant to Pesticides Management in Nigeria**

Nigeria is a Party to and a participant of many conventions and frameworks on the protection of human health and the environment. Some of these conventions include: Stockholm Convention on Persistent Organic Pollutants (POPs); Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Basel Convention on Transboundary Movements of Hazardous Wastes and their Disposal; Montreal Protocol; Bamako Convention on Hazardous Wastes; and International Code of Conduct for the Distribution and Use of Pesticides.

### **1.5.2 Stockholm Convention**

This Convention, in accordance with Principle 15 of the Rio Declaration on Environment and Development, aims at protecting human health and the environment from persistent organic pollutants. It is a global treaty to protect human health and the environment from highly dangerous, long-lasting chemicals by restricting and ultimately eliminating their production, use, trade, release

and storage. The Convention was adopted in Stockholm, Sweden on May 22, 2001. It calls for outright banning and destruction of the initial 12 persistent organic pollutants (POPs), 9 of which are pesticides. These POP pesticides are: Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Mirex and Toxaphene. The industrial POPs include Polychlorinated Biphenyls (PCBs), and unintentionally produced POPs include Dioxins, Furans, and PCBs again. Nigeria ratified the Convention in May 2004 and it came into force in August 2004. Globally, the Convention entered into force on 17 May 2004, with the initial 12 POPs. As of 2020, there are 29 listed POPs. The Stockholm Convention National Focal Point (NFP) for Nigeria is Mr. Charles Ikeah, Director, Department of Pollution Control and Environmental Health, Federal Ministry of Environment.

### **1. 5.3 Rotterdam Convention**

The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade is a global treaty that was adopted on 10 September 1998 and came into force on 24 February 2004. Nigeria ratified the Convention in June 2001. It is designed to protect public health and the environment by promoting informed decision-making by importing countries in relation to products that have been banned or severely restricted by at least two other Parties to the Convention. It formalizes the voluntary principles established in the International Code of Conduct. The Rotterdam Convention on PIC aims to help participating countries make informed decisions about the potentially hazardous chemicals that might be shipped to them, and to facilitate communication of these decisions to other countries. The Convention requires exporting Parties to honor the decisions of importing Parties. The key principles of PIC are: International shipment of a pesticide included in the PIC list should not occur against the wishes of the importing country. In the absence of a decision from an importing country, the export may proceed if the pesticide is registered in the country, or if it has previously been used or imported into the country; and if an importing country decides not to consent to further imports, the decision must be applied to imports from all sources, and domestic manufacturing and use must cease. Recommendations for inclusion of banned and severely restricted chemicals in the PIC procedure must be supported by risk evaluations reflecting prevailing conditions at the national level. The Rotterdam Convention Designated National Authority (DNA) for Nigeria is Mr. Charles Ikeah, Director, Department of Pollution Control and Environmental Health, Federal Ministry of Environment.

### **1. 5.4. Basel Convention**

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was concluded in Basel, Switzerland on March 22, 1989, and entered into force on May 5, 1992. The Basel Convention contains specific provisions for the monitoring of implementation and compliance. A number of articles in the Convention oblige Parties (national governments which have acceded to the Convention) to take appropriate measures to implement and enforce its provisions, including measures to prevent and punish conduct in contravention of the Convention. The key principles/outcomes of the Basel Convention are: In order to minimize the threat, hazardous wastes should be dealt with as close to where they are produced as possible; Transboundary movements of hazardous wastes or other wastes can take place only upon prior written notification by the State of export to the competent authorities of the States of import and transit (if appropriate); Each shipment of hazardous waste or other waste must be accompanied by



a movement document from the point at which a transboundary movement begins to the point of disposal and hazardous waste shipments made without such documents are illegal; and Outright bans on the export of these wastes to certain countries. However, transboundary movements can take place if the state of export does not have the capability of managing or disposing of the hazardous waste in an environmentally sound manner. Nigeria ratified the Convention in May 2004 and it came into force on 5 December 2019. The Basel Convention Focal Point for Nigeria is Mr. Charles Ikeah, Director, Department of Pollution Control and Environmental Health, Federal Ministry of Environment.

#### **1. 5.5 Montreal Protocol**

The Montreal Protocol on Substances that Deplete the Ozone Layer is an international agreement made in 1987. It was designed to stop the production and import of ozone depleting substances (ODS) and reduce their concentration in the atmosphere to help protect the earth's ozone layer. The Nigerian Focal Point for Montreal Protocol is Engr. Idris Abdullahi, National Ozone Officer, Federal Ministry of Environment.

#### **1. 5.6 Bamako Convention on Hazardous Wastes**

The Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa is a treaty of African nations prohibiting the import of any hazardous waste. The Convention was negotiated by twelve nations of the Organization of African Unity in January 30, 1991, and came into force in April 22, 1998. To date, it has 29 signatories and 25 Parties. Nigeria is a signatory, but has not ratified the Convention.

#### **1. 5.7 International Code of Conduct on Pesticides Management**

This is the worldwide guidance document on pesticide management for all public and private entities engaged in or associated with the distribution and use of pesticides. The code of conduct, originally adopted in 1985 by the Food and Agriculture Organization of the United Nations (FAO) conference and revised in 2002, promotes sound pesticide management practices that minimize potential risks to human health and the environment.

#### **1.5.8 Strategic Approach to International Chemicals Management (SAICM)**

The overall objective of the Strategic Approach to International Chemicals Management (SAICM) 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 was developed by a multi-stakeholder and multi-sectoral Preparatory Committee and supports the achievement of the 2020 goal agreed at the 2002 Johannesburg World Summit on Sustainable Development. SAICM makes many linkages with 2030 Sustainable Development Goals, as the SDGs are a crucial instrument to express the importance of chemicals management for sustainable development. The SAICM National Focal Point for Nigeria is Mr. Charles Ikeah, Director, Department of Pollution Control and Environmental Health, Federal Ministry of Environment.

## 2.0 Status of pesticide use in Nigeria

Although developing countries use only 25% of the pesticides produced worldwide, they experience 99% of the deaths [14]. This is because use of pesticides tends to be intense and unsafe, and regulatory, health and education systems are weaker in developing countries, including Nigeria. There is abundant evidence of poor pesticide education leading to extensive misuse in Nigeria [2]. It has been difficult to obtain an estimate of pesticide use in Nigeria. Until November 2020, the Food and Agriculture Organization (FAO) website that provides such information for several countries has no data for Nigeria [16].

However, it has been estimated that by 1998, about 125,000-130,000 metric tons of pesticides were being applied every year in Nigeria. In 1991, cocoa pesticides accounted for about 31% of the total agro-chemical market, of which fungicides accounted for 65% and insecticides 35% [17]. The two most-used pesticides in the world are the herbicides glyphosate (Roundup) and atrazine [17]. The deadliest chemicals are used in Nigeria due to their being cheaper than newer, more benign pesticides [18].

Pesticides are classified by the World Health Organization (WHO), as extremely hazardous (Class Ia), highly hazardous (Class Ib), moderately hazardous (Class II), slightly hazardous (Class III) and unlikely to be hazardous under short-term use (Class U) [19].

It has been well documented that small holder farmers in developing countries use large amounts of pesticides belonging to classes Ia, Ib, and II due to these being cheaper than the less hazardous, newer ones [20]. Invariably, newer, more benign formulations tend to be more expensive because they are protected by foreign patents, and local firms are not permitted to formulate them without paying heavy charges, which eventually drive-up market prices [21]. The low level of information, knowledge, and awareness among Nigerians on the dangers associated with the use of pesticides is highly prevalent. A major issue is the improper disposal of empty pesticide containers. Medical personnel are not adequately trained to recognize and deal with pesticides poisoning, the symptoms of which can be easily attributed to other causes by unsuspecting medical personnel [22]. Currently, there is no database on use of pesticides in the country, or of poisoning incidences related to their use. Analytical facilities for definite diagnosis are either too expensive or non-existent. Over 98% of sprayed insecticides and 95% herbicides reach a destination other than their target species, including non-target species, air, water and soil. In soils, pesticides residue can move from the surface when they are dissolved in runoff water, or percolate down through the soil, and eventually reach the groundwater [18].



