



Study on crop protection where the ‘Green Innovation Centres for the Agriculture and Food Sector’ (GIAE) initiative is being implemented

Nigeria

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Executive summary

Losses due to pests, diseases and weeds are estimated to be about 35% in major crops, and may exceed 50% in developing regions where pest management strategies are limited. Sustainable pest management methods include non-chemical control methods (biological, cultural, mechanical and physical) although presently, many farmers still rely on chemical pesticides to control pest outbreaks. The Green Innovation Centres initiative for the Agriculture and Food Sector initiative (GIAE), led by Gesellschaft für Internationale Zusammenarbeit (GIZ), aims to boost smallholder farmer productivity and improve the whole value chain to maximize farmers' benefits. In order to align its Green Innovation Centres to the best practices in pest and pesticide management, GIZ has mandated CABI to lead this study.

The aim of the study was to analyze the legal framework for pesticide management in Nigeria and review pest management practices for the major pests of the focal crops of the Green Innovation Centre. A desk study was carried out to analyze legislation and policy relating to pest and pesticide management and a review of scientific literature relating to the integrated pest management methods for the focal crops: cassava, Irish potato, maize and rice. The results and recommendations from the desk study were presented during an in-country stakeholder workshop. Participants at the workshop assisted in validating the findings, fillings gaps and prioritising implementation of the recommendations.

Several gaps were highlighted during the analysis of the existing legal framework for pesticide management. The areas that were not covered or not covered adequately in the framework included: packaging and labelling, transport, marketing, requirement for sale, availability restriction for vulnerable groups (children and pregnant women), disposal of empty containers and out of date products. There is currently no legislation in place to cover the registration of biopesticides and other biological control agents. However, there is draft legislation for the registration of biopesticide, expediting the promulgation of this legislation and introducing additional legislation for the registration of other biological control agents would be beneficial.

Stock-taking of highly hazardous pesticides (HHPs) and their use was carried out on registered pesticides. Unfortunately the list of registered pesticides for Nigeria has not been updated for some time. The current list does not indicate which crop or pests the pesticides are registered for so the analysis may not reflect which pesticides are currently available in-country. Based on the existing list 85 active ingredients are registered for use in Nigeria, 25 of these meet one or more of the HHP criteria. For several active ingredients (benomyl, carbendazim, endosulfan and monocrotophos) more than one of the HHP criteria are met.

A review of extension material produced by the GIAEs (producer reference guides) for the four focal crops was completed. The material was generally very good although pest and disease management for cassava, maize and rice was limited. Recommendations have been made in the report to improve these sections of the guides for pest and disease management (including fall armyworm on maize) and suggestions have been made to enhance the guidelines for safe pesticide use.

Several recommendations have been made in the report to improve management of pest and pesticide management including:

- Introduction of the concept of threshold levels for more efficient management of pests and diseases
- Promote the use of lower hazard pesticides, such as biopesticides
- Explore social media/ICT as an avenue for the dissemination of updated advisory materials
- Producing a series of 3D animations on management of key pests and diseases
- Specialized training for extension agents understanding pesticide labels and calibration of spraying equipment

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Disclaimer

The views expressed in this document are those of the authors and do not necessarily reflect the views of GIZ and BMZ.

Acronyms

ACMD	African Cassava Mosaic Disease
AI	Active ingredient
Bt	<i>Bacillus thuringiensis</i>
CABI	Centre for Agriculture and Bioscience International
ECOWAS	Economic Community of West African States
FAW	Fall armyworm
FMARD	Federal Ministry of Agriculture and Rural Development
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
GIAE	Grüne Innovationszentren in der Agrar-und Ernährungswirtschaft (in English: "Green innovation centres for the agriculture and food sector")
GIZ	Gesellschaft für Internationale Zusammenarbeit (in English: "Corporation for International Cooperation")
HHP	Highly hazardous pesticide
IPM	Integrated pest management
IRRI	International Rice Research Institute
ITC	International Trade Centre
MRL	Maximum Residue Level
NAFDAC	National Agency for Food and Drug Administration and Control
NAQS	Nigeria Agricultural Quarantine Service
NESREA	National Environmental Standards and Regulations Enforcement Agency
PAN	Pesticide Action Network
POP	Persistent organic pollutant
PPE	Personal protective equipment
SON	Standards Organization of Nigeria

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Introduction

Almost 3 billion people still suffer from malnutrition. In particular, smallholder farmers in underprivileged regions of the world are highly vulnerable. Yield losses to pests, diseases and weeds are estimated to be about 35% in major crops, and may exceed 50% in developing regions where pest control options are limited. This clearly underlines the key role played by pest management in safeguarding yields and ensuring food security. Sustainable pest management methods include biological, cultural, mechanical and physical (non-chemical) control methods. These non-chemical methods contribute to reducing pest pressure and damage. However, farmers around the world still rely on pesticides to control pest outbreaks. The Green Innovation Centres for the Agriculture and Food Sector initiative (GIAE), led by Gesellschaft für Internationale Zusammenarbeit (GIZ), under the special initiative One World – No Hunger, aims to boost smallholder farmer productivity and improve the whole value chain to maximize farmers' benefits. The programme is currently active in 14 countries: Benin, Burkina Faso, Cameroon, Ethiopia, Ghana, India, Kenya, Malawi, Mali, Mozambique, Nigeria, Togo, Tunisia, and Zambia. In order to align its Green Innovation Centres to the best practices in pest and pesticide management, GIZ mandated CABI to lead the present study.

The study covered the legal framework for pesticide management, as well pest management practices for the major pests of the Green Innovation Centres focal crops. A desk study, including an analysis of the legal framework and a literature review of pest management practices for the focal crops, was conducted in all 14 countries. The International Code of Conduct on Pesticide Management, published by the FAO and WHO, details the best pesticide management practices. These best practices are designed to minimize adverse effects that may result from pesticide use and to foster the use of sustainable pest management strategies. The analysis of the legal framework compared each country's regulations and policies against the best practices. The legal framework analysis also included an analysis of the registered pesticides and of the hazards linked to their use. For eight countries – Burkina Faso, Cameroon, Ghana, India, Kenya, Malawi, Mali, and Tunisia – the study was complemented by in-country data collection. This included key informant interviews and group discussion with major stakeholders in each value chain, including government officials, as well as questionnaires with extension agents and farmers. The information gathered in-country complemented and validated the findings of the legal framework analysis and provided a snapshot of pest management knowledge and practice in each country. This covered non-chemical and chemical pest management practices, pesticide management, as well as knowledge of integrated pest management (IPM).

Based on the results of the study, CABI drafted, for each country, actionable recommendations for implementation by the Green Innovation Centres. Additionally, CABI identified areas where further training of farmers or extension agents would be required and identified gaps in national regulations and policies. In all 14 countries, the results of the study and the recommendations were presented in stakeholder workshops. The stakeholders validated the recommendations and discussed their implementation. Overall, the present study contributes to food security by fostering the implementation of sustainable pest management practices and the establishment of an enabling environment in the countries where the GIAE initiative is active.

Methodology

The methodology for the study was devised in such a way that it could be implemented in all 14 countries without any major changes in the approach. Approaches and tools for the desk study and in-country data collection were developed by CABI Switzerland, based on experience from previous studies. Based on the findings from the desk study, adaptations were made to the in-country data collection tools to ensure information gaps were filled.

Desk study

A review of literature from the public domain and to which CABI has access was conducted to provide an overview of the agriculture sector within Nigeria, to map the value chains for each focal crop and to assess the institutional and regulatory arrangements for pest and pesticide management. This included, where relevant, information regarding crop protection against Fall Armyworm (FAW, *Spodoptera frugiperda*). Existing literature on crop protection studies and advisory documents was also reviewed to identify the current crop protection methods being applied within the value chain for the focal crops cassava, Irish potato, maize and rice. Utilizing a tool developed by CABI, the most up-to-date version of the national list of registered pesticides was analysed to identify the full list of active ingredients (AI) and products which are registered for use in Nigeria. For each AI registered, a profile was developed which includes the chemical class, use type and associated hazards to human health and the environment. The *Guidelines on Highly Hazardous Pesticides* (FAO 2016) define highly hazardous pesticides (HHPs) as “pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or environment according to internationally accepted classification systems”, and it lists criteria for determining whether or not an AI is an HHP. HHPs which are registered for use in the country were identified using these criteria and the toxicological profiles and information on target pests were also used to assess the availability of lower toxicity alternatives to the HHPs for specific crop pests. With the support of national partners, the national pesticide act, subsidiary legislation and other policies relating to pests and pesticides management were identified, and an analysis of the existing legal framework for pest and pesticides management was carried out. A cross-comparison was made with international guidelines (e.g. from the FAO and the ILO) and other regulatory best practices (e.g. OECD).

The desk study information was used to compile a preliminary description of the policy-setting process in Nigeria. The status of implementation and the adequacy of the enforcement of the regulations was then confirmed and complemented by data gathered through an in-country workshop with representatives of the pesticide regulatory authorities, ministries and other stakeholders.

Limitations of the methodology and data

Many legal, policy and legislative documents relating to agriculture, food and the environment were available through the Nigeria country profile in the FAOLEX database (<http://www.fao.org/faolex/en/>). Other policy and legal documents were available to download from ministry websites and on various legal websites. As no additional interviews were carried out in Nigeria the majority of any remaining gaps were filled by the participants of the in-country workshop but it is still unclear whether there are supporting guidance documents to complement the legislation, as these are not available online.



Results/findings

Agriculture sector characteristics and key stakeholders

Overview of agriculture sector performance and contribution to the economy

Agriculture is a key sector of Nigeria's economy, accounting for 21% of the nation's GDP in 2016 (Table 1). Although its contribution to the country's GDP has decreased from 33% in 2007 the agricultural sector has shown reasonably steady growth from 2007 up to 2016. Nigeria has a large rural population, accounting for approximately half of its population. In 2007 agriculture employed nearly 50% of the country's labour force but this has steadily decreased to only 28% in 2016. Despite the growth of the sector in recent years, agriculture remains predominantly rain-fed subsistence farming, with low productivity, a low level of technology and high labour intensity (FAO 2017).

Table 1. General characteristics of the agricultural sector in Nigeria

Selected indicators – agriculture sector generally	2007	2010	2013	2016
Total area of land under agriculture (1000 ha)	737,000.0*	700,000.0*	708,000.0*	No data available
Arable land per person (ha)	0.3	0.2	0.2	No data available
GDP per capita (current US\$)	1,136.8	2,327.3	2,997.0	2,178.0
Agricultural value added (% of GDP)	32.7	23.9	21.0	21.2
Agricultural value added (annual % growth)	7.2	5.8	2.9	4.1
Agricultural labour force (% of total labour force)	48.6	30.6	28.3	28.0
Rural population (% of total)	59.2	56.5	53.9	51.4
Value of total agriculture production (Agricultural Production Index) current million US\$	61,431*	51,231* (2011)	64,181* (2014)	No data available

Source of data: The World Bank (2018) and *FAOSTAT (2018)

Key crops, both domestic and for export

In 2013 (latest figures available) the three crops with the highest production quantity in Nigeria were cassava, yam and maize (Table 2), whilst crops accounting for the highest production value were yam, cassava and fruit crops (FAO 2017). Crops which had the highest export value were cocoa beans, followed by sesame seeds and rubber (naturally dried). Nigeria's exports to other countries between 2009 and 2013 were dominated by petroleum oil, which accounted for 89% of all exports. Fresh food accounted for 6.5% of exports, of which 70% was cocoa beans (International Trade Centre (ITC) 2014).

Table 2. Production and export data for key crops during 2013

Key commodities (general)	Year	Area harvested (Ha)	Yield Kg/Ha	Production	Export US\$ (1,000)
Major crops					
Cocoa (beans)	2013	1,233,498	298	367,000	420,000
Cocoa, butter	2013	-	-	-	92,191
Sesame seed	2013	526,900	1,110	584,980	181,000
Rubber (natural dry)	2013	367,763	407	149,652	129,109
Yam	2013	50,88,300	7,000	35,618,420	0
Focal crops					
Cassava	2013	6,741,300	7,032	47,406,770	0
Irish potato	2013	308,043	3,655	1,126,067	157
Maize	2013	5,762,700	1,461	8,422,670	351
Maize flour	2013	-	-	-	16
Rice	2013	2,931,400	1645	4,823,330	89

Source of data: FAOSTAT (2018)

General information about the focal crop value chain

Nigeria is the largest producer of cassava in the world. It is mainly grown by smallholder farmers on average land holdings of 0.5–2.5 ha (Adeniji et al. 2005), although larger-scale producers do exist, mainly as part of out-grower schemes (GIZ 2013a). Cassava is predominantly grown in the south and north-central parts of Nigeria, followed by the south-east and west, as both as a staple and a cash crop (Adeniji et al. 2005). Cassava is principally used for human consumption but industrial demand is growing for processed products such as cassava flour, starch, ethanol and animal feed. Irish potato production in Nigeria is largely by smallholder farmers concentrated in Plateau State, where 90% of potato cultivation takes place. Irish potato is grown throughout the year: rain-fed during the wet season and irrigated during the dry season. Maize is grown throughout Nigeria with the middle belt (North Central region) being the largest producer.

Smallholders account for 70% of maize farmers, who typically produce on an average area of 5 ha (Cadoni and Angelucci 2013). Around 60% of the maize produced is used for food, 30% for animal feed and a small percentage is processed (Cadoni and Angelucci 2013). Rice is an important staple cereal crop and Nigeria is the largest producer of rice in West Africa, however it is still a net importer. About 80% of the total rice produced is done by smallholder farmers on areas of land ranging from 0.2 – 1.5 ha. A value chain map for each of the focal crops can be found in Annex II (Figures 4–7).

Major markets

Cassava is predominantly grown as a staple and cash crop and traded locally on urban and rural markets. Some processing is carried out in-country to provide staple food stuffs such as gari, fufu and livestock feed. Irish potato is becoming more popular in Nigeria especially in urban areas. Most of the trade is domestic with some cross border trade with neighbouring countries. Irish potatoes are sold fresh but the majority of potatoes are processed to make French fries, crisps and potato flakes. The majority of maize produced in Nigeria is for the domestic market. Very little maize is formally exported (Table 2). Informal trade in maize has been reported with neighbouring countries although detailed information on quantities is unavailable (Cadoni and Angelucci 2013). Rice is now a principal staple food in Nigeria. Although production has increased significantly in recent years Nigeria only produces enough for domestic markets and remains a net importer of rice. In recent years the Nigerian government has introduced higher tariffs on imported rice to stimulate domestic production.

Sources of both synthetic pesticides and other inputs

According to the latest information available from FAOSTAT (2018) Nigeria imported US\$457 million of pesticides in 2014 and exported US\$18 million, hazardous pesticide imports accounted for US\$1.4 million of the total imports. Excluding hazardous pesticides, herbicides accounted for approximately 75% of all imports. Insecticides and fungicides accounted for 28% and 2% of

imports, respectively. Nigeria imports the majority of its pesticides from other countries and private companies, then formulates and/or distributes in-country. Tables 3 and 4 list some of the private sector stakeholders operating in Nigeria and the inputs and services they provide.

Table 3. Production and export data for key crops during 2013

Activity type	Company	Inputs
Private – manufacture and marketing	Syngenta Nigeria Ltd	Agrochemicals
Private – manufacture and marketing	The Biostadt Company	Agrochemicals, seeds, pesticide application equipment
Private – manufacture and marketing	Finepro Manufacturing Company Ltd	Agrochemicals
Private – manufacturer representative	Dizengoff West Africa (Nigeria) Ltd	Agrochemicals, agricultural equipment
Private – formulation, marketing and distribution	The Candel Company	Agrochemicals
Private – importation and distribution	Pestkil (Nigeria) Ltd	Pest control chemicals and equipment
Private – importation and distribution	Turner Wright Ltd	Agrochemicals
Private – distribution	Springfield Agro Ltd	Seeds, agrochemicals, fertilizers, farm tools
Private – distribution	Czard & Co Ltd	Agrochemicals, application equipment
Private – supplier	Multitrade Marketing Ltd	Safety equipment
Private – supplier	Kano Agricultural Supply Company Ltd	Agrochemicals, fertilizer
Private – sales	Miagro Ltd	Agrochemicals, agricultural equipment, fertilizers

Table 4. Private sector and other stakeholders

Farmer associations	Trade sector actors	Others
Nigerian Cassava Growers Association	Flour Millers Association of Nigeria	National Root Crop Research Institute
Plateau State Potato Producer Association	National Cassava Processor and Marketers Associations	National Cereals Research Institute
Potato Farmers Association of Nigeria	Cassava Stakeholders Association of Nigeria	International Institute of Tropical Agriculture
Maize Association of Nigeria	Rice millers, Importers and Distribution Association of Nigeria	Institute of Agricultural Research and Training
Rice Farmers Association of Nigeria	Nigeria Agro Inputs Dealers Association	National Agricultural Extension Research and Liaison Services

Role	Ministry name	Department/agency responsible	Specific functions (relating to pest and pesticide management)
National plant protection organization	Federal Ministry of Agriculture and Rural Development	Nigeria Agricultural Quarantine Service (NAQS)	<ul style="list-style-type: none"> • Conducts pest surveillance and monitoring for presence and spread of plant pests • Issues import permits for plant products and biocontrol agents • Issues phytosanitary certificates • Carries out pesticide residue, microbe and mycotoxin analysis for export certification • Inspection, treatment and certification of plant germplasm and commercial seeds for export • Inspection of crops in the field, warehouses and storage facilities prior to certification • Provides scientific support for quarantine inspectors at the entry/exit points • Production of International Standards of Phytosanitary Measures
Food safety	Federal Ministry of Industry, Trade and Investment	Standards Organization of Nigeria (SON)	<ul style="list-style-type: none"> • 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 • Pesticide and fertilizer testing laboratory
	Federal Ministry of Agriculture and Rural Development	NAQS	<ul style="list-style-type: none"> • Carries out pesticide residue, microbe and mycotoxin analysis for export certification
	Federal Ministry of Health	Department of Food and Drug Services	<ul style="list-style-type: none"> • Ensures food products are safe and guarantees the health of Nigerian citizens • Monitors, evaluates and sensitizes on food safety, including food poisons • Develops policies, guidelines and programmes relating to food safety and quality
	Federal Ministry of Health	NAFDAC	<ul style="list-style-type: none"> • Ensures food manufactured, imported, exported, sold and marketed in Nigeria meets food safety standards
Public health issues related to pesticide	Federal Ministry of Health	Department of Food and Drug Services	<ul style="list-style-type: none"> • Chemical management to minimize adverse effects to human health and environment

Role	Ministry name	Department/agency responsible	Specific functions (relating to pest and pesticide management)
Plant variety registration	Federal Ministry of Agriculture and Rural Development	National Agricultural Seeds Council	<ul style="list-style-type: none"> Regulates the seed industry in Nigeria Implements policy and actions regarding seed development and the seed industry Registration, release, production, marketing, distribution, certification, quality control, supply and use of seeds in Nigeria Importation and exportation of seeds Provides advice to Federal Government on seed programmes Advises on changing pattern of seed demand and farmers' needs
Agricultural research	Federal Ministry of Agriculture and Rural Development	Agricultural Research Council of Nigeria	<ul style="list-style-type: none"> Research and development Policy development Capacity building
Extension	Federal Ministry of Agriculture and Rural Development	Agric Extension	<ul style="list-style-type: none"> Dissemination of agricultural technologies to farmers Co-ordinates extension activities (public and private) Promotes ICT as a method for delivering and disseminating information
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"> Development of policy Setting levels for subsidies on fertilizers Sets tax incentives for investors and importation of agricultural equipment Increases tariffs on imports to promote home produce
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	

Analysis of existing legal framework for pest and pesticide management

Adherence to and implementation of international agreements relating to pesticides

- Nigeria became a party to the Montreal Protocol in 1988 and has taken the following steps to implement it: National Environmental (Ozone Layer Protection) Regulations, 2009 (S.I. No. 32 of 2009), which prohibit the sale, importation and export of ozone-depleting substance. The substances are listed in the third schedule. The regulations also state that phasing out the use of Methyl Bromide will be completed by 1 January 2015. Methyl Bromide is currently listed on the list of chemicals banned in Nigeria (NAFDAC 2018).
- Nigeria ratified the Rotterdam Convention in 2001 and it entered into force in 2004. Act No. 17 Treaty to Establish Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Ratification and Enforcement) Act, 2005, allows for enforcement related to adherence to and implementation of the Rotterdam Convention in Nigeria. To date, Nigeria has submitted 31 import responses, the most recent being in 2007. It has failed to provide import responses for seven pesticides. Nigeria has provided notice of final regulatory action for 23 pesticides, including 22 that are listed in Table 6 in Annex III of this report (Secretariat of the Rotterdam Convention 2018).
- Nigeria ratified the Stockholm Convention in 2004 and it came into force in 2004 and has banned the production, use, as well as the import, of persistent organic pollutants (POPs). Nigeria has submitted a National Implementing Plan for POPs management, which has been updated at regular intervals, most recently in 2016 (Federal Ministry of Environment 2016). The Plan outlines activities and strategies to be carried out, in addition to timeframes, in order to fulfil Nigeria's obligations under the Stockholm Convention.
- Nigeria ratified the Basel Convention in 1991 and it entered into force in 1992. Regulations related to adherence to and implementation of the Basel Convention include: Harmful Wastes Provision Decree No. 42 of 1988 and National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations S.I. 15 of 1991. Decree No. 42 restricts the export, import and transit of harmful waste for recovery or final disposal to any country. There is also additional legislation and there are additional guidelines in place in Nigeria for the reduction and elimination of hazardous waste generation in the country (Secretariat of the Basel Convention 2018).
- Nigeria is not a party to the ILO Safety and Health in Agriculture Convention (C184). However, it has ratified 40 ILO Conventions. Of these, 30 are in force while nine have been rejected and one abrogated (ILO 2018). Although there is no specific legislation or policy for those involved in agriculture Nigeria is a party to C011 - Right of Association (Agriculture) Convention, 1921 (No. 11), to secure for those engaged in agriculture the same rights of association as industrial workers (ILO 2018). The main occupational health and safety legislation in Nigeria is the Factories Act, CAP F1, Laws of the Federation of Nigeria (L.F.N) 2004, which covers factory workers. There is also an Employees' Compensation Act, 2010, which covers all employees – presumably including those involved in agriculture, although this is not made explicit (ILO 2016).

Overview of national regulations related to pests and pesticides management

- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Ratification and Enforcement) Act 2005.
- Federal Environmental Protection Agency Act. 1999 – Establishes the membership, functions and powers of the Federal Environmental Protection Agency.
- National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007 (No. 25 of 2007) – Establishes NESREA and its Governing Council.
- Chapter N1 National Agency for Food and Drug Administration and Control Act, 1993 (No. 15 of 1993) – Establishes NAFDAC and its Governing Council.
- Harmful Waste (Special Criminal Provisions, Etc.) Act (No. 42 of 1988) – Prohibits the carrying, depositing and dumping of harmful waste on any land or territorial waters.

- Pest Control of Produce (Special Powers) Act – Provides for the inspection of produce for pests before export at all sea and airports.
- SI of 2005 Drugs and Related Products (Registration etc.) Act 1996 (As amended) Pesticide Registration Regulations 2005.
- SI 9 of 1991 National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations.
- SI 15 of 1991 National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations.
- SI No. 32 of 2009 National Environmental (Ozone Layer Protection) Regulations, 2009 – made under the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007 – Prohibit the sale, import or export of products containing ozone-depleting substances.
- SI No. 65 of 2014 National Environmental (Hazardous Chemicals and Pesticides Regulation) 2014 – Prohibits the manufacture, formulation, importation, exportation, advertisement, sale or distribution of pesticide in Nigeria unless the pesticide has first been registered.
- Decree No. 42 of 1988 on Harmful Wastes – Currently restricts the export of hazardous wastes for final disposal in Nigeria.

Policies to promote reductions in unnecessary pesticide

The Agriculture Promotion Policy for Nigeria was developed by the Federal Ministry of Agriculture and Rural Development (FMARD) (2016) 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 safe use of pesticides, explore IPM control programmes and the use of organic control strategies. 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 hazardous pesticides (e.g. organic pesticides); improve regulation, inspection and enforcement of safe use of agrochemicals; as well as to improve quality assurance and residue testing.

Research

There is currently no policy in place which promotes research on alternatives to existing pesticides and non-chemical control measures. The need to strengthen the capacity of research institutes in Nigeria is mentioned in Section 4.3.5. of the Agriculture Promotion Policy (FMARD 2016), which promotes the future use of IPM to reduce pesticide use.

Regulations related to the manufacture of pesticides

Nigeria is not currently a major manufacturer of pesticides. The majority of pesticides are imported from other countries for reformulation, distribution and resale. No specific legislation could be found for the manufacture of pesticides but locally manufactured pesticides are required to be registered under the Drugs and Related Products (Registration etc.) Act 1996 (As amended) Pesticide Registration Regulations 2005.

Legal framework for non-chemical preventative and direct control measures

There is no legislation in place which covers registration for non-chemical preventative and direct control measures.

Price and trade policy, including subsidies

Distribution and trade is a market-driven supply process in Nigeria and there is no evidence to suggest that a subsidy scheme for pesticides is in place.

Registration

The registration of pesticides is covered by the Drugs and Related Products (Registration etc.) Act 1996 (As amended) Pesticide Registration Regulations 2005, and the Guidelines for Pesticide Registration in Nigeria (NAFDAC 2018a). The regulations detail the mandatory registration system

for pesticides in Nigeria. Part 1(i) states that “No pesticide shall be manufactured, formulated, imported, exported, advertised, sold or distributed in Nigeria unless it has been registered in accordance with the provisions of these regulations.” The definition of a pesticide in the regulations does not cover biopesticides or biological control agents.

- The registration process involves the risk-based evaluation of comprehensive scientific data demonstrating that the product is effective for its intended purposes and does not pose an unacceptable risk to human or animal health or the environment.
- NAFDAC is the body responsible for registration, which is overseen by its Governing Council.
- The National Agency for Food and Drug Administration and Control Act, 1993 (No. 15 of 1993) establishes NAFDAC as the registration body and its functions in relation to chemicals:
 - regulate and control the importation, exportation, manufacture, advertisement, distribution, sale and use of chemicals
 - conduct appropriate tests and ensure compliance with standard specifications
 - conduct investigations into the production premises and raw materials of chemicals and establish relevant quality assurance systems, including certificates of the production sites and of the regulated products
 - inspection of imported chemicals and establishing relevant quality assurance systems, including certification of the production sites and of the regulated products
 - compile standard specifications and guidelines for the production, importation, exportation, sale and distribution of chemicals
 - registration of chemicals
 - control the exportation of, and issue quality certification for, chemicals
 - establish and maintain relevant laboratories or other institutions in Nigeria
 - pronounce on the quality and safety of chemicals after appropriate analysis
 - advise federal, state and local governments, the private sector and other interested bodies regarding the quality and safety of, and regulatory provisions on, chemicals
 - undertake and co-ordinate research programmes on the storage, adulteration, distribution and rational use of chemicals
 - issue guidelines on, approve, and monitor the advertisement of chemicals
- Nigeria signed the regulation c/reg.3/05/2008 on Harmonization of the Rules Governing Pesticides Registration in the Economic Community of West African States (ECOWAS) region in 2008, but to date these have not been incorporated into national legislation.
- The application registration process has the following requirements: i) the pesticide has to be manufactured or formulated in NAFDAC-approved establishment; ii) the application must be completed using an application form obtained from NAFDAC; iii) the application must be accompanied by the correct fee; iv) a sample of the pesticide must be provided.
- Information required to be included in the application includes: certificate of analysis, certificate of manufacture, specimen label, name of the formulation, composition, environmental effects/fate, degradation, metabolism in plants and animals, toxicological data, teratogenicity and mutagenicity studies, residue levels for intended use, efficacy data from trials in Nigeria, method of application of dose, directions for use, disposal of containers, precautions including first aid and a note to a physician.
- No information is available on how the registration body makes its registration decisions or the types of final decisions the registration body can make.
- There is a requirement that the registration decision will be communicated to the applicant within 80 working days.
- There are no special requirements for pesticide registration specified in the legislation and no definitions for low-toxicity / low-risk pesticides are defined.
 - There is currently no legislation which provides for distinct registration pathways for biopesticides / biological control agents. However, in 2014 NAFDAC published the following draft regulations, which to date have not come into force: Biopesticides Registration Regulation 2014 (Draft); Biopesticide Labelling Regulation 2014 (Draft); and Biopesticide Advert Regulation 2014 (Draft). The draft regulations prescribe the minimum requirements for the importation, exportation, manufacture, distribution,

advertisement, sale and use of biopesticides in Nigeria. The legislation contains distinct registration pathways for biopesticides and defines biopesticides in Section 3 as: i) microbial pesticides; ii) biochemical pesticides; and iii) plant incorporated pesticides.

- The draft legislation requires identification of the genus and species name of the microorganism and the minimum number of active viable cells present.
 - Safe data sheets are requested to be submitted with the application, outlining the hazard identification, toxicological information, environmental information and details of personal protective equipment (PPE) to be used.
 - Field trial reports from two agro ecological zones for two cropping seasons to determine the efficacy of the biopesticide, carried out in Nigeria by agency-approved research institutes.
- The pesticide registration legislation states that a successful application will remain valid for five years and products need to be re-registered after this time period. No procedure is described for the denial, appeal or label extension, although it specifies that if a product is found to be of doubtful value, harmful or subject to misuse it will not be considered for registration.
 - NAFDAC is the responsible agency for compiling the national pesticide register although the register is not published on their website. It should be available to the public for purchase on request through their offices. The latest version available is published by Agriculture Nigeria (2017) on their online hub. The information contained in the list includes: trade names of products, NAFDAC registration number, the names of AI, concentration, country of origin, formulation type for some pesticides and the name of the registrant and the period of registration. Authorized use, including crops and target pests, is not included.
 - The date of publication is not indicated in the list and the regulations do not specify how often the list is required to be updated. The latest date of registration in the currently available list is 2010.
 - NAFDAC publishes a separate list of banned and severely restricted chemicals (undated) on their website (see Table 6 in Annex III of this report). A separate list for biopesticides is not available.

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 chemical and pesticides under the Prior Informed Consent and Persistent Organic Pollutant Conventions.

Analysis of registered pesticide list for HHPs and alternatives

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. The number of individual AI registered in the list is 85 and 481 different products are registered. The number of different registrants is unknown as a breakdown is not provided and the electronic file cannot be reformatted to conduct a search and summary. Although NAFDAC does not provide a copy of the registered pesticide list on their organizational website it does publish a list of banned pesticides. This list of banned and restricted pesticides is available on the NAFDAC website and contains 40 AI (see Annex III - Table 6), but the last time it was updated is not specified.

Biocontrol agents which are not covered by the national authority which handles registration of pesticides, e.g. macro-organisms

The current legislation or draft legislation for biopesticides does not contain any provision regarding export, shipment, import and release of biological control agents and other beneficial organisms.