**Figure 2: Pesticide application practices in Nigeria (Photo credit by SEDI)**

## **2.1 The list of nationally registered pesticides in Nigeria**

The last date when the only available registered pesticide list for Nigeria was updated is unknown. However, dates of registration and expiry indicate it was between 2004 and 2015. Pesticides registered for use in Nigeria are presented in Table 2.

**Table 2: List of Pesticides Registered for Use in Nigeria**

<b>Pesticides</b>	<b>Application</b>
Aldicarb	It is a systemic insecticide effective for the control of aphids, nematodes, flea, thrips, white flies, etc.
Diazinon	Insecticide
Paraquat	It is used as a plant desiccant effective against grasses
Dichlorvos	Insecticide
2-4-D	It is a selective, post-emergence herbicide used for the control of many annual broadleaf weeds
Mancozeb	It is a protective fungicide, effective against a wide range of foliage disease
Barban	Herbicides
Benomyl	Eradicant fungicides
Chlopyrifos	Insecticide

Chlopyrifos methyl	Insecticide
Zineb	Protectant fungicide
Malathion	Wide range insecticides used against aphids, red spider, thrips and leafhoppers.
Dichrotophos	Insecticide
Dimethoate	Insecticide
Molinate	Herbicide
Pyriproxyfen	Broad-spectrum insecticide
Lindane	Insecticide (restricted for use only on cocoa)
Methoxychlor	Broad insecticide
Perimiphos ethyl	Insecticide
Perimiphos methyl	Insecticide
Isoproturon	Systemic herbicide
Chlorotoluron	Post-emergence herbicide
Pentachlorophenol	Molluscicide
Cadusafos	Insecticide
Propoxur	Insecticide
Carbosulfan	Insecticide
Furathiocarb	Insecticide
Lambda cyhalothrin	Insecticide
Allethrin	Insecticide
Cyfluthrin	Insecticide
Tetramethrin	Insecticide
Permethrin	Insecticide
Phenothrin	Insecticide
Ethion	Insecticide
Deltamethrin	Insecticide
Cypermethrin	Insecticide
Temephos	Insecticide
Isazophos	Insecticide
Phosphamidon	Insecticide
Methidathion	Insecticide
Chlordecone	Insecticide
Fenthion	Organic thiophosphate: non-systemic insecticide
Carbofuran	Broad insecticide
Anilofos	Herbicide
Piperophos	Herbicide
Glyphosate	Herbicide
Glyphosate trimesium	Herbicide
Acetochlor	Herbicide
Butachlor	Herbicide
Propanil	Herbicide
Atrazine	Herbicide
Prometryn	Herbicide

Simazine	Herbicide
Ametryn	Herbicide
Cyanazine	Pre and post-emergence herbicide
Hydrazine	Herbicide
Desmetryn	Herbicide
Chlorophenols	Fumigant
1-3-dichloropropene	Fungicide and nematocide
Fenoprop	Herbicide
Metalochlor	Selective pre-emergence herbicide
Nitrofen	Organic herbicide
Terbuthalazine	Herbicide
TerbutrexTerbutryne	Herbicide
Diuron	Urea herbicide
Linurex (=Linuron)	Urea herbicide
Fluometurone;	Urea herbicide
Neburon	Urea herbicide
Chloroxuron	Urea herbicide
Diquat	Dessicants, defoliant and haulm killer
Monosodium Methyl Arsonate (MSMA)	Herbicide
Metazachlor	Herbicide
Phenoxyacid	Hormone weed killers
Dimethachlor	Herbicide
Fluxipyr	Herbicide
Imazaquin	Herbicide
Triassulfuran (Amber)	Herbicide
Osethoxydim	Herbicide
Oxadiazon (Ronster)	Herbicide
Clomaone	Herbicide
Trifluralin	Herbicide
Pendimethalin	Herbicide
Fluazifop – P.butyl	Herbicide
Folpet	Protective fungicide
Pentachloronitrobenzene	Molluscicides
Captan	Foliage fungicide with protective action
Carbaryl	It is contact insecticide and a fruit thinner with a broad spectrum of activity effective against many pests of fruit.
1, 2 dibromoethane	Fumigant
Hexachlorocyclohexanes	Fungicide

Sulfallate	Protective fungicide
Dinitrophenols	Fungicide and Acaricide
Dinitrocresols	Acaricide and fungicide
Dicofol	Acaricide and non-fungicide
Organotin	Acaricide and protective fungicides
Metalaxyl	Fungicide
Cyproconazole	Fungicide
Bavistin	Fungicide
Triadmenol	Fungicide
Dazomet	Fungicide
Dibromochloropropane	Nematocide
Methyl bromide	Fumigant – Rodenticide and nematocide
Brodifacoum	Rodenticide
Dicrotophos	Insecticide

Sources [23]; [24]: Ekeleme *et al.*, 2008; YESSO IPMP Report 2016

## 2.2 The List of HHPs amongst List of Nationally Registered Pesticides

The list of highly hazardous pesticide active ingredients registered for use in Nigeria is presented in Table 3. The individually registered active ingredients (AI) [25] used for different crops' pest management are indicated in Table 4. Although NAFDAC does not provide a copy of the registered pesticide list on their organizational website, it does publish a list of banned pesticides. The list of banned and restricted pesticides available on the NAFDAC website is found in Table 5 and contains 30 pesticides.

**Table 3: List of Highly Hazardous Pesticide Active Ingredients Registered for Use in Nigeria**

HHP AI	Chemical class	Use type	HHP1 Acute toxicity	HHP2 Carcino genicity	HHP3 Mutag enicity	HHP4 Repro ductive toxin	HHP 5 POP	HHP6 Prior informed consent	HHP7 Ozone- depleting substance	PAN HHP
Abamectin	Macrocyclic Lactone - avermectin	Insecticide	1	N	N	2	N	N	N	Y
Aluminium phosphide	Fumigant	Insecticide, rodenticide	1	N	N	N	N	N	N	Y
Benomyl	Benzimidazole	Fungicide	U	2	1A / 1B	1A / 1B	N	N	N	Y
Brodifacoum	Coumarin	Rodenticide	1A	N	N	N	N	N	N	Y
Butachlor	Amide	Herbicide	3	1B	N	N	N	N	N	Y

Carbendazim	Benzimidazole	Fungicide	U	2	1A / 1B	1A / 1B	N	N	N	Y
Carbofuran	Carbamate	Insecticide, nematocide	1B	N	2	N	N	Y	N	Y
Chlorothalonil	Aromatic fungicide	Fungicide, oomycide	U	1B	N	N	N	N	N	Y
Copper sulfate	Inorganic - copper	Fungicide, oomycide, bactericide	2	1A / 1B	N	N	N	N	N	N
Cyfluthrin	Pyrethroid	Insecticide	1B	N	N	2	N	N	N	Y
Diazinon	Organophosphorus	Insecticide	2	2	N	1B	N	N	N	Y
Dichlorvos (ddvp)	Organophosphorus	Insecticide, acaricide	1B	2	N	N	N	N	N	Y
Diuron	Urea	Herbicide	3	1B	N	N	N	N	N	Y
Endosulfan	Organochlorine	Insecticide, acaricide	2	N	N	N	Y	Y	N	Y
Furathiocarb	Carbamate	Fungicide	1B	N	N	N	N	N	N	Y
Haloxypop-p-methyl	Phenoxy	Herbicide	2	1B	N	N	N	N	N	Y
Mancozeb	Dithiocarbamate	Fungicide, oomycide	U	1B		2	N	N	N	Y
Methidathion	Organophosphorus	Insecticide	1B	2	N	N	N	N	N	Y
Monocrotophos	Organophosphorus	Insecticide	1B	N	2	N	N	Y	N	Y
Oxadiargyl	Oxadiazolone	Herbicide	N	N	N	1A / 1B	N	N	N	N
Oxadiazon	Oxadiazolone	Herbicide	U	1B	N	2	N	N	N	Y
Oxyfluorfen	Diphenyl ether	Herbicide	U	1B	N	N	N	N	N	Y
Permethrin	Pyrethroid	Insecticide	2	1B	N	N	N	N	N	Y
Propoxur	Carbamate	Insecticide	2	1B	N	N	N	N	N	Y

Source [25]: Crozier et al., 2018

### 2.2.1 Active Ingredients (AIs)

The AIs registered in Nigeria differ in terms of their overall hazard level. Of the HHPs identified, 40% are carcinogens, 40% are either extremely or highly acutely toxic, 16% are reproductive toxins and 8% are mutagens [25]. For several AIs, more than one of the HHP criteria is met; examples are Benomyl, Carbendazim, Endosulfan and Monocrotophos. None of the AIs are listed as candidate POPs. Fifteen of the identified AIs are currently listed in the Rotterdam database of notifications of final regulatory action. Forty-seven of the AIs are included in the Pesticide Action Network (PAN) HHP list (2019).