Packaging and labelling

The NAFDAC Guidelines for Pesticide Registration in Nigeria (NAFDAC 2018a) address pesticide labelling. Labelling requirements apply equally to imported and domestically manufactured products. All pesticides submitted for registration in Nigeria are required to include the following as a minimum:

- name of product (brand)
- name(s) of the active ingredient(s), including weight or volume
- net content
- batch number, manufacturing date and expiry date
- name and address of manufacturer
- precautions for storage and handling
- directions for safe use
- disposal method

Under the Chemical Monitoring Division Guidelines for Distribution of Chemicals in Nigeria Nafdac/Ncs/003/00 (NAFDAC 2018c) guidelines are given for person(s), companies and other stakeholders distributing chemicals in Nigeria. In the guidelines it states, under Section D, that label information packaging should conform to the Global Harmonized System (GHS). It also states under Section E, relating to retailers, that chemicals should be sold in their original containers and chemical distributors should not dispense or repackage chemicals except with permission from NAFDAC.

Marketing

The Registration and Regulatory Affairs Directorate of NAFDAC is responsible for controls on advertising. 3.1.f. of the Pesticide Registration Regulations 2005 states that the applicant has to submit in writing that every advertisement of the pesticide shall be submitted to NAFDAC for approval before publication. The Guidelines for Pesticide Registration state, in addition, that registration of a product does not automatically confer an advertising permit and a separate approval for advertising is required. NAFDAC may withdraw the certificate of registration if the product is advertised without approval from the Agency.

Transport

There is currently no regulation in place addressing the transport of pesticides.

Import and export

The Pesticide Registration Act 2005 Section 1(i) states that no pesticide can be imported or exported without registration. No exceptions are specified in the legislation and no other details are given.

Requirements for sale

The Drugs and Related Products (Registration etc.) Act 1996 (As amended) Pesticide Registration Regulations 2005 contains a single provision addressing the sale of pesticides, stating that they have to be registered. No other guidance is given in the document.

Licensing

Guidelines for Obtaining Listing Certificate/Warehouse Inspection (Nafdac/Cer/Frs/Lcwi/2017/00) are available for anyone who wishes to market chemicals locally or through import. NAFDAC also imposes specific and more restrictive requirements for severely restricted pesticides. An inspection has to be carried out to inspect the storage facility of any entity applying for a licence. A system exists to receive and evaluate applications, in order to assess risk. However, there are no criteria specified for the granting or denial of a licence. The terms of validity and the procedures for renewal of the licence are included and a system is in place for NAFDAC to impose fees for services associated with licensing. Details of an appeal process linked to the licensing scheme are not included in the pesticide legislation of guidelines.

Availability

The legislation contains no provision to regulate the availability and use of pesticides in accordance with the hazards involved and the existing levels of user training.

Handling and use, including regulations on application equipment

In Schedule XIV of the National Environmental (Hazardous Chemicals and Pesticides) Regulations a general code of practice is outlined for the safe use of pesticides. It covers spraying equipment, drift, provision of protective equipment, and health monitoring; and it recommends recyclable containers. However, these are just recommendations. An employer is required to protect the health and safety of their workers at the workplace in accordance with the provisions of the Factories Act and Labour Law but there is nothing specific in this legislation for agricultural workers. The legislation states that training and PPE will be provided to workers in the course of their normal jobs.

Restrictions related to vulnerable groups

The legislation does not contain any provision to prevent the use of pesticides by, and sale of pesticides to, children or pregnant and nursing women.

Requirements for PPE

There is no legislation that prescribes the use of PPE for the application of pesticides.

Storage

The Guidelines Obtaining Listing Certificate/Warehouse Inspection (Nafdac/Cer/Frs/Lcwi/2017/00) includes the following text:

- “...4.1 Applicants shall have a warehouse that will be inspected for adequacy and appropriateness for the storage of chemicals.
- 4.2 Warehouses located in residential buildings are not acceptable.
- 4.3 For rented warehouses, evidence of payment of rent for a minimum of one year or certificate of ownership in case of companies using their own warehouse.
- 5. Safety requirements: Fire extinguishers, nose masks, hand gloves, eye goggles, overalls, safety boots, source of running water and first aid box.”

Disposal of unused pesticides

The Harmful Waste (Special Criminal Provisions, Etc.) Act provides a clear framework for prosecuting anyone who is found to have dumped harmful waste.

Disposal of empty pesticide containers

Regulations are not in place to address the disposal of empty pesticide containers.

Post-registration monitoring

No policy is in place to collect reliable data and maintain statistics on the health effects of pesticides and pesticide poisoning incidents / environmental contamination.

Residue monitoring in food and Maximum Residue Levels (MRLs)

No legislation could be found that contains any provision to regulate and/or monitor pesticide residues in food. This is the mandate of SON. SON is responsible for setting the MRLs, following those MRLs set by the Codex Alimentarius.

Other relevant human health and environmental protection regulations

None.

Compliance and enforcement

There is no legislation that contains a provision to prohibit the import, packaging, re-packaging, transportation, distribution or sale of a pesticide unless it is packaged in accordance with criteria provided in the law.

NAFDAC is responsible for inspection and there is provision in the Drugs and Related Products (Registration etc.) Act 1996 (As amended) Pesticide Registration Regulations 2005 that inspectors should be trained and fully qualified. NAFDAC also defines those actions that will be considered as offences, and the consequences of the infringement, such as the revocation of a licence used in connection with the commission of the offence.

Analysis of good agricultural practice (GAP)/good crop management and other voluntary standards

Overview of voluntary standards / certification schemes applied in relation to the focal crops

After consultation with GIAE staff and key stakeholders it became evident that farmers do not apply voluntary standards to cassava, Irish potato, maize and rice crops in Nigeria. This may be because the study's focal crops are only produced and traded locally. Any of the crops that are exported are mainly exported to neighbouring countries within the region.

Voluntary standards which are applied in Nigeria are mainly applied for export commodities. Rain Forest Alliance, UTZ Certified and Organic are currently all running schemes for certified cocoa production and there is a demand to buy these products, particularly in Europe. Other export markets with certification include fruit and vegetables.

Voluntary standards that could be applied to cassava, Irish potato, maize and rice, and that are applied in other countries, include: GlobalGap, Organic and Fair Trade. UTZ certification schemes in African countries mainly focus on commodity crops such as tea, coffee, shea, cocoa, sugar, flowers and fruit. The Sustainable Rice Platform has recently been launched and is a multi-stakeholder platform which was established in 2011 by UN Environment and the International Rice Research Institute (IRRI) to promote resource efficiency and sustainability in supply chains in the global rice sector. Members include Fair Trade, GlobalGap, Rainforest Alliance, UTZ and GIZ. Details of the performance indicators can be found at <http://www.sustainablerice.org>.

Analysis of GAP / good crop management and other voluntary standards applied to focal crops

Major voluntary standards criteria relating to pest and pesticide management usually fall into specific categories (IPM, pesticide management, safety and environmental protection) and have to be addressed to varying degrees depending on the certification applied (Annex VII – Figure 8). The following analysis examines how stringent the requirements are. Fair Trade certification does not address site selection, or adequate disposal of spraying mixtures. Only soft detailed requirements are given for adequate storage and disposal of pesticide containers and waste disposal. High-level guidance and strict detailed requirements are given for other criteria relating to IPM, pesticide management, safety and environmental protection. GlobalGap certification does not address site selection, require the use of HHP to be banned or necessitate the provision of bathing facilities for workers applying pesticides. Most other categories provide high-level guidance or strict detailed requirements. The only categories Organic certification addresses with high-level guidance and strict detailed requirements are site selection, that preventative measures should be implemented, that pest control should be based on monitoring and that use of HHPs is banned. Organic certification also addresses soil, water and biodiversity conservation. Farm economic stability and provision of capacity building are only adequately addressed by UTZ, with some requirements included in Fair Trade certification.

State of science on crop protection

Cassava: best management practices

African Cassava Mosaic Disease (ACMD)

ACMD is caused by a virus and widespread throughout Nigeria. The virus is spread through the use of infected planting materials and is transmitted by the whitefly, *Bemisia tabaci* (CABI 2017a). As there are no pesticides for controlling viruses and spraying the vector is often ineffective and uneconomic, management of ACMD takes place largely through phytosanitation and the use of resistant planting materials (Thresh and Cooter 2005).

Prevention

- Practice good crop hygiene by removing all diseased plants and crop residues from the field before planting the new crop (Thresh and Cooter 2005).
- Use only healthy disease-free stem cuttings as new planting material (Thresh et al. 1994).
- Plant ACMD-resistant/tolerant varieties that are available in Nigeria.

Monitoring

- Inspect plants weekly for at least the first two to three months of growth (Guthrie 1990). Symptoms include the characteristic mosaic on the leaves; distortion and reduction of leaf size may also occur. If symptoms of the disease are observed, remove diseased plants from the field.

Cultural control

- Remove (rogue out) all diseased plants from the field (Thresh and Cooter 2005).

Cassava Bacterial Blight (*Xanthomonas axonopodis* pv. *Manihotis*)

Bacterial blight is a widespread and major constraint to cassava production. The disease thrives in wet conditions and is often most prevalent in the wet season or the beginning of the dry season. Losses can be greatly reduced by the implementation of a combination of management methods (CABI 2017b).

Prevention

- Use only healthy, disease-free planting material produced at certified sites (Boher and Verdier 1994; Lozano 2009).
- Plant resistant/tolerant varieties if available (Boher and Verdier 1994; CABI 2017b).
- Early or late planting can reduce the disease incidence (Boher and Verdier 1994).
- Conduct crop rotation for at least one rainy season (or six months), combined with burying or removing and burning all crop residues before planting the new crop (Lozano 1986).
- Increasing potassium levels in potassium-deficient soils has been reported to increase resistance to the disease (Odurukwe and Arene 1980).
- Intercropping with maize or melon has been reported to reduce the incidence of the disease (Ene 1977; Fanou 1999).

Monitoring

- Monitor the crop regularly, especially during the wet season, for symptoms such as leaf spots, wilting, dieback, gummy exudate on young shoots and discolouration of the vascular tissue (Lozano 2009).

Cultural control

- Remove (rogue out) all diseased plants from the field. Pruning diseased plants has also been reported to delay the spread of the disease (Ene 1977).

Irish potato: best management practices

Late blight (*Phytophthora infestans*)

Late blight is a disease caused by a water mould (oomycete). It affects both the above-ground part of the plant and the tubers below the surface, and spreads very quickly when the weather is wet and conditions are humid.

Prevention

- Sow certified healthy seed tubers that are free from the disease (CABI 2018c, Frost et al. 2013, Ghorbani et al. 2004).
- Use resistant/tolerant varieties of seed potatoes for planting where they are available and have been tested for conditions in Nigeria. It has been reported that many imported varieties of seed potatoes are not suitable for planting in Nigeria (Ugonna et al. 2013).
- Reduce inoculum levels by removing all crop debris, culled and unharvested potatoes, and remove from the field (CABI 2018c).

Monitoring

- Inspect the crop weekly, looking for symptoms on the leaves which appear as water-soaked spots, turning into irregularly dark-brown to black shaped lesions which increase in size as the disease progresses (Namandaa et al. 2004).

Cultural control

- Remove all diseased plants from the field as soon as symptoms are seen. If a hotspot occurs destroy the whole section of the crop (CABI 2018c).

Chemical control

- Azoxystrobin [GIZ Classification D], metalaxyl-M (mefenoxam) [GIZ Classification C] and copper oxychloride [GIZ Classification C] are all effective against *P. infestans*. These fungicides can be used as preventative measures when wet conditions are expected or as soon as the first symptoms are seen on the crop

Bacterial wilt (*Ralstonia solanacearum*)

Is a widespread bacterial disease which attacks the underground parts of the plant causing the leaves to wilt and the tubers to rot internally. The disease is very difficult to manage and relies on preventative and cultural methods.

Prevention

- Use certified seed tubers (CABI 2017d; Frost et al 2013)
- Do not cut the tubers in half when planting leave them whole (CABI 2017d)
- Perform a long rotation (2 years or more) without Solanaceous crops such as tomato and garden egg (CABI 2017d; Kurabachew and Ayana 2016; Lemaga et al. 2001)
- Avoid excessive surface water when irrigation is used (Janse 1996)
- The placement and burial of a green manure can reduce the damage caused by the bacteria and allow better yields. The wild sunflower *Tithonia diversifolia* has given good results (Fontem and N'tchorere 2009, Justo et al. 2013)

Chemical control

- There is no effective chemical management methods for this disease (CABI 2017d)

Potato tuber moth (*Phthorimaea operculella*)

The larvae of the potato tuber moth damages both potato foliage and tubers (CABI 2018a). It is one of the most damaging pests in the tropics and subtropics. Damage caused by this pest in stored potatoes can range from 25% to 100% of stored tubers (Aryal 2015).

Prevention

- Use only healthy tubers for planting material (Lal 1991).
- Deep planting: plant tubers at 15cm or lower, ridge the field six to seven weeks after planting so the tubers are buried at least 25cm below the ground (Raman and Booth 1983).
- Keep the soil moist to prevent cracking. When the soil cracks adult moths can gain access to the tubers to lay their eggs (Raman and Booth 1983).
- Early planting and early harvesting can reduce levels of infestation (Raman and Booth 1983).
- Four weeks before harvest mulch with neem leaves to repel the adult females (Ali 1993).
- Infestation levels can be reduced by practising crop rotation for two years. Do not plant susceptible crops, such as tomato and garden egg (Raman and Booth 1983).
- Remove culling piles and volunteer potatoes as they can cause re-infestation the following season (Shelton and Wyman 1980).

Monitoring

- Monitor plants in the field every week from sowing until harvest, looking for symptoms on leaves, stems and tubers. Look for mines on the leaves and stems and weakened or broken stems (CABI 2018a).
- Cut open 10 stored tubers once a week and look for irregular galleries inside the tubers caused by the larvae.

Biological control

- Field treatment and storage treatment with *Bacillus thuringiensis* (Bt) has been found to be effective against potato tuber moth, especially *Bt kurstaki* (Aryal 2015).

Chemical control

- Apply chlorpyrifos, fenitrothion, cypermethrin and deltamethrin [all GIZ classification B] in the field on the appearance of the pest, then follow up with two or three repeat applications (Raj and Trivedi 1993).

Maize: best management practices

FAW (*Spodoptera frugiperda*)

FAW is a Lepidopteran pest that feeds on the leaves and stems of maize, rice, sorghum, sugarcane and other crops (CABI 2018b). In maize the larvae can burrow into the cobs and destroy the growing tip, causing the plant to die.

Prevention

- Early planting to avoid high populations of the pest in areas where the pest has not become established.
- Do not plant a new maize crop near an infested field.
- Intercrop with cassava, beans or another legume (Abrahams et al. 2018).

Monitoring

- Scout the field at least once a week as soon as plants emerge.
- Look at 100 plants to assess the damage (Abrahams et al. 2018).
- Look for egg masses on the leaves: they are usually covered with a protective grey-pink protective layer of scales (CABI 2018b).
- Look for the larvae, which are light-green/dark-brown caterpillars with longitudinal stripes down their body, a dark head, with a white/yellow pale upside-down Y shape.
- Look for ragged leaves on the stem and growing from the whorl.
- Frass can accumulate in the whorl of the maize plant.

- Start treatment if more than 20 whorls have damage and the small larvae are still present (King and Saunders 1984).
- Once the maize is at tassel and silk stage, do not spray.

Cultural control

- While scouting to identify if infestation is low, handpick any eggs masses and larvae found, and destroy.

Biopesticide control

- Apply azadirachtin (NeemAzal) [GIZ classification D] or Bt (BiPel) [GIZ classification D]

Chemical control

- As a last resort, apply a lower-risk synthetic insecticide approved by the government but spray early in the morning or afternoon when the pest is more active.

African maize stalkborer (*Busseola fusca*)

Busseola fusca is a major pest of maize in West Africa. Maize plants are less tolerant to stemborer attack than sorghum and pearl millet plants, and the effect on grain yields is therefore greater (CABI 2018c). Stalk borer can be managed adequately using preventative/cultural control. The use of synthetic chemicals on maize is uneconomical.

Prevention

- Early planting to avoid high numbers of the pest at the peak of the season (Addis 2016; Kfir et al. 2002).
- Intercropping maize with cassava or legumes has been found to significantly reduce the rate of infestation of maize by stalk borer (Addis 2016; Kfir et al. 2002).
- Managing crop residue after harvest is important in reducing carry-over of the pest into the next season. Plough in the crop stubble or bury 10–15cm below the surface Kfir et al. 2002).

Rice: best management practices

Rice blast disease (*Magnaporthe oryzae*)

Rice blast is a fungal disease of rice that can cause heavy losses under favourable climatic conditions (CABI 2018d).

Prevention

- Plant varieties which are resistant/tolerant to rice blast (CABI 2018d, IRRI 2017a).
- Plant early, at the beginning of the rainy season (IRRI 2017a).
- Nitrogen must be provided in several applications (two or more). An excess of nitrogen increases the damage caused by the disease (Afolabi and Adigbo 2014; CABI 2017d; IRRI 2017a; Xu et al. 2006).
- Avoid water stress and immerse the fields as often as possible (CABI 2018d, IRRI 2017a).

Monitoring

- Initial symptoms are white to grey-green lesions or spots on the leaves, with dark-green borders. As the disease progresses older lesions become elliptical or spindle-shaped, whitish to grey in the centre, with a brownish-red or necrotic margin. The lesions can widen and join together, eventually killing whole leaves (IRRI 2017a).

Chemical control

- A systemic fungicide, such as azoxystrobin [GIZ classification D], can be applied at heading (IRRI 2017a).

Rice stemborers (*Maliarpha separata*, *Scirpophaga* spp., *Chilo* spp., *Sesamia* spp.)

Many different species of stemborers affect rice and feed on rice plants from the seedling stage until harvest.

Prevention

- Plant resistant varieties. Varieties such as LAC 23, ITA 121, TOS 4153, NERICA 1, NERICA 2, NERICA 4, NERICA 5, NERICA 7 and NERICA 14 have been reported to be tolerant/resistant to rice stemborers (IRRI 2017b, Mück 2015; Nwilene et al. 2013).
- Destroy egg masses at the seedling stage and during transplanting. Cut the leaves to shorten them during transplanting to limit the number of eggs from the seedbed to field (IRRI 2017b).
- Avoid staggering the planting dates, as the pests will move from one crop to another (IRRI 1985; (IRRI 2017b).
- Vetiver (*Vetiveria zizanioides*) or Sudan grass may be used as a trap crop for species of the genus *Chilo* ssp. Plant a strip at the edge of the field: this will attract the stemborers to lay eggs on the trap crop. The eggs will not develop as the trap crops are toxic to borers (Van den Berg 2013, XuSong et al. 2009). Important note: this technique has been effective in Asia against another species of the genus *Chilo*, it has not been tested on rice in West Africa (only on maize). There is no scientific study to prove the effectiveness of this measure on rice Africa.
- In flooded cultivation, periodically raise the water level to submerge the eggs laid at the plant base (IRRI 2017b).
- Avoid excess nitrogen – stagger the application (IRRI 1985, 2017b, Randhawa, Aulakh 2014).
- When harvesting, cut the stems at their base to eliminate the larvae in the straw. Dry the straw in the sun or burn it to kill the larvae (IRRI 2017c, Mück 2015).
- Eliminate crop residues and volunteer regrowth by ploughing and flooding the field (IRRI 2017b, Ramzan et al. 2009, Mück 2015).

Monitoring

- Monitor 20 tufts of rice and consider treatment only if more than two clumped egg masses are seen during the first two months then more than one egg mass on 20 clumps afterwards (IRRI 2017b).

Chemical control

- Chlorpyrifos (Dursban 4 EC) can be applied to manage stemborers [GIZ classification B].

Review of GAIEs extension material

The material reviewed consisted of six producer reference guides, covering cassava, Irish potato (rain-fed and irrigated), maize and rice (rain-fed and irrigated).

In general, the material was very good and the general information was consistent throughout the six guides. The guidelines for pesticide use could be improved by adding information on the observance of pre-harvest intervals and re-entry intervals. More specific information could be added on the safe storage of pesticides (i.e. in a labelled, locked location outside of the house), calibration of the application equipment, washing and maintenance of application equipment, and additional use of PPE.

There was very little information on pest and diseases and their management in any of the guides, apart from the guide for potato. This information should be included so farmers can identify the problem and manage it accordingly. The potato guidelines included disease 'factsheets', with an image of the symptoms and a basic description and recommendations for management. It would be good to include similar 'factsheets' in all of the guides.

Irish potato: If there are tolerant/resistant varieties available for potato diseases available in Nigeria the varieties should be given in the guidelines. There was no fungicide control option given for late blight of potato – this could be added to increase the options available.

Cassava: The main pests and diseases should be included. The only pest currently mentioned is grasshoppers. During the workshop several pests were identified as being constraints to cassava production: ACMD, bacterial blight, anthracnose, mealybug, cassava mites and whitefly.

Maize: Again, there is a need to add main pests and diseases to the guide, including management of FAW. A list of authorized insecticides is included for management of maize insect pests and the AI in all recommendations is cypermethrim. It would be advisable to consider including other AI with different modes of action in the recommendation, to avoid resistance occurring.

Rice: The main pests and diseases and their management options need to be included

Threshold levels for the various pests and diseases need to be included so farmers know when to start the various management methods.

Biopesticides are becoming more widely available in Africa. Consider recommending Bt or azadirachtin as alternatives to synthetic insecticides, if they are available.

During the stakeholder workshop GIZ requested that the CABI facilitators he draft script for the 'Safe use of pesticide' 3D animation review was also carried out of the

Pesticide hazards, assessment of risks and documented harmful effects of pesticides

Stock-taking of HHPs which are registered, and their use - Hazard identification: Identification of the HHPs and other hazards associated with pesticides which are registered in the countries.

The 85 AI registered in Nigeria differ in terms of their overall hazard level (Figure 1): 25 of the AI which are allowed for use meet one or more of the HHP criteria; 24 AI are categorized as "danger" (one or more of the associated human health hazard statements indicate that the AI is "toxic" or "fatal if inhaled"); 32 AI are categorized as "warning"; one AI is categorized as "low hazard" (there are no known human health hazard statements associated with the AI); and key human health hazard data are missing for three AI. The AI which are identified to be HHPs are listed in Annex IV.

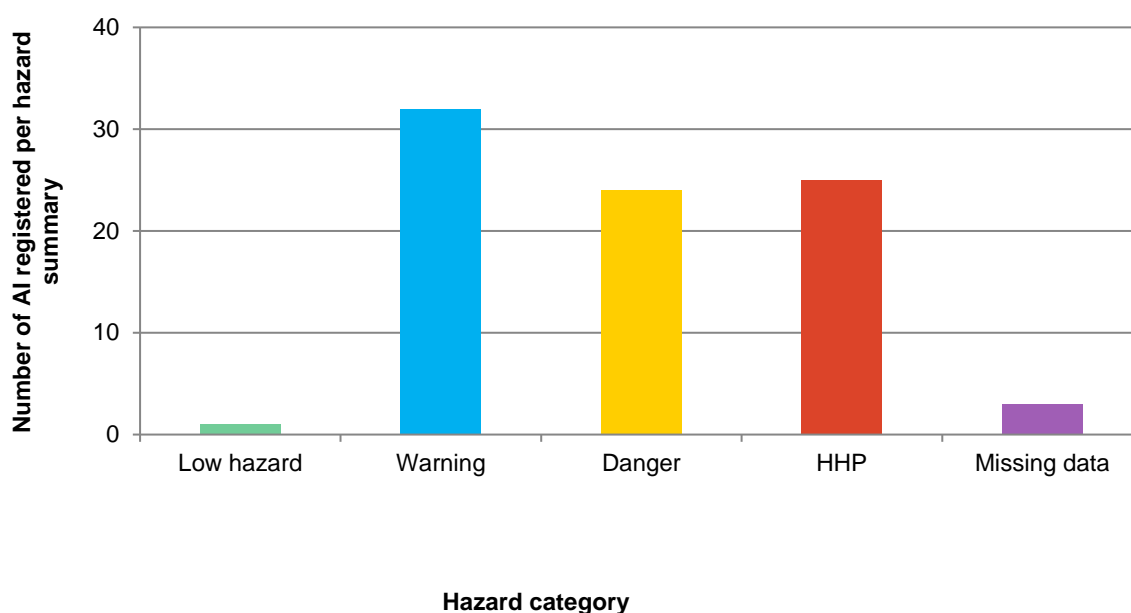


Figure 1. Number of AI in each hazard category

Of the HHPs identified, 40% are carcinogens, 40% are either extremely or highly acutely toxic, 16% are reproductive toxins and 8% are mutagens (Figure 2). Carbofuran, endosulfan and monocrotophos all require prior informed consent under the Rotterdam Convention, and

endosulfan is also a POP listed in the Stockholm Convention. For several AI, more than one of the HHP criteria are met: benomyl, carbendazim, endosulfan and monocrotophos.

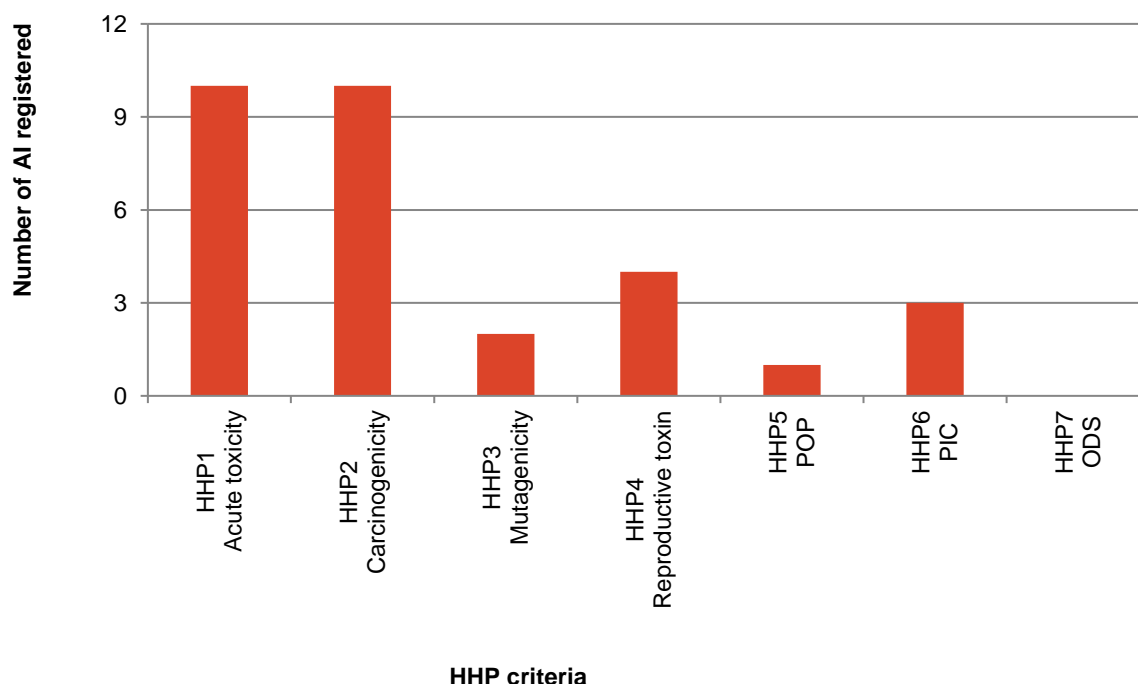


Figure 2. Number of HHP AI allowed for use per HHP criteria

In addition to the information on the HHP criteria, the compiled GHS hazard statements identify other human health and environmental hazards. Irritation to the skin, eyes or respiratory tract are frequently listed as potential health effects (35 AI). Other human health effects which are identified include endocrine disruption (16 AI), allergic reactions (28 AI), the potential for serious eye damage (28 AI) and the potential for organ damage (both specific and general, 32 AI). The human health hazard statements covering health effects are included in the determination of hazard category. With respect to environmental hazards, 72 AI were found to be very toxic to aquatic organisms, often with the potential for long lasting effects. Data on pollinator hazards are available for 27 AI, and, of those that were assessed, eight AI were found to be very toxic or very highly toxic to bees.

None of the AI are listed as candidate POPs. Fifteen of the identified AI are currently listed in the Rotterdam database of notifications of final regulatory action. Forty-seven of the AI are included in the Pesticide Action Network (PAN) HHP list (2016). On an AI basis, almost 49% of the AI are allowed for use in the EU (approved = 41 AI) or pending approval for use in the EU (pending = one AI), whereas the other 51% are not allowed for use in the EU (not approved = 32 AI) or otherwise not listed (10 AI). Refer to Annex V for information on the specific AI.

Seven of the identified AI are allowed for use in organic agriculture in that they are listed in Annex II of Commission Regulation (EC) 889/2008. Twelve of the AI are classified as U (unlikely to cause acute hazard under conditions of normal use) in the *WHO Recommended Classification of Pesticides by Hazard* (2009). Several (eight) of the AI identified through this study are not listed in the 2009 classification.

Per the GIZ procurement policy, 11 AI fall into procurement category A (not allowed), 46 AI fall into procurement category B (only as exception, elaborate verification needed), 13 AI fall into procurement category C (only by authorized staff with strict protection; not for small farmers) and 11 AI fall into procurement category D (appropriate precaution) (Figure 3). Four of the AI have not been classified by GIZ.

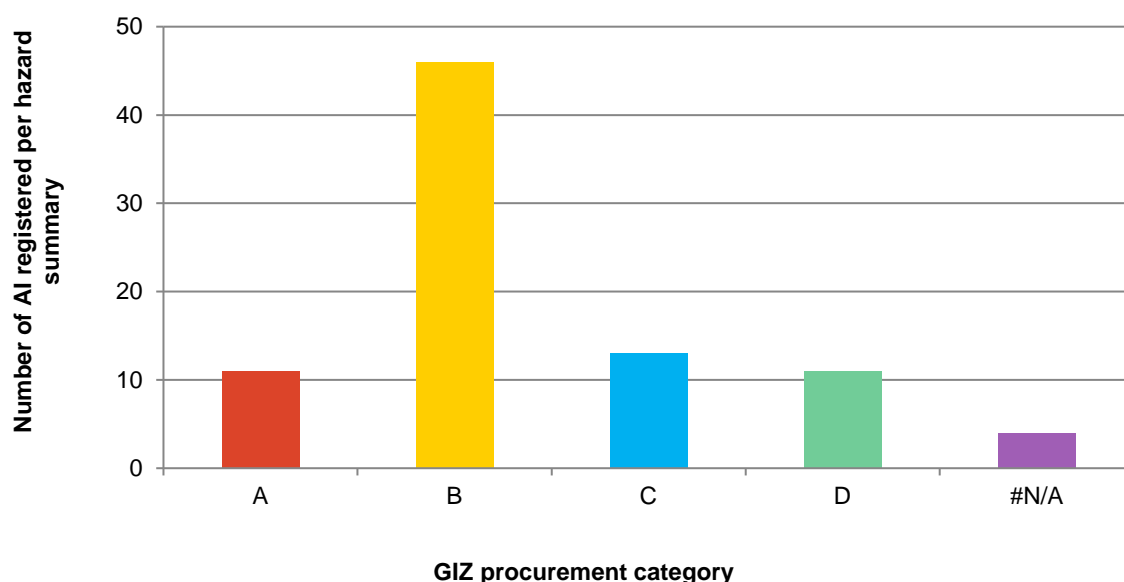


Figure 3. Number of AI per GIZ procurement category

The list of registered pesticides for Nigeria does not indicate for which crop and which pests the pesticides are registered. Based on data from registrations for similar crops and pests and other countries, lists of the HHP and non-HHP pesticides which are registered and likely to be used for the key pests of each focal crop were compiled (Annex VI).