### 2.2.2 Crops using HHPs

**Table 4: List of HHPs used for Different Crops' Pest Management**

HHPs that are used to manage the target pest	Pesticide type	Crops
Abamectin	Insecticide	Maize; rice; vegetables; fruits
Diazinon	Insecticide	Cassava; rice; maize; cocoa; vegetables
Copper sulfate	Fungicide, oomycide, bactericide	Cassava; Irish potato; rice; cocoa
Mancozeb	Fungicide, oomycide	Cassava; Irish potato; groundnut; vegetables; cowpea; maize; sorghum; soybean; tobacco; cotton
Cyfluthrin	Insecticide	Cassava; rice; maize
Dichlorvos (DDVP)	Insecticide, acaricide	Cassava; rice; broad spectrum
Endosulfan	Insecticide, acaricide	Cassava; cocoa
Monocrotophos	Insecticide	Cassava; rice; maize
Permethrin	Insecticide	Cassava; rice; maize
Chlorothalonil	Fungicide, oomycide	Irish potato
Aluminium phosphide	Insecticide, rodenticide	Irish potato; rice; maize
Zinc phosphide	Rodenticide	Irish potato; rice; maize
Lambda cyhalothrin	Insecticide	Cowpea; cotton; groundnut; vegetables; maize; rice; fruit trees



Carbofuran	Insecticide, nematicide	Vegetables; maize; sorghum; groundnut; cowpea; soybean; potatoes; rice; Irish potato
Carbendazim	Fungicide	Cassava; Irish potato; rice; groundnut; vegetables; cowpea; maize; sorghum; soybean; tobacco; cotton
Benomyl	Fungicide	Cowpea; fruits; nuts and ornamentals
Furathiocarb	Fungicide	Seed treatment: maize, millet, sorghum, groundnut, cotton, cowpea, etc.
Haloxfop-P-Methyl	Herbicide	Corn; sorghum; sugarcane; pineapple
Propoxur	Insecticide	Cocoa
Methidathion	Insecticide	Cassava; vegetables
Brodifacoum	Rodenticide	Rice
Diuron	Herbicide	Rice; maize
Oxadiazon	Herbicide	Rice; maize
Oxyfluorfen	Herbicide	Rice; maize
Oxadiargyl	Herbicide	Rice; maize
Butachlor	Herbicide	Rice; maize

Source 23; 25: Ekeleme *et al.*, 2008; Crozier *et al.*, 2018

**Table 5: NAFDAC List of Banned Pesticides in Nigeria**

S/N	Pesticide	Category	Status
1	Aldrin	Insecticide	Banned
2	Binapacryl	Fungicide	Banned
3	Captafol	Fungicide	Banned
4	Chlordane	Insecticide	Banned
5	Chlordimeform	Insecticide	Banned
6	DDT	Insecticide	Banned
7	Dieldrin	Insecticide	Banned
8	Dinoseb&dinoseb salts	Herbicide	Banned
9	Heptachlor	Herbicide	Banned
10	Lindane	Insecticide	Banned
11	Ethylene dichloride	Fumigant	Banned
12	Parathion	Insecticide	Banned
13	Methyl parathion	Insecticide	Banned
14	Phosphamidon	Insecticide	Banned
15	Monocrotophos	Insecticide	Banned
16	Methamidophos	Insecticide	Banned
17	Chlorobenzilate	Insecticide	Banned
18	Toxaphene	Insecticide	Banned
19	Pentachlorophenol	Herbicide, insecticide	Banned
20	Ethylene oxide	Fumigant, disinfectant	Banned
21	Hcf (mixed isomers)/bhc	Insecticide	Banned
22	Edb(1,2-dibromoethene)	Fumigant	Banned
23	2,4,5 trichlorophenoxy acetic acid	Herbicide	Banned
24	Endrin	Insecticide	Banned
24	Mirex	Insecticide	Banned
26	Ethylene dibromide	Fumigant	Banned
27	Hexachlorobenzene	Fungicide	Banned
28	Endosulphan	Acaricide, insecticide	Banned
29	Delta hch	Agricultural insecticide	Banned
30	Flouracetamide	Rodenticide	Banned

**Source: NAFDAC website**

### 2.3 General data on the volume of use of HHPs for Agriculture

In 2018, the total pesticides imported was 147,446 tonnes, worth \$383,628,018 USD, out of which highly hazardous pesticides consisted of 584 tonnes, worth \$2,593,201 USD [26]. Insecticides, excluding highly hazardous pesticides, were 19,424 tonnes, with a value of \$58,748,425 USD. Fungicides, excluding highly hazardous ones, were 2561 tonnes, with a value of \$13,516,054 USD. Total imports of pesticides and highly hazardous pesticides (Table 6) indicates an increase in imports. A list of HHPs in use in Nigeria is presented in Table 7. Herbicides imported, excluding highly hazardous ones, were 123,722 tonnes, worth \$305,825,907 USD. This shows that herbicides are the most widely used class of pesticides in Nigeria. The import quantity (tonnes) and value of insecticides, fungicides, herbicides, household pesticides, HHPs and all pesticide imported into Nigeria are presented in figures (3-8).

## 2.4 General Data on the Volume of Use of HHPs for Non-Agriculture (Household and Public Health)

Other pesticide (disinfectants) for household use imported was 745 tonnes worth 1,238,518 USD. The import quantity (tonnes) and value of household pesticides is presented in Figure 6.

**Table 6: Total Pesticide and Highly Hazardous Pesticide Import**

Item	Year	Element	Unit	Value
Pesticides (total)	2009	Import Quantity	Tonnes	65707.54
		Import Value	1000 US\$	106473.4
Pesticides (total)	2010	Import Quantity	Tonnes	77238.49
		Import Value	1000 US\$	128670.6
Pesticides (total)	2011	Import Quantity	Tonnes	84572.2
		Import Value	1000 US\$	212350
Pesticides (total)	2012	Import Quantity	Tonnes	100834.4
		Import Value	1000 US\$	254029
Pesticides (total)	2013	Import Quantity	Tonnes	103747.7
		Import Value	1000 US\$	292361.7
Pesticides (total)	2014	Import Quantity	Tonnes	141634.8
		Import Value	1000 US\$	457030.4
Pesticides (total)	2015	Import Quantity	Tonnes	-
		Import Value	1000 US\$	-
Pesticides (total)	2016	Import Quantity	Tonnes	59500.93
		Import Value	1000 US\$	188848.1
Pesticides (total)	2017	Import Quantity	Tonnes	106589.9
		Import Value	1000 US\$	338302.3
Pesticides (total)	2018	Import Quantity	Tonnes	147446
		Import Value	1000 US\$	383628
Highly hazardous pesticides	2009	Import Quantity	Tonnes	6911
		Import Value	1000 US\$	12018.46
Highly hazardous pesticides	2010	Import Quantity	Tonnes	59
		Import Value	1000 US\$	269.6
Highly hazardous pesticides	2011	Import Quantity	Tonnes	96
		Import Value	1000 US\$	486.321
Highly hazardous pesticides	2012	Import Quantity	Tonnes	17
		Import Value	1000 US\$	17.964
Highly hazardous pesticides	2013	Import Quantity	Tonnes	14
		Import Value	1000 US\$	29.523
Highly hazardous pesticides	2014	Import Quantity	Tonnes	254
		Import Value	1000 US\$	1415.339
Highly hazardous pesticides	2014	Import Quantity	Tonnes	254

		Import Value	1000 US\$	1415.339
Highly hazardous pesticides	2016	Import Quantity	Tonnes	790
		Import Value	1000 US\$	4260.68
Highly hazardous pesticides	2017	Import Quantity	Tonnes	-
		Import Value	1000 US\$	4749.848
Highly hazardous pesticides	2018	Import Quantity	Tonnes	584
		Import Value	1000 US\$	2593.201

Source [26]: FAOSTAT (2020)

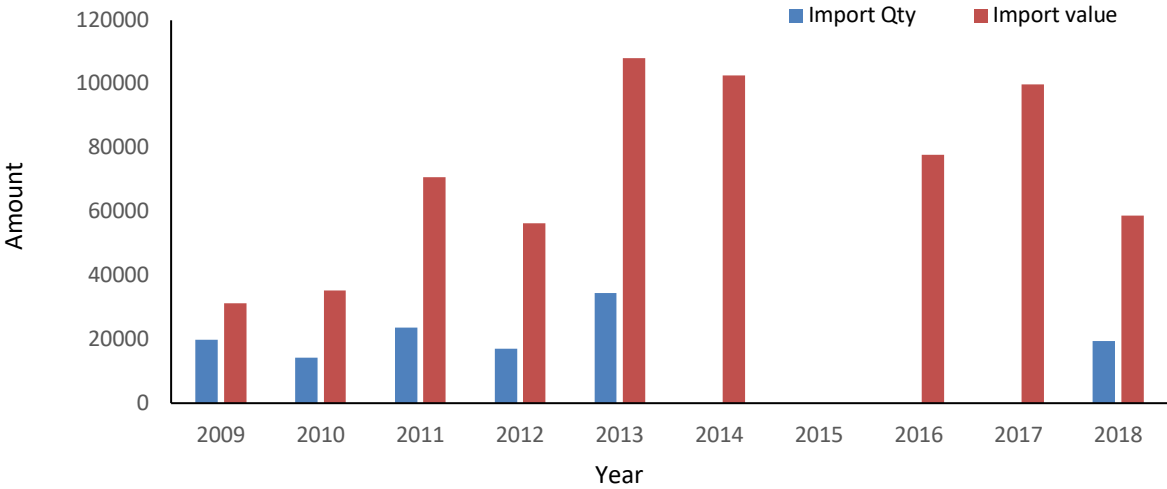
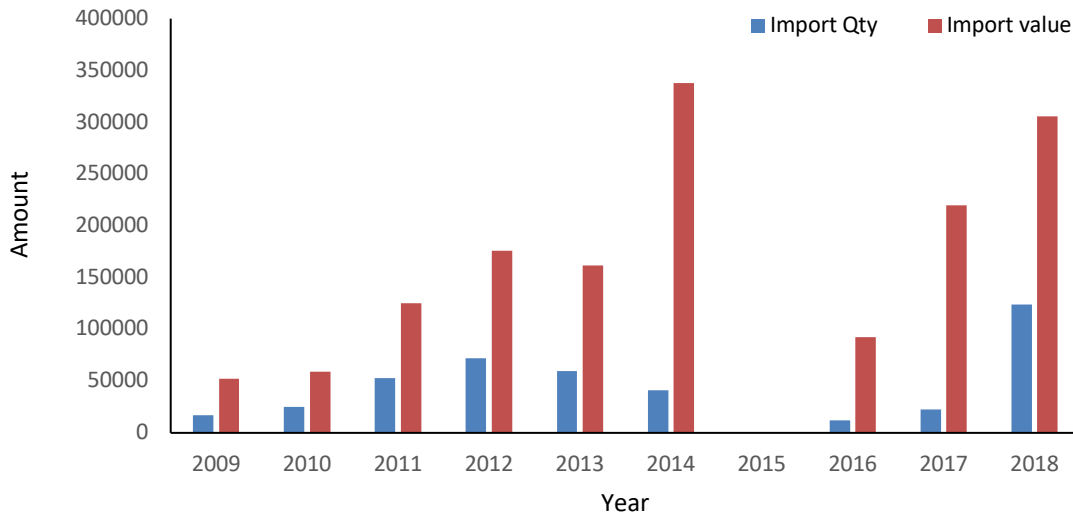


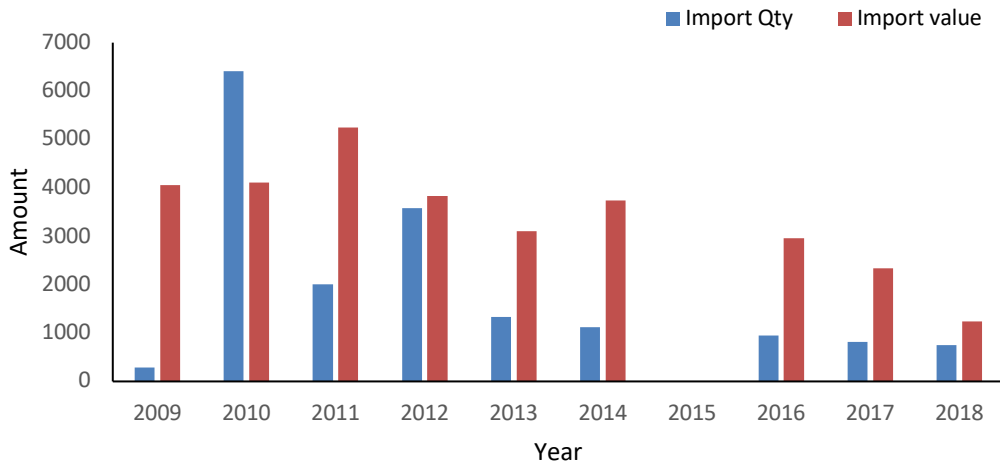
Figure 3: *Import quantity in tonnes and value of insecticides, excluding highly hazardous Insecticides, per \$1000 USD*



**Figure 4: *Import quantity in tonnes and value of fungicides, excluding highly hazardous fungicides, per \$1000 USD***

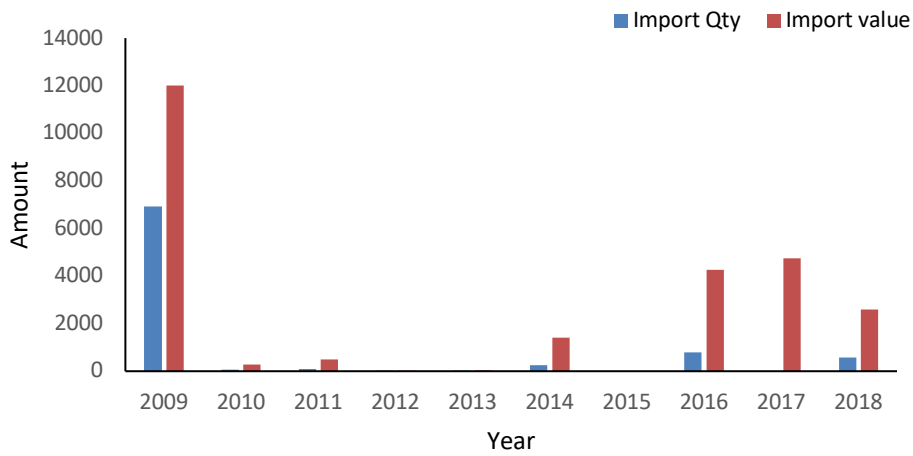


**Figure 5: *Import quantity in tonnes and value of herbicides, excluding highly hazardous herbicides, per \$1000 USD***



**Figure 6: Import quantity in tonnes and value of household pesticides (disinfectants), excluding highly hazardous pesticides, per \$1000 USD**