Conclusions

Main findings and recommendations for action

SWOT analysis carried out during the stakeholder workshop

<p><u>STRENGTHS</u></p> <p>Extension services</p> <ul style="list-style-type: none"> • Existence of a network of public and private (NGOs) extension systems • Existence of a research-extension-farmer linkage approach to technology transfer • Support from development projects • Existence of women and youth empowerment programme (Npower, YEAP) • Coordinated approach to the development of extension services (federal to state) <p>Implementation of IPM in value chains</p> <ul style="list-style-type: none"> • Existence of less cumbersome and capital-intensive IPM strategies • Reduction in pesticide use • Existence of biopesticides in the market <p>Pesticide management</p> <ul style="list-style-type: none"> • Existence of projects contributing to the elimination of obsolete pesticides • Existence of Act 803 • Nigeria is a signatory to major international protocols and conventions on pesticides and plant protection • Existence of NAFDAC Act CAP N1, Law of the Federation of Nigeria, 2004 • Existence of NESREA ACT CAP164 Law of the Federation of Nigeria, 2004 	<p><u>WEAKNESSES</u></p> <p>Extension services</p> <ul style="list-style-type: none"> • Fewer personnel than needed • Ageing extension personnel/experienced ones leaving • Inadequate extension materials on crop protection • Inadequate extension training materials • Slow development of ICT in extension delivery • Insufficient documentation of tested experiences in IPM • Insufficient knowledge in diagnosing diseases and pest problems (production and post-harvest) • Inadequate knowledge of registered pesticides for the different crops • Weak synergies between research and extension • Inadequate support for extension services <p>Implementation of IPM in value chains</p> <ul style="list-style-type: none"> • Weak capacities in identification and analysis of the economic importance of pests and their natural enemies • Weak in-country capacities to determine MRLs • Few farmers trained in IPM • Some IPM strategies are laborious • Poor knowledge of the interaction across economy–human health–environment during the implementation of IPM strategies • Weak institutional and organizational structures of farmer-based organizations and chain actors in general <p>Pesticide management</p> <ul style="list-style-type: none"> • Insufficient pesticide inspection personnel prevents systematic pesticide control • Registered pesticide list not readily available to all • Lack of disposal sites in the country • Accessibility of supporting documents to pesticides laws affects implementation • Sanctions not severe enough to deter offenders • Poor knowledge on part of actors on the major international protocols and conventions on pesticides and plant protection that the country is signatory to • No strong political will to enforce existing sanctions
<p><u>OPPORTUNITIES</u></p> <p>Extension services</p> <ul style="list-style-type: none"> • Presence of communication channels and extension tools • Presence of local trainers (lead farmers) • Presence of input dealers giving technical advice <p>Implementation of IPM in value chains</p> <ul style="list-style-type: none"> • Farmers interested in trying new methods of pest control • Meeting national and international quality standards • Boosting consumer confidence by preserving the health of chain actors and the environment • Promotion of contractual models of production and supply 	<p><u>THREATS</u></p> <p>Extension services</p> <ul style="list-style-type: none"> • Decreasing budgetary support from projects • Exodus from rural areas to urban areas (farm labour problems) • Institutional instabilities (changing ways of doing things) • Insecurity in predominantly farming communities • Policy instability <p>Implementation of IPM in value chains</p> <ul style="list-style-type: none"> • Climate change • Degradation of natural resources • Lack of motivation and youth not interested in agriculture

<ul style="list-style-type: none"> • Promotion of the private sector in biopesticides production • Existence of spray gangs and mechanization service providers who are sometimes well trained • Farmers are compelled by the recent inflationary situation to source other options of pest control due to the rising prices of imported chemical pesticides <p>Pesticide management</p> <ul style="list-style-type: none"> • Pesticide distributors financing the collection and disposal of empty containers (e.g. the Candel Company) • Existence of producer responsibility programmes to take care of packaging materials and waste emanating from their products 	<ul style="list-style-type: none"> • Relatively high prices of pesticides • Existence of HHPs • Existence of unregistered pesticides on the market • Incompetent pesticide distributors and retailers giving extension advice • Detection of pesticide residues in farm produce leading to rejection by industries and individual consumers, both locally and internationally • Competition from safe produce <p>Pesticide management</p> <ul style="list-style-type: none"> • Uncontrolled influx of HHPs • Inadequate funding • By-passing regulation for registration
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Stakeholder perspectives

An in-country workshop was held for stakeholders from the focal crop value chains where the results of the study and the recommendations were presented. The stakeholders were then able to validate the recommendations and discussed their implementation. All of the participants recognized that there are gaps in the legislative framework for pesticide management. There is considerable overlap in the mandates of NAFDAC, NESREA and NAQS. The representative from NAFDAC informed us during the workshop that this is a known issue and NAFDAC, NESREA and other agencies involved in pesticide management had recently met to discuss redefining the roles and responsibilities of each of the agencies. There is no information on the last time the national registered pesticide list was updated and after highlighting the importance of the document during the workshop the participants from NAFDAC agreed to look into the issue.

A lack of capacity on the part of extension agents in relation to pest and disease management, and the need to provide them with better support and training, was highlighted. The availability of low-quality and counterfeit pesticides is also an issue in Nigeria and weak enforcement from the government exacerbates the problem. Concerns were raised about farmers' handling of pesticides and the need to train them in the correct procedures regarding the application and use of PPE. Participants also suggested that farmer representatives for the focal crops should have been invited to participate in the workshop and that the results and recommendations should have been circulated before the workshop to enable the relevant agencies to provide documentation to fill in some of the gaps particularly for legislation and policy.

Recommendations for the implementation of priority, innovative measures in crop protection in the selected value chains

- Develop pest management practices for all focal crops (with the exception of Irish potato) - especially in relation to FAW – to supplement the GIZ value chain guidelines.
- Where possible, introduce the concept of threshold levels for more efficient management of pests and diseases.
- Promote the use of lower hazard pesticides, such as biopesticides.
- Consider setting up plant clinics for farmers in the regions where the GIAEs initiatives are operating.

Priority advisory needs in crop protection in the country

- Carry out mass sensitization on safe post-harvest handling and advocacy, and sensitization on mycotoxins (aflatoxin).
- Explore social media as an avenue for the dissemination of updated advisory materials.
- Use social media to link extension agents to experts for diagnostic support.
- Conduct a series of radio programmes in local languages and dialects on IPM for farmers.
- Promote pest and disease information provision using ICT (e.g. Plantwise FactsheetApp for extension agents).
- GIZ should consider doing a series of 3D animations on management of key pests and diseases.

Recommendations for pesticide management

- Specialized training for extension agents and lead farmers on reading and understanding pesticide labels and calibration of spraying equipment.
- Train agro-input dealers on the basic principles of IPM as it relates to pest and disease management.
- Stock taking of HHPs registered and available in country and identification and promotion of available lower-hazard alternatives.
- Promote the dissemination and use of an updated version of the registered pesticide list

Priorities for policy action

- Harmonize registration criteria and data requirements in the region (ECOWAS). This would make pesticide management much more efficient. To achieve this, the ECOWAS regulation C/regi 3/05/2005 should be incorporated into national legislation.
- Harmonize the laws relating to pesticide management to prevent duplication of functions and mandates within the government. Where there is clear overlap responsibilities should be clearly defined. Currently, NAFDAC and NESREA have an overlap in mandates – and to some extent with NAQS too.
- Update the registered list pesticides on a regular basis and make an electronic version available to the public online.
- Produce and publish legislative instruments to support the pesticide legislation.
- Fill in the gaps not covered in the legislation for pesticide management, including: packaging and labelling, transport, marketing, requirement for sale, availability restriction for vulnerable groups, disposal of empty containers and out of date products.
- Advocate for legislation to cover the registration of non-chemical preventative and direct control measures to promote IPM.
- Speed up the promulgation of the drafts on biopesticides and develop additional legislation for the registration of other biological control agents
- Bring to the attention of legislators the absence of legislation on the use of PPE and one that prevents vulnerable groups (children and pregnant women) from handling pesticides



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Annexes

Annex I: Cross-national overview of the legal framework for pesticide use

Section / aspect	NG
Adherence to and implementation of international agreements relating to pesticides	
The country is a party to the Montreal Protocol	✓
The country has enacted a provision relating to the implementation of the Montreal Protocol	✓
The country is a party to the Rotterdam Convention	✓
The country has enacted a provision relating to the implementation of the Rotterdam Convention	✓
The country is a party to the Stockholm Convention	✓
The country has enacted a provision relating to the implementation of the Stockholm Convention	✓
The country is a party to the Basel Convention	✓
The country has enacted a provision relating to the implementation of the Basel Convention	✓
The country is a party of the ILO Safety and Health in Agriculture Convention (C184)	X
The country has enacted a provision relating to the implementation of the ILO Safety and Health in Agriculture Convention (C184)	X
Policies to promote reductions in unnecessary pesticide use, such as policies on IPM, GAP, organic production and sustainable agriculture	
A policy is in place to develop and promote the use of IPM	✓
A policy is in place to promote the adoption of GAP, organic production and/or sustainable agriculture standards	✓
A policy is in place to facilitate access to information on matters including pesticide hazards and risks, residues in food, IPM/IVM, alternatives to HHPs and related regulatory and policy actions	X
The country's policies to achieve the sustainable use of pesticides include quantitative objectives, targets, measures, timetables or indicators to reduce risks and impacts, in parallel with the requirements of the EU directive 2009/128/EC (National Action Plan for the Sustainable Use of Plant Protection Products/Biocides)	X
Research	
A policy is in place to encourage and promote research on alternatives to existing pesticides that pose fewer risks, such as non-chemical preventative and direct control measures	X
Regulations related to the manufacture of pesticides	
A regulation addressing the manufacture and packaging of pesticides exists:	X
• It defines appropriate engineering standards and operating practices, including quality assurance procedures	X
• It defines necessary precautions to protect workers	X
• It ensures the proper siting of plants and stores, monitoring and control of waste, emissions and effluents	X
• It ensures that packaging or re-packaging is carried out only on licensed premises that comply with safety standards	X
• It contains provisions for poisoning cases	X

Section / aspect	NG
<ul style="list-style-type: none"> It ensures that lists of banned pesticides for manufacture are in harmony with the country's international obligations 	✓
Legal framework for non-chemical preventative and direct control measures	
Registration is required for non-chemical preventative and direct control measures	X
A subsidy scheme for non-chemical preventative and curative control methods is in place	X
Price and trade policy, including subsidies	
Distribution and trade is a market-driven supply process / there is no government purchasing	✓
A subsidy scheme for pesticides is in place	X
<ul style="list-style-type: none"> The subsidy scheme could potentially lead to excessive or unjustified pesticide use and may divert interest from more sustainable alternative measures 	X
<ul style="list-style-type: none"> There are subsidies for pesticides for field applications 	X
<ul style="list-style-type: none"> There are subsidies for pesticides for treatment of seed/planting material 	X
<ul style="list-style-type: none"> There are subsidies for pesticides for treatment of seed/planting material and/or for post-harvest applications 	X
<ul style="list-style-type: none"> The subsidy scheme is restricted to lower-risk alternatives 	X
A subsidy scheme for PPE is in place	X
Registration (synthetic pesticides and biopesticides)	
The legislation establishes a mandatory registration system for pesticides, tailored to national needs	✓
The registration process involves the risk-based evaluation of comprehensive scientific data demonstrating that the product is effective for its intended purposes and does not pose an unacceptable risk to human or animal health or the environment	✓
The legislation identifies the body responsible for registration	✓
The legislation sets out the powers and functions of the registration body	✓
There is a mechanism in place for regional coordination / harmonization for the registration of pesticides	X
The legislation indicates how the registration body will make its registration decisions	X
The legislation lists the types of final decisions the registration body can take	X
The legislation indicates that the decision must be communicated to the applicant, within a certain time period, and must include a justification based on the decision criteria	X
The legislation clearly defines the activities and types of pesticides requiring registration (e.g. all pesticide uses or a subset)	X
<ul style="list-style-type: none"> There are special requirements for products used on seed / plant material 	X
<ul style="list-style-type: none"> There are special requirements for products used for post-harvest application 	X
<ul style="list-style-type: none"> There are special requirements for non-chemical preventative and curative control methods 	X
<ul style="list-style-type: none"> There are provisions for experimental permits for the importation of limited quantities of unregistered pesticides for research, education or registration purposes 	X
<ul style="list-style-type: none"> There are provisions for use of unregistered pesticides in emergency situations 	X
Low-toxicity / low-risk pesticides are defined	X
The regulation provides a definition for biopesticides/biocontrol agents	X

Section / aspect	NG
The legislation addressing registration contains a system designed to encourage the use of fewer or less toxic pesticides	X
• There are fewer data requirements for less toxic products alternatives	X
• There is a special process for biopesticides (or an equivalent grouping for pesticides of natural origin under a different name, e.g. "biocontrol agents")	X
• There is an accelerated process or lower fees for registration of less toxic products	X
• New pesticides can only be registered if they replace more toxic pesticide products used for the same purpose	X
The legislation provides for distinct registration pathways for biopesticides or biological control agents and chemical pesticides	X
• The data requirements for biopesticides / biological control agents include:	X
o identity, biology and ecology of the agent	X
o information for the assessment of safety and effects on human health	X
o information for the assessment of environmental risks	X
o information for the assessment of efficacy, quality control and benefits of use	X
o toxicity for humans and the environment of additives (for microbial biological control agents only)	X
The legislation contains other provision which aim at facilitating the registration of biopesticides / biological control agents	X
The legislation indicates the validity period for registrations	✓
The legislation describes procedures for denial of registration and appeal	X
The legislation describes requirements for label extension	X
The legislation provides for review of registered pesticides and empowers the registration body to impose new conditions in view of new information	X
The legislation requires mandatory re-registration at specified intervals	X
The legislation assigns responsibility for keeping records	X
The legislation includes provisions ensuring confidentiality of trade secrets	X
A pesticide register compiling all registered products is made publicly available by the responsible authority. It contains the following information:	✓
• trade names of the products	✓
• registration numbers	✓
• name(s) of the AI	✓
• concentration of the AI	✓
• formulation type	X
• authorized uses, including crops and target pests	X
• the name of the registrant	✓
• the period of registration	✓
• user groups (e.g. use of some pesticides is restricted, for example to certified professionals)	X
A separate list containing the pesticide products that are banned or severely restricted is published by the national authority. Likewise, biopesticides are listed identified in a	✓