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**Figure 7: Import quantity in tonnes and import value of highly hazardous pesticides per \$1000 USD**

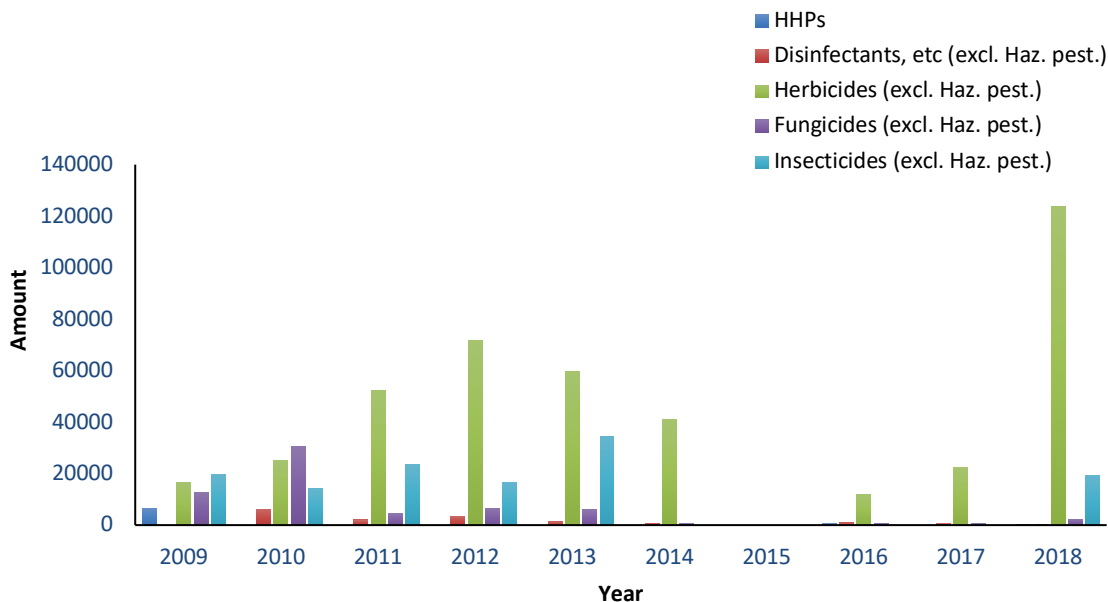


Figure 8: *Import quantity in tonnes and import value of all pesticides (highly hazardous pesticides, disinfectants, herbicides, fungicides and insecticides) per \$1000 USD*

## 2.5 HHPs Banned in Other Countries but in Use in Nigeria

Table 7: **List of HHPs Banned in Other Countries but in Use in Nigeria**

Pesticide	Countries	Status
2,4-D	4 countries including Mozambique, UK, Norway, Vietnam	Banned
Aldicarb	103 countries including Europe, China, South Africa	Severe restriction as plant protection product. Banned for other uses.
Acetochlor	38 countries including Europe	Banned
Atrazine	37 countries including Europe	Severe restriction as plant protection product. Banned for other uses.
Aluminium phosphide	China	Banned
Ametryn	Europe	Banned
Nitrofen	Europe	Banned
Benomyl	34 countries including Europe, Brazil	Banned
Butachlor	31 countries including Europe, Brazil, UK	Banned
Brodifacoum	30 countries including Europe	Banned
Cadusafos	31 countries including Europe, China	Banned
Carbendazim	29 countries including Europe, UK	Banned
Carbaryl	35 countries including Europe	Banned
Carbofuran	63 countries including Europe	Banned
Carbosulfan	41 countries including Europe	Banned

Chlorothanolin	3 countries including Colombia and Palestine	Banned
Cyanazine	29 countries including Europe, Oman	Banned
Cyhalothrin	28 countries including Europe	Banned
Cyfluthrin	29 countries including Europe, UK	Banned
Cypermethrin	UK	Banned
Diazinon	32 countries including Europe	Banned as plant protection product
Dichlorvos	33 countries including Europe	Banned as plant protection product
Dicofol	46 countries including Europe, Brazil, USA	Banned
Dicrotophos	34 countries including Brazil, Europe, UK	Banned
Diquat	29 countries including Europe	Banned
Dimethoate	4 countries including Saudi Arabia, Cameroon, Sri Lanka, UK	Banned
Diuron	Mozambique, UK	Banned
Ethion	30 countries including Europe, Mozambique	Banned
Fenthion	31 countries including Europe	Severe restriction
Fluazifop-p-butyl	Norway	Banned
Folpet	Malaysia	Banned
Furathiocarb	29 countries including Europe, Brazil	Banned
Haloxfop-methyl	Europe, Brazil, UK	Banned
Hexachlorocyclohexanes	132 countries including Europe, Brazil, China, south Africa	Banned
Imazaquin	Palestine, UK	Banned
Methidathion	Europe	Banned
Malathion	3 countries including Europe, Palestine, Syria	Banned
Methyl bromide	35 countries including Europe, UK	Banned
Metalaxyl	Brazil, UK	Banned
Molinate	UK	Banned
Mancozeb	Saudi Arabia	Banned
Methoxychlor	UK	Banned
Oxadiazon	29 countries including Europe, UK	Banned
Oxadiargyl	29 countries including Europe, UK	Banned
Paraquat dichloride	46 countries including Europe, UK	Banned
Pentachlorophenol	Europe, UK	Banned as plant protection product. Severe restrictions for other uses.
Permethrin	29 countries including Europe, UK	Banned as plant protection product.
Pendimethalin	Norway, UK	Banned
Phosphamidon	51 countries including Europe, Brazil, China, South Africa, UK	Banned
Propoxur	29 countries including Europe, UK	Banned
Propanil	28 countries including Europe, UK	Banned



Simazine	31 countries including Europe, UK	Severe restriction
Trifluralin	28 countries including Europe, UK	Banned
Temephos	UK	Banned
Zinc phosphide	32 countries including China, Mozambique	Banned
Zineb	32 countries including Europe, Brazil, Oman, Saudi Arabia and UK	Banned as plant protection product.

Sources [27]; [28]: Food and Fairness Briefing (2008); PAN 2019

## 2.6 Human Health and Environmental Impacts or Human Rights Issues Related to HHPs

### Impacts of HHPs

The impacts of highly hazardous pesticides are divided into human health and environmental impacts.

#### *Human Health impacts of HHPs*

Consumption of crops and plants grown under chemical pest control could cause health hazards to humans. This is especially common in the consumption of fruits and vegetables without proper washing. For example, Akinloye et.al. [29] reported the presence of paraquat residues in some commonly consumed vegetables in Abeokuta, Nigeria. In 2016, a case of organophosphate poisoning was reported for a child in Uyo, Nigeria. This illustrates the effect of the predisposing factors to accidental childhood poisoning [30].



**Figure 9: Applying pesticides without wearing PPE at Edo State, Nigeria (Photo by SEDI)**

### ***Environmental Impacts of HHPs***

Eighteen persistent organic pollutants (POPs) residues were measured in water, sediment, fish, soil and egg samples in the Lagos lagoon. The results indicated that water, sediment, fish, soil and egg samples collected from the Lagos lagoon are contaminated with varying amounts of persistent organic pollutants [31]. A study in 2002 showed that 217 fruit and vegetables, four major cereals (rice, maize, sorghum and soybeans), and food stuffs of animal origin from different locations within Nigeria were analyzed for the presence of organochlorine. Meat, pulses and cereals were discovered to contain DDT, Aldrin and Dieldrin above the maximum residue limit (MRL), while others contained the pesticides below MRL [32].