Section / aspect	NG
separate list	
Analysis of registered pesticide list for HHPs and alternatives	
Lists the time of last update	X
The number of AI registered	X
The number of products registered	X
The number of registrants	X
For the banned list, the last time it was updated; the number (and identity) of the banned pesticides	X
Biocontrol agents which are not covered by the national authority which handles registration of pesticides, e.g. macro-organisms	
The legislation contains provisions addressing export, shipment, import and release of biological control agents and other beneficial organisms. It contains the following requirements:	X
<ul style="list-style-type: none"> to carry out pest risk analysis of biological control agents 	X
<ul style="list-style-type: none"> to obtain, provide and assess documentation as appropriate, relevant to the export, shipment, import or release of biological control agents and other beneficial organisms 	X
<ul style="list-style-type: none"> to ensure that biological control agents and other beneficial organisms are taken either directly to designated quarantine facilities or mass-rearing facilities or, if appropriate, passed directly for release into the environment 	X
<ul style="list-style-type: none"> to encourage monitoring of release of biological control agents or beneficial organisms in order to assess impact on target and non-target organisms 	X
Packaging and labelling	
The legislations specifies the products to which the packaging and labelling requirements apply (e.g. apply equally to imported and domestically manufacturer products)	X
The legislation specifies the technical requirements for packaging and re-packaging	X
The legislation incorporates requirements for packaging and labelling into the registration process	X
The legislation requires packaging that is safe	X
The legislation requires packaging which will not degrade under normal conditions (e.g. packaging material should be impermeable to contents)	X
The legislation requires packaging which does not resemble common packaging of consumable goods	X
The legislation requires that packaging or re-packaging only takes place on licensed premises where staff are adequately protected	X
The legislation bans re-packaging when effective controls are not possible in the national context	✓
The legislation prohibits the re-packaging or decanting of pesticide into food or drink or other inappropriate containers	X
The legislation prohibits reuse of containers except under exceptional circumstances (e.g. where there is a programme in place to refill containers)	X
The legislation requires that an officially approved label is a mandatory part of the product package	✓
The legislation lists the information which is required on the label	
<ul style="list-style-type: none"> product name 	✓
<ul style="list-style-type: none"> use type 	✓
<ul style="list-style-type: none"> type of formulation 	X
<ul style="list-style-type: none"> AI name 	✓

Section / aspect	NG
• AI concentration	✓
• co-formulants	X
• net content	✓
• name of supplier	X
• manufacturer	✓
• batch number	✓
• registration number	X
• hazard and safety information following the GHS	✓
• directions for use	X
• warning against container reuse, instructions for storage and disposal	X
• legal requirement that pesticides be used in a way which is consistent with the label	X
The legislation lists how the information in the label should be communicated (languages, system of weights and measures...)	✓
The legislation outlines physical requirements of the label (e.g. minimum size of packaging, use of a durable material, fade resistant ink)	X
A handbook or manual is available to guide label design and/or review	✓
Marketing	
The legislation contains provisions specifically addressing pesticide advertising	X
• It defines pesticide advertising broadly to cover all forms	X
• It prohibits the advertising of unregistered or illegal pesticides	X
• It prohibits false or misleading advertising of pesticides	X
• It prohibits advertising contrary to approved uses or label instructions	X
• It designates the authority responsible for enforcement	✓
Transport	
A regulation addressing the transport of pesticides is in place	X
• It sets out requirements for vehicles and containers	X
• It prohibits the transport of pesticides in the same vehicle as passengers, animals, food or feed	X
• It requires physical separation in cases where joint transport or storage is unavoidable	X
Import and export	
The legislation contains provisions specifically addressing the import and export of pesticides	✓
• It prohibits the import / export of pesticides that have not been registered	✓
• It prohibits the import / export of counterfeit, substandard or outdated pesticides, or of pesticides otherwise not meeting the prescribed requirements	X
• It establishes application procedures for a pesticide import permit	✓

Section / aspect	NG
• It develops procedures and criteria for decisions on import permits	X
• It requires inspection of pesticides at the point of entry	X
• It fosters collaboration between the competent national authority and the customs department at points of entry	X
• It establishes exceptions for donations or imports by public entities for specific purposes	X
• It requires that exported pesticides meet the same quality standards as comparable domestic ones	X
• It requires the use of GHS customs codes on shipping documents	X
Requirements for sale	
The legislation contains a provision specifically addressing the sale of pesticides	X
• It sets requirements so that only those with competency and training may be licensed to sell pesticides	X
• It includes among the decision-making criteria for the grant of a licence issues such as storage, display, training, knowledge, record-keeping, safety equipment and emergency plans	X
• It prescribes the separation of pesticides from food and medicine	X
• It prescribes that pesticides may only be sold in their undamaged original containers	X
• It prescribes that pesticides may only be sold with a readable label	X
• It prescribes that pesticides must not be sold to minors	X
• It prescribes that shops that sell pesticides must have firefighting equipment	X
• It prescribes that shops that sell pesticides must have a warning board	X
Licensing	
The legislation contains provisions to identify which pesticide-related activities are permitted only to operators that hold a valid licence	✓
• It prescribes the holding of a valid licence for manufacture and packaging	X
• It prescribes the holding of a valid licence for sale	✓
• It prescribes the holding of a valid licence for transportation, import and export	✓
• It prescribes the holding of a valid licence for special applications	X
• It imposes specific and more restrictive requirements for severely restricted pesticides	✓
• It provides for back-up inspections	✓
• It establishes a system to receive and evaluate applications, in order to assess risk	✓
• It sets out clear criteria for the grant or denial of the licence, as well as provisions for the imposition of conditions, suspension and revocation	X
• It establishes the term of validity and the procedures for renewal of the licence	✓
• It enables the authority to impose fees for services associated with licensing	✓
• It sets out an appeal process linked to the licensing scheme	X
Availability	

Section / aspect	NG
The legislation contains provisions to regulate the availability and use of pesticides in accordance with the hazards involved and the existing levels of user training	X
• It takes into account the type of formulation, method of application and its uses when determining the risk and degree of restriction appropriate to the product	X
• It contains provision to limit the availability of pesticides that are sold to the general public through non-specialized outlets	X
• It contains restrictions which specifically target products used on seed/planting material	X
• It contains restrictions which specifically target products used for post-harvest applications	X
Handling and use, including regulations on application equipment	X
The legislation contains provisions to prohibit the use of pesticides for a purpose, or in a manner, other than that prescribed on the label	X
Responsibilities of pesticide operators (farmers and farmer workers) are identified in national regulations, e.g. to follow safety and hygiene norms, to follow recommendations relating to PPE use, to take reasonable precautions, to report risks	X
The legislation requires employers to take the necessary measures to protect the health of workers and the environment	✓
• The required measures include provision of training	✓
• The required measures include provision of protective equipment	✓
• The required measures include health monitoring of the workers	X
The legislation ensures that all workers, including those in agriculture, are protected under the legal framework	X
The legislation contains provisions to promote the use of pesticide application methods and/or equipment that minimize the risks	X
The legislation contains provisions to permit pesticide application equipment and PPE to be marketed only if they comply with established standards	X
The legislation contains provisions to prescribe the use of proper application equipment	X
• Respect of the recommended application	X
• Appropriate calibration of the spraying equipment for the pesticides to be applied	X
The legislation contains provisions to prescribe the responsible cleaning of application equipment	X
• To rinse the content of the tank with fresh water and to apply the remaining liquid on the treated field	X
• Application equipment must be rinsed externally in the field	X
The legislation contains any other provision to prohibit the use of pesticides in an unsafe manner that poses a threat to human health or the environment	X
Requirements for training	
A policy is in place to produce and disseminate relevant and clear educational materials on pesticide use and management	X
The legislation requires pest control operators to hold a licence or permit:	X
• for all products and application methods	X
• only for specific products and application methods	X
The content of the mandatory trainings is described in the law	X
Restrictions related to vulnerable groups	
The legislation contains any provision to prevent the use of pesticides by and sale of pesticides to children or pregnant and nursing women	X

Section / aspect	NG
The legislation requires employers to take the necessary measures to prevent use by children and other vulnerable groups	X
Requirements for PPE	
A policy is in place to promote the use of PPE which is suitable	X
The legislation prescribes the use of PPE for the application of pesticides	X
<ul style="list-style-type: none"> Operator risk and exposure is assessed at the time of registration in order to determine the PPE performance requirements 	X
<ul style="list-style-type: none"> Application of international standards (e.g. ISO 27065) or national standards for the classification of PPE by performance requirements (level of chemical resistance or some other measure to differentiate the level of protection provided by PPE) 	X
<ul style="list-style-type: none"> Only PPE which has met national standards may be marketed 	X
<ul style="list-style-type: none"> The label is required to list the elements of PPE (e.g. gloves, protective footwear, face protection, apron) and their performance requirements 	X
<ul style="list-style-type: none"> Responsibilities of pesticide operators (farmers and farm workers) are identified in national regulations, e.g. to follow safety and hygiene norms, to follow recommendations relating to PPE use, to take reasonable precautions, to report risks 	X
Storage	
The legislation makes provisions for safe storage of pesticides	✓
<ul style="list-style-type: none"> It differentiates between private, end-user or home storage, and bulk or commercial storage 	✓
<ul style="list-style-type: none"> It imposes record-keeping requirements on those storing pesticides 	X
<ul style="list-style-type: none"> It prohibits the reuse of a pesticide container for any non-pesticide storage reason 	X
<ul style="list-style-type: none"> It indicates the type of containers required 	X
<ul style="list-style-type: none"> The legislation specifies how and where pesticide products may be stored 	✓
<ul style="list-style-type: none"> <ul style="list-style-type: none"> The plant protection products are stored in their original containers and packs 	X
<ul style="list-style-type: none"> <ul style="list-style-type: none"> The plant protection products are stored according to label storage requirements 	✓
<ul style="list-style-type: none"> <ul style="list-style-type: none"> The plant protection products that are liquid formulations are stored on shelving that is never above those products that are powder or granular formulations 	X
<ul style="list-style-type: none"> <ul style="list-style-type: none"> The plant protection product storage facilities are built in a manner that is structurally sound and robust 	X
<ul style="list-style-type: none"> <ul style="list-style-type: none"> The plant protection product storage facilities have sufficient and constant ventilation of fresh air to avoid a build-up of harmful vapours 	✓
<ul style="list-style-type: none"> <ul style="list-style-type: none"> The plant protection product storage facilities have or are located in areas with sufficient illumination by natural or artificial lighting to ensure that all product labels can be easily read while on the shelves 	✓
<ul style="list-style-type: none"> <ul style="list-style-type: none"> The plant protection product storage facilities are equipped with shelving that is not absorbent in case of spillage 	X
<ul style="list-style-type: none"> <ul style="list-style-type: none"> The plant protection product storage facilities have retaining tanks or products are bundled according to 110% of the volume of the largest container of stored liquid, to ensure that there cannot be any leakage, seepage or contamination to the exterior of the facility 	X
<ul style="list-style-type: none"> <ul style="list-style-type: none"> The plant protection product storage facilities and all designated fixed filling/mixing areas are equipped with a container of absorbent inert material such as sand, floor brush and dustpan, and plastic bags that must be in a fixed location to be used exclusively in case of spillage of plant protection products 	X
<ul style="list-style-type: none"> <ul style="list-style-type: none"> An accident procedure, including emergency contact telephone numbers, visually displays the basic steps of primary accident care and is accessible by all persons within 10 metres of the plant protection product/chemical storage facilities and designated mixing areas 	X
<ul style="list-style-type: none"> <ul style="list-style-type: none"> All plant protection product/chemical storage facilities and all filling/mixing areas have eye-washing amenities, a source of clean water at a distance no more than 10 	X

Section / aspect	NG
metres, and a first aid kit containing the relevant aid material	
Disposal of unused pesticides	
A policy is in place to prevent the accumulation of obsolete pesticides and used containers	X
A policy is in place to inventory obsolete or unusable stocks of pesticides and used containers, and establish and implement an action plan for their disposal	X
The legislation contains provisions to ensure that disposal of hazardous pesticide waste is carried out in an environmentally sound manner	✓
The legislation bans certain types of activities in relation to pesticide waste (e.g. pouring it down drains or into water sources, burying it in unapproved sites and burning it in unapproved incinerators)	X
The legislation places affirmative duties on industry to assist in proper disposal	X
The legislation requires any person or entity seeking to dispose of pesticides or pesticide waste to seek authorization from the competent authority	X
The legislation contains provisions for the implementation of a toxic waste collection scheme	X
The legislation contains provisions for the establishment of facilities for the management of bulk quantities of toxic waste	X
Disposal of empty pesticide containers	
The regulations address the disposal of pesticide containers	X
<ul style="list-style-type: none"> The regulations governing disposal of empty pesticide containers are the same across the country 	X
<ul style="list-style-type: none"> Appropriate PPE is required when handling empty pesticide containers 	X
<ul style="list-style-type: none"> Cleaning the container before final disposal is the responsibility of the person disposing of the container 	X
<ul style="list-style-type: none"> When a metal, plastic or glass pesticide container is empty, it should be immediately triple rinsed (or pressure washed), with the resulting residue from the pesticide container being added to the spray tank for application 	X
<ul style="list-style-type: none"> After rinsing, the container should be rendered unusable by puncturing, crushing or breaking 	X
<ul style="list-style-type: none"> The regulation contains specifications for the storage conditions for empty pesticide containers (e.g. bagged, stored in secure, ventilated location) 	X
<ul style="list-style-type: none"> The regulation bans the reuse of empty pesticide containers 	X
<ul style="list-style-type: none"> Burying empty pesticide container is prohibited; or, if burying is allowed, specifications are provided for how the empty containers should be buried 	X
<ul style="list-style-type: none"> Burning empty pesticide containers is prohibited; or, if burning is allowed, specifications are provided for how the empty containers should be burned (e.g. to stay out of smoke, information on what should be done with the ash) 	X
<ul style="list-style-type: none"> Empty containers are classified as hazardous waste regardless of whether or not they have been decontaminated 	X
<ul style="list-style-type: none"> Empty containers must be transported in specially licensed vehicles 	X
<ul style="list-style-type: none"> Empty containers may not be transported with food, beverages, medicines, feed, animals and people 	X
<ul style="list-style-type: none"> Users must return containers to the manufacturer or to the place of purchase or to the place indicated on the invoice issued at the time of purchase 	X
<ul style="list-style-type: none"> Final disposal of empty pesticide containers must be carried out by authorized companies / containers must be destroyed at a specialized facility 	X
<ul style="list-style-type: none"> The procedure for disposal is described in legislation (recycling (if available), in a sanitary landfill, by incineration...) 	X
<ul style="list-style-type: none"> Pesticide waste generators (= pesticide users) are required to establish waste management plans for harm reduction 	X
The legislation contains dispositions to establish a container management system	X