A study on organochlorine and polychlorinated residue in some rivers in the northern part of Nigeria [33] discovered that high levels of organochlorine and polychlorinated pesticides were a result of the extensive use of Lindane in fishing and Aldrin in cultivated farmland close to these water bodies. A result of the survey carried out [34] to determine the degradation of Endosulfan in Ibadan soil and to evaluate the effect of the recommended rate (0.25% A.I) of the insecticide (Endosulfan-35EC) on some soil chemical properties showed that application of Endosulfan-35EC significantly increased the acidity, magnesium and iron content of the treated soil, and reduced the concentration of calcium, potassium and sodium in the treated soil.

An average of 3.91ng/g of Endosulfan was present as residue in the soil six months after application. There was 85% population reduction of nematode as a result of Endosulfan

application. The study concluded that the application of Endosulfan is moderately persistent in Ibadan soil and hinders availability of some soil nutrients.



**Figure 10: Pesticide contaminating the soil during application at Edo State, Nigeria (Photo by SEDI)**

## **2.7 The Precautionary Principle and Provisions to Phase Out HHPs, Ban Pesticides and Deregister the Already-Registered Pesticides**

Within the framework of gradually eliminating HHPs, there is no specific law made in Nigeria tailored to Nigerian communities for a phase out of highly hazardous pesticides.

In exercise of the powers conferred on the Governing Council of the National Agency for Food and Drug Administration and Control (NAFDAC) of Nigeria by section 8 of the Drugs and Related Products (Registration, etc.) Act of 1996 (As Amended), NAFDAC came up with the Pesticide Registration Regulations of 2005 [35]. The regulations lay down that no pesticide is to be manufactured, formulated, imported, exported, advertised, sold, or distributed in Nigeria unless it has been registered in accordance with the provisions of these regulations. Samples of pesticides for registration may, however, be manufactured, formulated, or imported with the approval of the Agency.

The registration of hazardous chemicals and pesticides (or restricted pesticides) is carried out by NESREA through the National Environmental (Hazardous Chemicals and Pesticides) Regulation 2014. The definition of hazardous chemicals and pesticides in this legislation is quite loose and could refer to any pesticide, but it is assumed that this Act deals specifically with restricted chemicals and pesticides under the Rotterdam and Stockholm Conventions [25]. Several responsible bodies and organizations are government agencies, such as the National

Environmental Standards and Regulations Enforcement Agency (NESREA), the National Agency for Foods and Drugs Control (NAFDAC), the Cocoa Research Institute of Nigeria (CRIN), and the Nigeria Stored Products Research Institute (NSPRI), etc., and they are at the forefront of translating research findings to regulations and communicating these to the nation through various workshops [35]. There is no policy in place to collect reliable data and maintain statistics on the health effects of pesticides and pesticide poisoning incidents/environmental contamination (25).

### 2.7.1 Adherence to and Implementation of International Agreements Related to Pesticides

The Montreal Protocol-related regulations state that phasing out the use of Methyl Bromide would be completed by 1 January 2015. Methyl Bromide is currently listed on the list of chemicals banned in Nigeria, despite still in use in various states in the country [36].

### 2.7.2 Policies to Promote Reductions in Unnecessary Pesticide Use

The Agriculture Promotion Policy for Nigeria was developed by the Federal Ministry of Agriculture and Rural Development [37] and covers the period 2016–2020. Section 4.1.5.2 of the policy refers to agricultural pests and diseases, and the intent to promote the rational use of pesticides, explore Integrated Pest Management (IPM) programmes and the use of organic pest management strategies [26]. The policy describes the main constraints to pest and disease management as being indiscriminate use of agricultural inputs, which often leads to contamination of food, and ineffective disease containment and control strategies. The policy aims to enhance access to information on, and promote the use of, safe alternatives to highly hazardous pesticides (e.g. organic (natural) pesticides); improve regulation, inspection and enforcement of rational use of agrochemicals; as well as to improve quality assurance and residue testing. There is a policy in place to develop and promote the use of integrated pest management (IPM). A policy is also in place to promote organic production and/or sustainable agriculture standards. Inter-agency pest and pesticide management roles are presented in Table 8.

**Table 8: Pest and Pesticide Management Role**

<b>Ministries and government departments involved in pest and pesticide management role</b>	<b>Ministry name</b>	<b>Department/agency responsible</b>	<b>Specific functions (relating to pest and pesticide management)</b>
Registration of pesticides	Federal Ministry of Health	National Agency for Food and Drug Administration and Control (NAFDAC)	<ul style="list-style-type: none"> <li>• Regulates and controls the manufacture, importation, exportation, distribution, advertisement, sale and use of food, drugs, cosmetics, medical devices and packaged water (known as “Regulated Products”) and chemicals</li> <li>• Registration of chemicals</li> <li>• Review of chemical regulations in accordance with international conventions</li> <li>• Monitors the risk assessment of chemicals</li> <li>• Sampling of regulated products</li> <li>• Undertakes and coordinates research on the storage, adulteration, distribution and rational use of chemicals</li> </ul>



Enforcement of pesticide regulations	Federal Ministry of Environment Federal Ministry of Health	National Environmental Standards and Regulations Enforcement Agency (NESREA) NAFDAC	<ul style="list-style-type: none"> <li>• Enforcement of: <ul style="list-style-type: none"> <li>- laws, policies and standards relating to the environment</li> <li>- international agreements, including chemicals, hazardous waste and ozone depletion</li> <li>- legislation on sound chemicals management, rational use of pesticides and disposal of spent packages</li> <li>- legislation on the importation, exportation, production, distribution, storage, sale, use, handling and disposal of hazardous chemicals</li> <li>- ensuring that environmental projects funded by donor organizations and external support agencies adhere to regulations on environmental safety and protection</li> </ul> </li> <li>• Prohibits the production, importation, manufacture, distribution, display for the purpose of sale any counterfeit, adulterated, banned, fake, substandard or expired drug or unwholesome processed food</li> <li>• Prohibits the sale or hawking of drugs or poisons in any place not licensed or registered</li> <li>• The Enforcement Directorate is responsible for the investigation, interrogation and compilation of case files in NAFDAC</li> <li>• Pays unscheduled visits to all ports of entry and border</li> </ul>

<b>Role</b>	<b>Ministry name</b>	<b>Department/agency responsible</b>	<b>Specific functions (relating to pest and pesticide management)</b>
National plant protection organization	Federal Ministry of Agriculture and Rural Development	Nigeria Agricultural Quarantine Service (NAQS)	<ul style="list-style-type: none"> <li>• Conducts pest surveillance and monitoring for presence and spread of plant pests</li> <li>• Issues import permits for plant products and biocontrol agents</li> <li>• Issues phytosanitary certificates</li> <li>• Carries out pesticide residue, microbe and mycotoxin analysis for export certification</li> </ul>

			<ul style="list-style-type: none"> <li>• Inspection, treatment and certification of plant germplasm and commercial seeds for export</li> <li>• Inspection of crops in the field, warehouses and storage facilities prior to certification</li> <li>• Provides scientific support for quarantine inspectors at the entry/exit points</li> <li>• Production of International Standards of Phytosanitary Measures</li> </ul>
Food safety	<p>Federal Ministry of Industry, Trade and Investment</p> <p>Federal Ministry of Agriculture and Rural Development</p> <p>Federal Ministry of Health</p> <p>Federal Ministry of Health</p>	<p>Standards Organization of Nigeria (SON)</p> <p>NAQS</p> <p>Department of Food and Drug Services</p> <p>NAFDAC</p>	<ul style="list-style-type: none"> <li>• Responsible for developing and enforcing standards relating to products, measurements, materials and processes, certification of industrial products, assistance in the production of quality goods, among others</li> <li>• Pesticide and fertilizer testing laboratory</li> <li>• Carries out pesticide residue, microbe and mycotoxin analysis for export certification</li> <li>• Ensures food products are safe and guarantees the health of Nigerian citizens</li> <li>• Monitors, evaluates and sensitizes on food safety, including food poisons</li> <li>• Develops policies, guidelines and programmes relating to food safety and quality</li> <li>• Ensures food manufactured, imported, exported, sold and marketed in Nigeria meets food safety standards</li> </ul>
Public health issues related to pesticides	Federal Ministry of Health	Department of Food and Drug Services	<ul style="list-style-type: none"> <li>• Chemical management to minimize adverse effects to human health</li> </ul>

<b>Role</b>	<b>Ministry name</b>	<b>Department/agency responsible</b>	<b>Specific functions (relating to pest and pesticide management)</b>
Plant variety registration	Federal Ministry of Agriculture and Rural Development	National Agricultural Seeds Council	<ul style="list-style-type: none"> <li>• Regulates the seed industry in Nigeria</li> </ul>

			<ul style="list-style-type: none"> <li>• Implements policy and actions regarding seed development and the seed industry</li> <li>• Registration, release, production, marketing, distribution, certification, quality control, supply and use of seeds in Nigeria</li> <li>• Importation and exportation of seeds</li> <li>• Provides advice to Federal Government on seed programmes</li> <li>• Advises on changing pattern of seed demand and farmers' needs</li> </ul>
Agricultural research	Federal Ministry of Agriculture and Rural Development	Agricultural Research Council of Nigeria	<ul style="list-style-type: none"> <li>• Research and development</li> <li>• Policy development</li> <li>• Capacity building</li> </ul>
Extension	Federal Ministry of Agriculture and Rural Development	Agric Extension	<ul style="list-style-type: none"> <li>• Dissemination of agricultural technologies to farmers</li> <li>• Co-ordinates extension activities (public and private)</li> <li>• Promotes ICT as a method for delivering and disseminating information</li> </ul>
Setting and overseeing financial instruments, such as subsidies, incentive programmes, taxes on inputs	Federal Ministry of Agriculture and Rural Development	Several departments within the ministry	<ul style="list-style-type: none"> <li>• Development of policy</li> <li>• Setting levels for subsidies on fertilizers</li> <li>• Sets tax incentives for investors and importation of agricultural equipment</li> <li>• Increases tariffs on imports to promote home produce</li> </ul>
Official contact points for the Basel, Rotterdam and Stockholm Conventions	Federal Ministry of Environment	Mr. Charles Kanu Ikeah, Director of the Department of Pollution Control and Environmental Health	Represents Nigeria in global policy negotiations

## 2.8 Companies/Associations Representing the Pesticide Industry in Nigeria

### 2.8.1 Pest Control Association of Nigeria (PECAN)

The Pest Control Association of Nigeria (PECAN) is a professional organization of individuals and businesses engaged in pest control. PECAN started from a meeting of pest controllers on 16<sup>th</sup> August 1989 in Lagos. Initially, the association was named the National Pest Controllers Association of Nigeria. However, it was later renamed ‘Pest Control Association of Nigeria’ in 1990. The formal registration of the Association under the Land (perpetual succession) Act CAP 98 was made on 5<sup>th</sup> November, 1991 (Registration No. 6270). Major pesticide companies are presented below (Table 9).

**Table 9: Major Pesticide Companies in Nigeria**

S/ N	Company Name	Product Details	Location
1	Komes Ventures Limited	Importation and distribution of agricultural chemicals (herbicides, pesticides, etc.)	203 Igbosere road, 3 <sup>rd</sup> floor, Lagos Island, Lagos
2	African Agro Commodities Ltd	Marketing of crop protection chemicals and sprayers	138-140, Manganda road, Bompai, Kano State
3	Alphayel Ventures Ltd	Supplying chemicals used in farms and agricultural practice such as fertilizers, etc.	2 Toyin Ogunsanya lane, off Abeokuta street, Iju-Ishaga, Lagos
4	Harvestfield Industries Ltd	Provides agro-chemicals such as herbicides, insecticides, fungicides and sprayers	1, Isheri Road, olowora junction B/Stop, Omole phase 2 Ikeja, Lagos
5	Primegold Chemicals Industries Ltd	Provides services in the manufacturing and sale of fertilizers, pesticides, fungicides and insecticides	Km 10, East-west Road, Aletto- Eleme Port Harcourt, Rivers state
6	Saro Agro Science Limited	Agricultural service company in Nigeria for sales of agricultural chemicals	Plot 2068, block 18c, Odunsanya Odugunwa Crescent, Green estate, Amuwo Odofin, Lagos
7	African Fertilizers and Chemicals Nigeria Ltd	Provides agricultural fertilizers and agro- chemicals	2A Dakar Road, Apapa, Lagos
8	Hermonwell Company Ltd	Provision of sustainable agrochemicals supplies trade distribution and marketing agribusiness solutions with agricultural extension services	Plot 10 Oluwole Ogunrinde street, independence estate, Itele, Ota, Ogun State



## 2.9 Consultations

### 2.9.1 Federal Ministry of Environment

Discussions were held with Mrs. Falmata Bukar-Kolo, Assistant Director, Chemicals Management Division, Federal Ministry of Environment, Abuja. She noted that highly hazardous pesticides (HHPs) continue to pose challenges to the environment and the Federal Ministry of Environment is poised to tackle these challenges through enlightenment, enforcement of regulations and coordination of hazardous pesticides management.



Figure 11: *Mrs. Falmata Bukar-Kolo and lead consultant*

### 2.9.2 Nigeria Customs Service (NCS)

Discussions were held with Mrs. Julie Onubogu, Superintendent of Customs, Nigeria Customs Service. She indicated that there is need for enhanced data collection and inter-agency cooperation information sharing.



**Figure 12: Mrs. Julie Onubogu (Nigeria Custom Service) and lead consultant**

### **2.9.3 Federal Ministry of Industry, Trade and Investment**

Discussions were had with Mrs. Chinyere Nwoke, Director, Chemical and Non Petrochemical Directorate, Federal Ministry of Industry, Trade and Investment. She noted the strategic role the Ministry plays in promoting chemical trade and investment and the need for more inter-governmental agency coordination in relation to highly hazardous pesticides management.

### **2.9.4 Federal Ministry of Agriculture and Rural Development**

Discussions were held with Mr. Curtis Esezobor. He acknowledged the challenge of highly hazardous pesticides in the agricultural sector. He noted that there is need for more efforts on agricultural extension to farmers and joint research on topics including: Use of harmful pesticides and herbicides; Exposure of farmers due to unsound use of pesticides; and contamination of groundwater and air from sprays.

### **2.9.5 National Agency for Foods and Drugs Control**

SEDI also held discussions with Mr. Innocent Nyoyoko, Deputy Director, Chemical Evaluation and Research Directorate, National Agency for Foods and Drugs Control. He stated the NAFDAC mandate to include: Registration of chemicals; Review of chemical regulations in accordance with international conventions; and monitoring the risk assessment of chemicals. He noted that all imported chemicals must pass through Customs before going through NAFDAC for registration, and enforcement can be enhanced through public enlightenment and strengthening the capacity of the Customs department to enhance service delivery.

### **2.9.6 National Environmental Standards Regulatory and Enforcement Agency (NESREA)**

Discussions were had with Mrs. Spanny Embiemu. She stated the NESREA mandate to include: The registration of hazardous chemicals and pesticides (or restricted pesticides) through the

National Environmental (Hazardous Chemicals and Pesticides) Regulation 2014. She stated that a chemicals management policy is currently being reviewed by the agency that captures highly hazardous pesticides.

### **3.0 National endeavors to phasing out HHPs**

There is no specific law made in Nigeria tailored to the Nigerian context for a phase out of highly hazardous pesticides. However, Nigeria is a signatory to the relevant international conventions (Stockholm Convention, Rotterdam Convention, Basel Convention and Montreal Protocol). The national extant laws in Nigeria are consistent with the international laws and the World Bank Operational Policy 4.09 and annex C of OP4.01 on the procurement, use, handling and disposal of pesticides [24].