Section / aspect	NG
Post-registration monitoring	
A policy is in place to collect reliable data and maintain statistics on health effects of pesticides and pesticide poisoning incidents / on environmental contamination and adverse effects, including the monitoring pesticide residues in feed, drinking water and/or the environment	X
• It assigns responsibility for mandatory monitoring and data collection with respect to pesticides	X
• It sets out the powers and responsibilities of the responsible body and the inspection corps with regard to information-gathering	X
• It imposes reporting requirements on manufacturers, importers, distributors and sellers of pesticides	X
• It requires reporting of pesticide-related incidents to the competent authority	X
Residue monitoring in food and MRLs	
The legislation contains provisions to regulate and/or monitor pesticide residues in food	X
• It defines which authority is in charge of the monitoring	X
• It defines which authority is in charge of setting the MRLs	X
• It applies to domestic production for national consumption as well as to imports / exports	X
• It applies only for a limited number of export crops	X
• It prescribes following the MRLs set by the <i>Codex Alimentarius</i>	✓
Other relevant human health and environmental protection regulations	
A policy is in place to raise awareness among users about the importance and ways of protecting health and the environment	X
A policy is in place to carry out health surveillance programmes in respect of those who are occupationally exposed to pesticides	X
A policy is in place to provide guidance and instructions to health workers on the diagnosis and treatment of suspected pesticide poisonings	X
A policy is in place to establish national or regional poisoning information centres	X
Compliance and enforcement	
The legislation contains provisions to prohibit the import, packaging, re-packaging, transportation, distribution or sale of a pesticide unless it is packaged in accordance with criteria provided in the law	X
The legislation contains provisions to detect and control counterfeiting and illegal trade in pesticides	X
The legislation contains provisions to facilitate the exchange of information (e.g. actions taken to ban or severely restrict a pesticide; scientific, technical, economic, regulatory and legal information; the availability of resources and expertise; cases of counterfeit and illegal pesticides being traded; poisoning and environmental contamination incidents data) between regulatory and implementing authorities	X
The legislation designates the national authority responsible for inspection	✓
• It defines the powers of the inspectors	✓
The legislation provides procedures and criteria for inspections	X
• It provides procedures and requirements for sample-taking	X
• It contains provisions for the designation of official laboratories for analysis of samples	X
• It provides clear and effective procedures for intervention if irregularities are found during inspections	X

Section / aspect	NG
<ul style="list-style-type: none"> • It defines the actions that are considered as offences, including special offences for public officials 	✓
<ul style="list-style-type: none"> • It determines which offences are criminal and which administrative 	X
<ul style="list-style-type: none"> • It determines proportional and deterrent fines and includes mechanisms to adapt the fines if their value declines 	X
<ul style="list-style-type: none"> • It defines other consequences of the infringement, such as the revocation of a licence or forfeiture of materials used in connection with the commission of the offence 	X

Annex II: Value chain maps

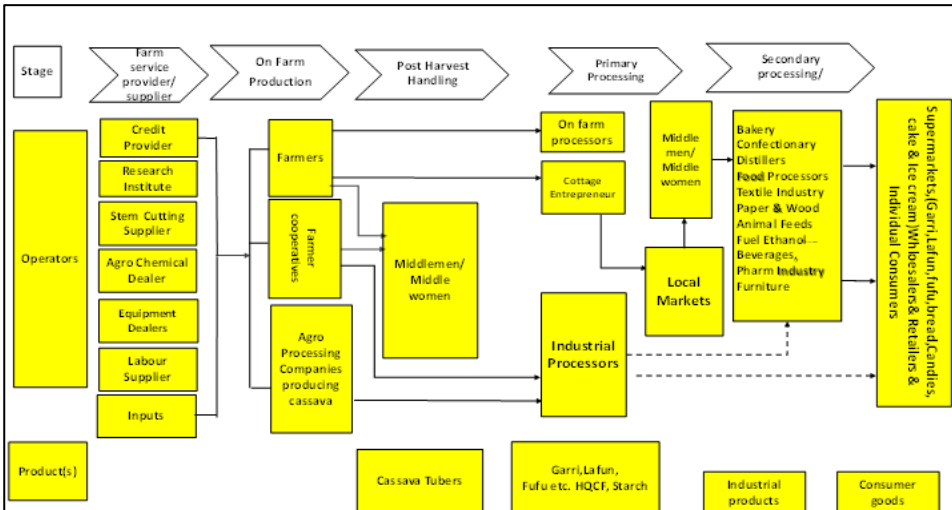


Figure 4. Value chain map for cassava in Nigeria (GIZ 2013a)

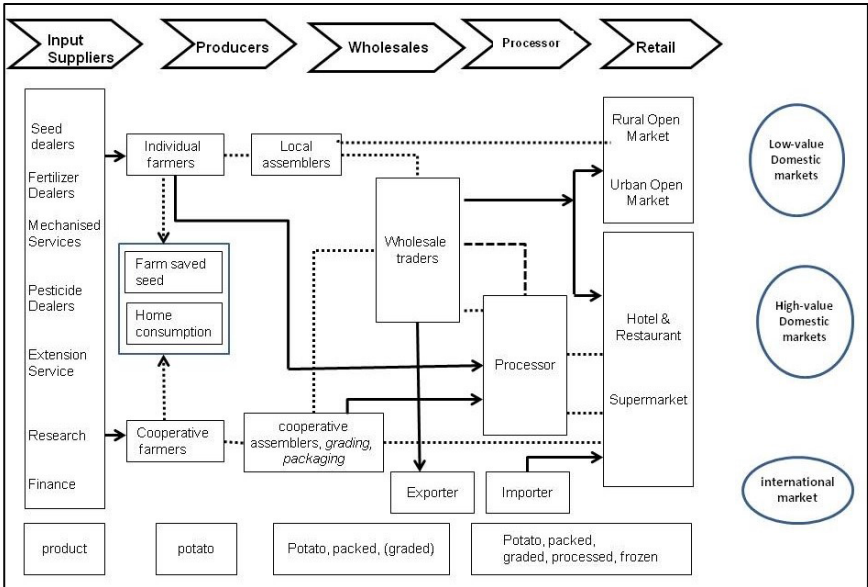


Figure 5. Value chain map for seed potatoes in Nigeria (GIZ 2013b)

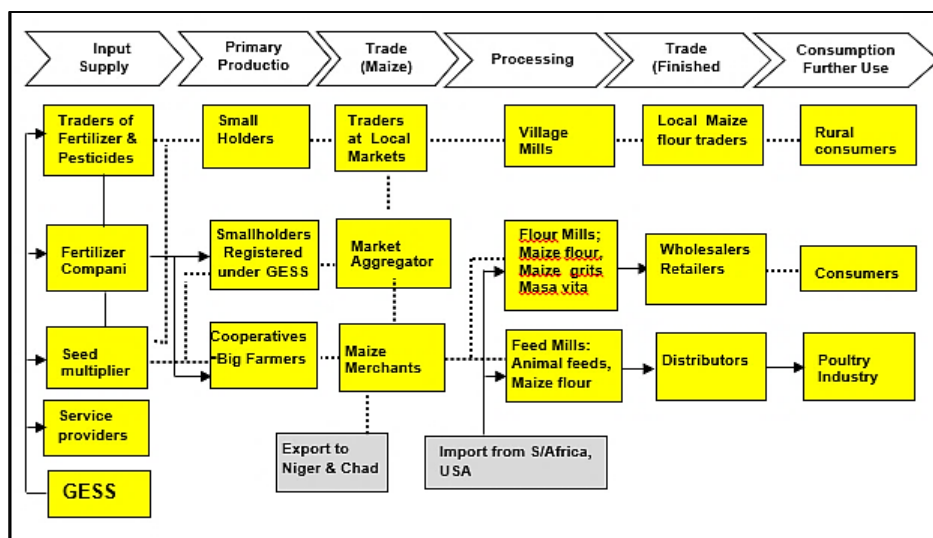


Figure 6. Value chain map for maize in Nigeria (GIZ 2013c)

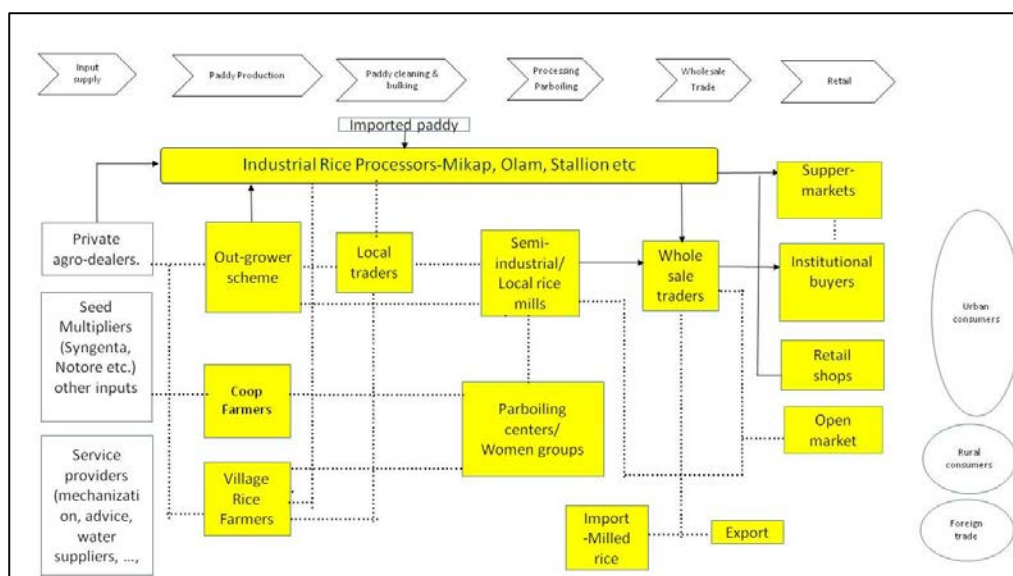


Figure 7. Value chain map for rice in Nigeria (GIZ 2013d)

Annex III: AI banned in Nigeria

Table 6. List of banned or restricted pesticides in Nigeria issued by NAFDAC (NAFDAC 2018b)

1	2,4,5 dichlorophenoxy Acetic acids	21	Endrin
2	Aldrin	22	Ethylene Dichloride
3	Biapacryl	23	Ethylene Oxide
4	Camma.H.c.h (benzene Haxachloride or lindane)	24	Flouroacetamide
5	Captafol	25	HCF Mixed Isomer BHC
6	Chlordane	26	Heptachlor
7	Chlordimeform	27	Heptachlor(oorganochlorine)
8	Chlorobenzilite	28	Hexachlorobenzene
9	DDT	29	Lindane
10	Dieldrin	30	Methamidophos
11	Delta H.C.H (1,2,3,5,6-Hexachlorocyclohexane (organochlorine)	31	Methyl Bromide
12	Delta HCH	32	Methyl Parathion
13	Diallate (Anadex)	33	Mirex
14	Dibromoehlors propan	34	Monocrotophos
15	Dichlorodiphenyl trichloroethan (DPT)	35	Paraquat Biclride
16	Dieldrin (organonochlorine)	36	Parathion
17	Dinoseb & DinosedSalts	37	Pentachlorophenol
18	Dinoseb(Dinitrobutyl phenol)	38	Phosphamidon
19	EDB1,2 dichloromoethene	39	Texaopene (campoechlor)
20	Endosulphan	40	Toxaphene

Annex IV: List of HHP AI registered for use in Nigeria

HHP AI	Chemical class	Use type	HHP1 Acute toxicity	HHP2 Carcinogenicity	HHP3 Mutagenicity	HHP4 Reproductive toxin	HHP5 POP	HHP6 Prior informed consent	HHP7 Ozone- depleting substance	PAN HHP	EU-approved	GIZ classification
ABAMECTIN	Macrocyclic Lactone - avermectin	Insecticide	1	N	N	2	N	N	N	Y	Approved	B
ALUMINIUM PHOSPHIDE	Fumigant	Insecticide, rodenticide	1	N	N	N	N	N	N	Y	Approved	B
BENOMYL	Benzimidazole	Fungicide	U	2	1A / 1B	1A / 1B	N	N	N	Y	Not approved	A
BRODIFACOU	Coumarin	Rodenticide	1A	N	N	N	N	N	N	Y	Not approved	A
BUTACHLOR	Amide	Herbicide	3	1B	N	N	N	N	N	Y	Not approved	B
CARBENDAZIM	Benzimidazole	Fungicide	U	2	1A / 1B	1A / 1B	N	N	N	Y	Not approved	A
CARBOFURAN	Carbamate	Insecticide, nematocide	1B	N	2	N	N	Y	N	Y	Not approved	A
CHLOROTHALONIL	Aromatic fungicide	Fungicide, oomycide	U	1B	N	N	N	N	N	Y	Approved	B
COPPER SULFATE	Inorganic - copper	Fungicide, oomycide, bactericide	2	1A / 1B	N	N	N	N	N	N	Approved	C
CYFLUTHRIN	Pyrethroid	Insecticide	1B	N	N	2	N	N	N	Y	Not approved	A
DIAZINON	Organophosphorus	Insecticide	2	2	N	1B	N	N	N	Y	Not approved	B
DICHLORVOS (DDVP)	Organophosphorus	Insecticide, acaricide	1B	2	N	N	N	N	N	Y	Not approved	A
DIURON	Urea	Herbicide	3	1B	N	N	N	N	N	Y	Approved	B
ENDOSULFAN	Organochlorine	Insecticide, acaricide	2	N	N	N	Y	Y	N	Y	Not approved	A
FURATHIOCARB	Carbamate	Fungicide	1B	N	N	N	N	N	N	Y	Not approved	A
HALOXYFOP-P-METHYL	Phenoxy	Herbicide	2	1B	N	N	N	N	N	Y	approved	B
MANCOZEB	Dithiocarbamate	Fungicide, oomycide	U	1B		2	N	N	N	Y	Approved	B
METHIDATHION	Organophosphorus	Insecticide	1B	2	N	N	N	N	N	Y	Not approved	A
MONOCROTOPHOS	Organophosphorus	Insecticide	1B	N	2	N	N	Y	N	Y	Not approved	A
OXADIARGYL	Oxadiazolone	Herbicide	N	N	N	1A / 1B	N	N	N	N	Not approved	B
OXADIAZON	Oxadiazolone	Herbicide	U	1B	N	2	N	N	N	Y	approved	B
OXYFLUORFEN	Diphenyl ether	Herbicide	U	1B	N	N	N	N	N	Y	Approved	B
PERMETHRIN	Pyrethroid	Insecticide	2	1B	N	N	N	N	N	Y	Not approved	B
PROPOXUR	Carbamate	Insecticide	2	1B	N	N	N	N	N	Y	Not approved	B

HHP AI	Chemical class	Use type	HHP1 Acute toxicity	HHP2 Carcinogenicity	HHP3 Mutagenicity	HHP4 Reproductive toxin	HHP5 POP	HHP6 Prior informed consent	HHP7 Ozone- depleting substance	PAN HHP	EU-approved	GIZ classification
ZINC PHOSPHIDE	Inorganic-zinc	Rodenticide	1B	-	-	-	N	N	N	Y	Approved	A

Annex V. List of AI which are registered in Nigeria which require exceptional authorization for recommendation or procurement