#### **3.1 Projects/programs and campaigns to phase out HHPs**

Nine highly persistent pesticides (Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Mirex, Toxaphene, and Hexachlorobenzene) are banned for use in Nigeria by NAFDAC. Unfortunately, several of these are still openly sold in Nigeria [22]. NAFDAC regularly issues permits, valid for five years, for specific brands of pesticide formulations that can be used in the country. Several responsible bodies and organizations such as the National Environmental Standards and Regulations Enforcement Agency (NESREA), National Agency for Foods and Drugs Control (NAFDAC), Cocoa Research Institute of Nigeria (CRIN), Nigeria Stored Products Research Institute (NSPRI), and Nigerian Institute for Oil-Palm Research (NIFOR) etc. are at the forefront of translating research findings to regulations and communicating these to the nation through training programmes [29]. There are also private organizations and non-governmental organizations (NGOs) such as the Pest Control Association of Nigeria (PECAN) and the West African Agricultural and Productivity Programme (WAAPP-Nigeria) working to ensure rational use of pesticides in Nigeria.

#### **3.2 Main challenges in the process of campaigning the phasing out of HHPs**

While evidence abounds that botanical pesticides are generally safe and effective [38], their use in Nigeria, as in other parts of Africa, is still hampered by some challenges, which include:

- Compared with synthetic insecticides, botanical insecticides require non-persistent natural ingredients. Hence, frequent applications are required to obtain a reasonable degree of crop protection;
- Botanical pesticide formulations are yet to be available in usable forms to farmers in commercial quantities so as to serve as alternatives to synthetic pesticides; and
- There needs to be proper mechanism so that farmers themselves can try them in the field and own them as real alternatives to synthetic pesticides.

### 3.3 Conclusion/Recommendations and Project Ideas that Support the National HHPs Phase Out

- There should be stricter laws that look into registration of new pesticides in the country. There should also be laws that prevent sale and use of banned pesticides such as 2, 4-D, Paraquat, Endosulfan, etc, and facilitate the effective supervision and enforcement of pesticide use, especially in the agriculture and health sectors.
- There should also be laws put in a place for gradual phase out of highly hazardous pesticides. Research findings suggest a combination of lack of resources, lack of political will, and incoherence between environmental, health, rural development, agriculture and trade policy, resulting in poorly implemented and enforced pesticide control policies [39].
- There is lack of governmental interest and clear policies on biopesticide development, regulation, and implementation in Nigeria. Policies made to enhance the use of biopesticides should be enacted. There are a lot of projects constituted to research the use of biopesticides in Nigeria, but these projects have not been largely successful throughout the country.
- Aggressive enlightenment campaigns through the efforts of both public and private sectors to create a high-level awareness amongst the citizenry about the dangers of HHPs should be undertaken.
- Policy and special financial incentives (subsidies) geared towards boosting local production of alternative, safe biopesticides and agroecological approaches should occur.
- Cooperation within the ECOWAS would strengthen the management of HHPs in individual countries in the region, through activities on risk reduction, including the progressive ban of HHPs and promoting agricultural best practices.

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## Appendices

### Appendix I: List of Crop and Livestock Protection Products Approved for Use by NAFDAC

#### a) Insecticides

Organochlorine insecticides	Organophosphorus insecticides	Carbamates	Pyrethroids
1. Endosulfan	<u>1.</u> Diazinon	1. Carbaryl	1. Lambda – Cyhalothrin
2. Helptachlor	<u>2.</u> Dichlorvos (DDVP)	2. Carbofuran	2. Cypermethrin
3. Lindane (Restricted to use on cocoa only)	<u>3.</u> Chlorpyrifos	3. Propoxur	3. Deltamethrin
	<u>4.</u> Chlorpyrifos – Methyl	4. Carbosulfan	4. Phenothrin
	<u>5.</u> Dicrotophos	5. Furathiocarb	5. Permethrin
	<u>6.</u> Dimethoate	6. Temik (Aldicarb)	6. Tetramethrin
	<u>7.</u> Monocrotophos		7. Cyfluthrin
	<u>8.</u> Perimiphos – Ethyl		8. Allethrin
	<u>9.</u> Perimiphos – Methyl		
	<u>10.</u> Ethion		
	<u>11.</u> Rugby (Cadusofas)		
	<u>12.</u> Malathion		
	<u>13.</u> Temeguard (Temephos)		
	<u>14.</u> Isazofos		
	<u>15.</u> Parathion – Methyl		
	<u>16.</u> Phosphamidon		
	<u>17.</u> Methidathion		



b) **Herbicides and fungicides**

<u>Organophosphorus</u>	<u>Carbamates</u>	Other herbicides	Fungicides
<p>1. Anilofos</p> <p>2. Piperophos</p> <p>3. Glyphosate</p> <p>4. Glyphosate Trimesium (Touchdown or Sulfosate)</p> <p>5. Amideherbicides (Acetochlor; Alachlor; Propanil; Butachlor; Metalochlor)</p> <p>Triazines and Triazoles (Atrazine; Ametryn; Desmetryn; Terbutalazine; Terbutrex Terbutryne)</p> <p>Chlorophenoxy herbicides (Prometryn; Simazine; 2,4-D (2,4 Dichlorphenoxyacetic acid))</p> <p>7. Urea and guanidines ; (Diuron ; Linurex (=Linuron); Fluometurone; Chloroxuron; Neburon)</p> <p>Quaternary nitrogen compounds (paraquat; diquat)</p>	<p>1. Asulam</p>	<p>1. Dimethachlor</p> <p>2. Metazachlor</p> <p>3. Monosodium Methyl Arsonate (MSMA)</p> <p>4. Fluxipyr</p> <p>5. Imazaquine</p> <p>6. Triassulfuran (Amber)</p> <p>7. Osethoxydim</p> <p>8. Oxadiazon (Ronster)</p> <p>9. Clomaone</p> <p>10. Trifluralin</p> <p>11. Stamp 500 (pendimethalin)</p> <p>12. Fluazifop – P.butyl</p>	<p>1. Benomyl (Nitroheterocyclic Compound)</p> <p>2. Dazomet (Thiadiazine Fungicide)</p> <p>3. Folpet (Phthalimide Fungicide)</p> <p>4. Metalaxyl (Acylalamine Fungicide)</p> <p>5. Cyproconazole (Alto – 100SL)</p> <p>6. Bavistin (Carbon) – Benzimide</p> <p>7. Triadmenol (Bayfidon GR Conzole Fungicide)</p>

## Appendix II: List of Key Contacts and Institutions

S/ N	Name	Organization	Position
1	Dr. Agbonsalo Osaigbovo	University of Benin	Associate Professor
2	Prof. Daniel Enobakhare	Entomological Society of Nigeria, University of Benin	Professor
3	Prof. Friday Ekeleme	International Institute of Tropical Agriculture (IITA)	Professor
4	Prof. Rabiu Adamu	Ahmadu Bello University, Zaria	Professor
5	Mrs. Falmata Bukar-Kolo	Chemicals Management Division, Federal Ministry of Environment	Assistant Director
6	Dr. Leslie Adogame	Sustainable Research and Action for Environmental Development (SRADev)	Executive Director
7	Mrs. Julie Onubogu	Nigeria Customs Service	Superintendent of Customs
8	Prof. Babajide Alo	Centre for Environmental Human Resources Development, University of Lagos	Director
9	Mr. Innocent Nyoyoko	Chemical Evaluation and Research Directorate, National Agency for Foods and Drugs Control	Deputy Director
10	Mrs. Chinyere Nwoke	Chemical and Non Petrochemical Directorate, Federal Ministry of Industry, Trade and Investment	Director
11	Prof. Percy Onianwa	University of Ibadan Linkage Centre for Cleaner Production Technology and Hazardous Waste Management	Executive Director
12	Mrs. Spanny Embiemu	National Environmental Standards Regulatory and Enforcement Agency	Principal Scientific Officer
13	Mr. Curtis Esezobor	Federal Ministry of Agriculture and Rural Development, Edo State Office	Director
14	Mrs. Darling Igebor	National Agency for Foods and Drugs Control	Senior Scientific Officer
15	Mr. Isaac Eranga	Nigerian Observer	Media consultant



**Figure 13: *Pesticide application in Edo State, Nigeria (Photo by SEDI)***