Pesticide AI	Chemical class	Use type	Hazard summary	Proposed POPs	Rotterdam notifications	PAN HHP list	Approved for use in the EU
ABAMECTIN	Macrocyclic Lactone - avermectin	Insecticide	HHP	N	N	Y	Approved
ACETOCHLOR	Chloroacetamide	Herbicide	Warning	N	Y	Y	Not approved
ALLETHRIN	Pyrethroid	Insecticide	Danger	N	N	N	Not approved
ALUMINIUM PHOSPHIDE	Fumigant	Insecticide, rodenticide	HHP	N	N	Y	Approved
ATRAZINE	Triazine	Herbicide	Warning	N	Y	Y	Not approved
BETA-CYPERMETHRIN	Pyrethroid	Insecticide	Missing data	N	N	Y	Not approved
BIFENTHRIN	Pyrethroid	Insecticide	Danger	N	Y	Y	Approved
BIOALLETHRIN	Pyrethroid	Insecticide	Warning	N	N	N	Not approved
BUTACHLOR	Amide	Herbicide	HHP	N	N	Y	Not approved
CHLOROTHALONIL	Aromatic fungicide	Fungicide, oomycide	HHP	N	N	Y	Approved
CHLORPYRIFOS	Organophosphorus	Insecticide, Acaricide	Danger	N	N	Y	Approved
COPPER HYDROXIDE	Inorganic - copper	Fungicide, oomycide, bactericide	Danger	N	N	Y	Approved
CYPERMETHRIN	Pyrethroid	Insecticide, acaricide	Danger	N	N	Y	Approved
DELTAMETHRIN	Pyrethroid	Insecticide	Danger	N	N	Y	Approved
DIAZINON	Organophosphorus	Insecticide	HHP	N	Y	Y	Not approved
DIMETHOATE	Organophosphorus	Insecticide	Danger	N	N	Y	Approved
DIURON	Urea	Herbicide	HHP	N	N	Y	Approved
FLUAZIFOP-P-BUTYL	Phenoxy	Herbicide	Warning	N	Y	N	Not listed
FOLPET	Phthalimide	Fungicide	Warning	N	Y	Y	Approved
GLYPHOSATE	Organophosphorus	Herbicide	Danger	N	N	Y	Approved
HALOXYFOP-P-METHYL	Phenoxy	Herbicide	HHP	N	N	Y	Approved
HEXACONAZOLE	Triazole	Fungicide	Warning	N	N	N	Not approved
IMIDACLOPRID	Neonicotinoid	Insecticide	Warning	N	N	Y	Approved
IMIPROTHRIN	Pyrethroid	Insecticide	Warning	N	N	Y	Not listed
LAMBDA-CYHALOTHRIN	Pyrethroid	Insecticide	Danger	N	N	Y	Approved
MANCOZEB	Dithiocarbamate	Fungicide, oomycide	HHP	N	N	Y	Approved
METOLACHLOR	Amide	Herbicide	Danger	N	N	N	Not approved
MSMA	Arsenical	Herbicide	Danger	N	N	N	Not approved
NOVALURON	Insect growth regulator	Insecticide	Warning	N	N	N	Not approved
OXADIARGYL	Oxadiazolone	Herbicide	HHP	N	N	N	Not approved
OXADIAZON	Oxadiazolone	Herbicide	HHP	N	N	Y	Approved
OXYFLUORFEN	Diphenyl ether	Herbicide	HHP	N	N	Y	Approved
PARAQUAT	Quaternary ammonium	Herbicide	Danger	N	Y	N	Not approved
PARAQUAT DICHLORIDE	Quaternary ammonium	Herbicide	Danger	N	Y	Y	Not listed
PERMETHRIN	Pyrethroid	Insecticide	HHP	N	Y	Y	Not approved
PIRIMIPHOS-METHYL	Fumigant, organophosphorous	Fumigant, insecticide, acaricide	Warning	N	N	Y	Approved
PRALLETHRIN	Pyrethroid	Insecticide	Danger	N	N	Y	Not listed

Pesticide AI	Chemical class	Use type	Hazard summary	Proposed POPs	Rotterdam notifications	PAN HHP list	Approved for use in the EU
PRETILACHLOR	Amide	Herbicide	Danger	N	N	N	Not approved
PROFENOFOS	Organophosphorus	Insecticide	Danger	N	Y	Y	Not approved
PROMETRYN	Triazine	Herbicide	Warning	N	N	N	Not approved
PROPANIL	Amide	Herbicide	Warning	N	Y	N	Pending
PROPOXUR	carbamate	Insecticide	HHP	N	N	Y	Not approved
SPINOSAD	Biochemical biopesticide - microbial extract / fermentation product / enzyme	Insecticide	Warning	N	N	Y	Approved
TEMEPHOS	Organophosphorus	Insecticide	Danger	N	N	Y	Not approved
TETRAMETHRIN	Pyrethroid	Insecticide	Warning	N	N	Y	Not approved
THIAMETHOXAM	Neonicotinoid	Insecticide	Warning	N	N	Y	Approved

Annex VI: List of the key pests of the focal crops, with the HHP and non-HHP AI which are registered for their management

Target pest common names	Crop	AI effective against target pest which are registered and are not HHPs	HHPs which are used to manage the target pest
Cassava Mosaic Virus	Cassava	-	-
Anthrachnose (<i>Glomerella cingulata</i>)	Cassava	COPPER OXIDE, COPPER OXYCHLORIDE, METALAXYL	CARBENDAZIM, COPPER SULFATE, MANCOZEB
Bacterial blight (<i>Xanthomonas axonopodis</i> pv. <i>Manihotis</i>)	Cassava	COPPER OXIDE, COPPER OXYCHLORIDE	COPPER SULFATE
Mealy bug (<i>Phenacoccus manihoti</i>)	Cassava	ACETAMIPRID, BIFENTHRIN, CHLORPYRIFOS, DELTAMETHRIN, DIMETHOATE, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PIPERONYL BUTOXIDE, PRALLETHRIN, PROFENOFOS, PYRETHRINS, THIAMETHOXAM	CYFLUTHRIN, DIAZINON, DICHLORVOS (DDVP), ENDOSULFAN, MONOCROTOPHOS, PERMETHRIN
Cassava green mite (<i>Mononychellus tanajoa</i>)	Cassava	BIFENTHRIN, CHLORPYRIFOS, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PIPERONYL BUTOXIDE, PIRIMIPHOS-METHYL, PRALLETHRIN, PROFENOFOS, THIAMETHOXAM	DIAZINON, DICHLORVOS (DDVP)
Spider mites	Cassava	BIFENTHRIN, CHLORPYRIFOS, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PIPERONYL BUTOXIDE, PIRIMIPHOS-METHYL, PRALLETHRIN, PROFENOFOS, THIAMETHOXAM	DIAZINON, DICHLORVOS (DDVP)
Grasshopper	Cassava	BIFENTHRIN, CHLORPYRIFOS, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PRALLETHRIN, THIAMETHOXAM	CYFLUTHRIN, DIAZINON
Crickets	Cassava	IMIDACLOPRID, LAMBDA-CYHALOTHRIN, THIAMETHOXAM	
Late blight (<i>Phytophthora infestans</i>)	Irish potato	COPPER HYDROXIDE, COPPER OXIDE, COPPER OXYCHLORIDE, METALAXYL, METALAXYL-M (MEFENOXAM)	CARBENDAZIM, CHLOROTHALONIL, COPPER SULFATE, MANCOZEB
Early blight (<i>Alternaria solani</i>)	Irish potato	COPPER HYDROXIDE, COPPER OXIDE, COPPER OXYCHLORIDE, METALAXYL-M (MEFENOXAM)	CARBENDAZIM, CHLOROTHALONIL, COPPER SULFATE, MANCOZEB
Various Insect vectored viruses	Irish potato	-	-
Bacterial wilt (<i>Ralstonia solanacearum</i>)	Irish potato	COPPER HYDROXIDE, COPPER OXIDE, COPPER OXYCHLORIDE	COPPER SULFATE
Nematodes	Irish potato	-	CARBOFURAN
Potato tuber moth (<i>Phthorimaea operculella</i>) - storage pest	Irish potato	-	ALUMINIUM PHOSPHIDE, ZINC PHOSPHIDE
Rodents (storage)	Irish potato	-	ALUMINIUM PHOSPHIDE, ZINC PHOSPHIDE

Target pest common names	Crop	AI effective against target pest which are registered and are not HHPs	HHPs which are used to manage the target pest
Aflatoxin (<i>Aspergillus flavus</i>)	Maize	-	
Smut (<i>Ustilago maydis</i>)	Maize	-	
African armyworm (<i>Spodoptera exempta</i>)	Maize	ALPHA-CYPERMETHRIN, BIFENTHRIN, BIOALLETHRIN, CHLORPYRIFOS, CYPERMETHRIN, D-ALLETHRIN, DELTAMETHRIN, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PIPERONYL BUTOXIDE, PRALLETHRIN, PYRETHRINS, SULPHUR, TETRAMETHRIN, THIAMETHOXAM	ABAMECTIN, CYFLUTHRIN, DIAZINON, MONOCROTOPHOS, PERMETHRIN
FAW (<i>Spodoptera frugiperda</i>)	Maize	ALPHA-CYPERMETHRIN, BIFENTHRIN, BIOALLETHRIN, CHLORPYRIFOS, CYPERMETHRIN, D-ALLETHRIN, DELTAMETHRIN, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PIPERONYL BUTOXIDE, PRALLETHRIN, PYRETHRINS, SULPHUR, TETRAMETHRIN, THIAMETHOXAM	ABAMECTIN, CYFLUTHRIN, DIAZINON, MONOCROTOPHOS, PERMETHRIN
Stemborer (<i>Busseola fusca</i> and various other spp.)	Maize	ALPHA-CYPERMETHRIN, BIFENTHRIN, BIOALLETHRIN, CHLORPYRIFOS, CYPERMETHRIN, D-ALLETHRIN, DELTAMETHRIN, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PIPERONYL BUTOXIDE, PRALLETHRIN, PYRETHRINS, SULPHUR, TETRAMETHRIN, THIAMETHOXAM	ABAMECTIN, CYFLUTHRIN, DIAZINON, MONOCROTOPHOS, PERMETHRIN
Weevils (<i>Sitophilus zeamais</i>)	Maize	[Check] ALPHA-CYPERMETHRIN, BIFENTHRIN, CHLORPYRIFOS, CYPERMETHRIN, DELTAMETHRIN, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, THIAMETHOXAM	ALUMINIUM PHOSPHIDE, ZINC PHOSPHIDE, ABAMECTIN, CYFLUTHRIN, DIAZINON, PERMETHRIN
Larger grain borer (<i>Prostephanus truncatus</i>)	Maize	BIFENTHRIN, DELTAMETHRIN, SPINOSAD, THIAMETHOXAM	ALUMINIUM PHOSPHIDE, ZINC PHOSPHIDE,
Rodents	Maize	-	ALUMINIUM PHOSPHIDE, ZINC PHOSPHIDE
Birds	Maize	-	-
Striga (<i>Striga hermonthica</i>)	Maize	-	-
Weeds	Maize	2,4-D, ACETOCHLOR, ATRAZINE, BISPYRIBAC SODIUM, CLOMAZONE, FLUAZIFOP-P-BUTYL, GLYPHOSATE, METOLACHLOR, MSMA, PARAQUAT, PARAQUAT DICHLORIDE, PENDIMETHALIN, PROMETRYN, PROPANIL, S-METOLACHLOR, TERBUTHYLAZINE, TRICLOPYR	BUTACHLOR, DIURON, OXADIARGYL, OXADIAZON, OXYFLUORFEN
Rice blast (<i>Magnaporthe oryzae</i>)	Rice	-	CARBENDAZIM
Brown spot (<i>Cochliobolus miyabeanus</i>)	Rice		

Target pest common names	Crop	AI effective against target pest which are registered and are not HHPs	HHPs which are used to manage the target pest
False smut (<i>Ustilaginoidea virens</i>)	Rice		
Bacterial diseases	Rice	COPPER HYDROXIDE, COPPER OXIDE, COPPER OXYCHLORIDE	COPPER SULFATE
Stemborer (<i>Diopsis macrophthalma</i> , <i>Sesamia inferens</i> , <i>Chilo suppressalis</i> , <i>Maliarpha separata</i>)	Rice	ALPHA-CYPERMETHRIN, BIFENTHRIN, BIOALLETHRIN, CHLORPYRIFOS, CYPERMETHRIN, D-ALLETHRIN, DELTAMETHRIN, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PIPERONYL BUTOXIDE, PRALLETHRIN, PYRETHRINS, SULPHUR, TETRAMETHRIN, THIAMETHOXAM	ABAMECTIN, CYFLUTHRIN, DIAZINON, MONOCROTOPHOS, PERMETHRIN
Termites	Rice	IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PIPERONYL BUTOXIDE	-
Ants	Rice	BIFENTHRIN, CHLORPYRIFOS, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PIPERONYL BUTOXIDE, PRALLETHRIN, THIAMETHOXAM	CARBOFURAN, CYFLUTHRIN, DIAZINON, DICHLORVOS (DDVP)
Locusts	Rice	BIFENTHRIN, CHLORPYRIFOS, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, PRALLETHRIN, THIAMETHOXAM	CYFLUTHRIN, DIAZINON
Weevils	Rice	[Check] ALPHA-CYPERMETHRIN, BIFENTHRIN, CHLORPYRIFOS, CYPERMETHRIN, DELTAMETHRIN, IMIDACLOPRID, LAMBDA-CYHALOTHRIN, THIAMETHOXAM	ALUMINIUM PHOSPHIDE, ZINC PHOSPHIDE, [check] ABAMECTIN, CYFLUTHRIN, DIAZINON, PERMETHRIN
Rodents	Rice	-	ALUMINIUM PHOSPHIDE, ZINC PHOSPHIDE
Weeds	Rice	2,4-D, ACETOCHLOR, ATRAZINE, BISPYRIBAC SODIUM, CLOMAZONE, FLUAZIFOP-P-BUTYL, GLYPHOSATE, METOLACHLOR, MSMA, PARAQUAT, PARAQUAT DICHLORIDE, PENDIMETHALIN, PROMETRYN, PROPANIL, S-METOLACHLOR, TERBUTHYLAZINE, TRICLOPYR	BUTACHLOR, DIURON, OXADIARGYL, OXADIAZON, OXYFLUORFEN

Annex VII. Overview of the requirements of major voluntary standards

Not addressed		High-level guidance		Soft detailed requirements		Strict detailed requirements	
Point /criteria		Organic	Fair Trade	RFA	UTZ	Global GAP	RTRS
IPM	Site selection						
	Preventative measures (e.g. resistant planting material, crop rotation) should be implemented						
	Cultivation techniques and mechanical control should be implemented where applicable						
	Pest control interventions should be based on monitoring						
	Strategies to prevent the build-up of resistance to pesticides should be implemented where applicable						
Pesticide management	ⁱ Highly hazardous pesticides are banned (click below for details)						
	ⁱⁱ Adequate storage of pesticides						
	ⁱⁱⁱ Adequate disposal of pesticide containers						
	Adequate disposal of surplus spraying mixture						
Safety	People involved in handling/application of pesticides should have received training						
	The use of PPE is an explicit requirement						
	Observance of re-entry intervals						
	Observance of pre-harvest intervals						
	Bathing facilities are provided to workers applying pesticides						
Environmental protection	Fertilizer and nutrient management						
	Conservation of soil						
	^{iv} Conservation of water						
	^v Biodiversity						
	^{vi} Waste disposal						
	^{vii} Energy conservation and carbon footprint						
	^{viii} Farm economic sustainability						
	^{ix} Provision of capacity building and training, access to information and support services						

Figure 8. Overview of the requirements of major voluntary standards

Black in the corresponding square indicates that the point is not addressed by the standard. The colour red indicates high-level guidance (e.g. prevention [of pests] by implementing GAP). Blue indicates that the requirements are detailed but soft, i.e. major GAP are lacking). Where this is the case, the points that are not addressed are indicated below. Grey indicates that the requirements are detailed and that major GAP are followed.

ⁱ RTRS: Restrictions limited to the pesticides banned by the Stockholm and Rotterdam Convention.

ⁱⁱ RFA: Requirement limited to: Storage in a locked facility, access limited to the trained staff; Fair Trade: Soft requirements for central storage (pesticide may be stored in containers other than the original container). High-level requirements for cooperative members.

ⁱⁱⁱ Fair Trade: Contains guidance to prevent reuse, but does not address final disposal of containers. RTRS: Does not address final disposal of containers.

^{iv} GlobalGAP: No requirement related to the application of pesticides near water bodies.

^v RTRS: Only addresses the protection of waterbodies/watercourses.

^{vi} Fair Trade: No indication on final disposal, small amounts of hazardous waste may be burned.

^{vii} RTRS: Contains measures to prevent the increase of the footprint, not to reduce it.

^{viii} Fair Trade: Limited to business planning and review.

^{ix} Fair Trade: Training limited to IPM and agrochemical management; Global GAP: limited to health and safety.



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