Food Safety-Crop Protection Nexus: Insights From Uganda's Agriculture Sector

Synthesis Report

FOOD SAFETY COALITION UGANDA

December 2024

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HOPE FOR THE FUTURE

AFIRD

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Global Consumer Centre

UNACOH
"Health for All & By All"

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COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

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Partnering for Growth

SUKUMA
Enhancing Agribusiness Development

KRC UGANDA
Research, Advocacy & Development

FOOD SAFETY COALITION UGANDA

HORTEXA

FRA
Food Rights Alliance

GEDA - Uganda
Gender, Environment & Development Action Uganda

AUPWAE

PARAMOUNT RESEARCH TRIANGLE CONSORTIUM (RTC) UGANDA

Bask Organics

Caritas UGANDA

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Transforming Livelihoods

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About FoSCU

Driven by the quest for sustainable access to safe food in Uganda, in the year 2023, twenty-one local stakeholders started a joint platform- Food Safety Coalition Uganda (FoSCU) with a mission of *"harnessing partnerships towards promoting sustainable safe food access for consumers in Uganda and beyond"*, and a motto of "Safe food for all by all"- a constant reminder that every consumer has a RIGHT TO EAT and a RESPONSIBILITY TO ENSURE that what we eat is safe.

Currently, FoSCU members jointly work through four technical working groups: i) research and innovations, ii) communication and behaviour change, iii) technical assistance and capacity building, iv) governance and normative work. Through these thematic groups, FoSCU documents evidence on food safety gaps and local solutions, creates awareness through innovative and interactive communication tools, extends technical assistance to support skilling of food supply chain actors, and advocates for betterment of the country's food safety institutional, policy and legislative framework.

In terms of internal governance, a seven-member committee steers the strategic direction of this Coalition, of whom, four are Chairpersons of the four technical working groups.

Further information on FOSCU is available on https://foscu.org/

Acknowledgement

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Executive Summary

This report aims at assessing the relationship between the approaches used to manage pests and diseases, and the safety of the food eventually produced. The motive to understand this nexus was triggered by food safety concerns in the country, especially associated with agrochemicals. The report is based on secondary data sources.

Why the urgency about Uganda's food safety situation?

Inappropriate practices by actors along the food supply chain results in food contamination with hazards that are chemical (drugs, food additives, pesticides, industrial chemicals, environmental pollutants and natural toxins), biological (bacteria, fungi, viruses), and physical (broken glass, metal, plastic, stones, sand, paper, pits, wood, hair, animal droppings) in nature. Dietary exposure to food safety hazards results in acute and chronic food-borne ill conditions for consumers-further burdening the country's already stretched healthcare system.

How is the current approach to crop protection pertinent to food safety?

Production-the foundational node of the food supply chain- faces key challenges, notably emerging pests and diseases- an issue exacerbated by climate change, trade, and agricultural intensification among others. Over-reliance on synthetic chemical pesticides as the main crop protection tool, has increasingly been linked with food contamination in the country. According to MAAIF official chemical register as of end of 2023, at least 115 active ingredients and 669 brands of synthetic chemical pesticides were officially registered for use. However, 47.8% (55/115) and 15.6% (18/115) of the registered active ingredients would be categorized as highly hazardous pesticides according to the Pesticide Action Network and FAO/WHO (JMPM) criteria, respectively. In comparison with registration status in the countries of source, majority (65.5%) of the 55 flagged active ingredients were not approved for use in the European Union, for instance. High toxicity to bees and concerns related to human health- carcinogenicity, fatality, and reproductive toxicity- were the main issues associated with the pesticides identified as HHPs. In addition to the type of pesticides used, inadequate practices by farmers such as violation of recommended mixing rates, non-adherence to pre-harvest intervals, and indiscriminate disposal of pesticide waste result in contamination of the food chain with unsafe levels of pesticides and their degradation products. Concerningly, positive association between pesticide exposure and negative health outcomes is increasingly being established.

What corrective local initiatives have been undertaken?

Relevant interventions geared towards improving crop protection and/or food safety in the country have and some still are being undertaken by different state and non-state actors. They include but not limited to: harmonising the regulatory and institutional framework, policy development, advocacy and awareness creation, research and documentation, technical capacity building on botanicals, development of pheromone-based pest management technologies, registration and trade in microbials, development of resistant varieties, and promotion of agroecology.

What does FoSCU recommend?

To sustainably protect crop health and produce safe food in the country, through this report, FoSCU advances recommendations relevant targeting different stakeholder groups of knowledge brokers *(public and private research institutions, academia and think tanks)*, private sector *(importers, distributors, and retailers of crop protection products),* advocacy actors *(CSOs, CBOs, FBOs, Cultural institutions, producer and consumer associations)*, donors and development partners, government Ministries *(MAAIF, MOH, MTIC, MWE, MoFPED...)* Departments and Agencies/Authorities.

Acronyms and Abbreviations

ACB	Agricultural Chemicals Board
AFIRD	Agency For Integrated Rural Development
CABI	Centre for Agriculture and Bioscience International
CBO	Community Based Organisation
CEFROHT	Centre for Food and Adequate Rights Living
CIMMYT	International Maize and Wheat Improvement Centre
CIP	Cleaning In Process
CONSENT	Global Consumer Centre
CSO	Civil Society Organisation
DALYs	Disability Adjusted Life Years
DCIC	Department of Crop Inspection and Certification
DGAL	Directorate of Government Analytical Laboratories
FAMEWS	Fall Armyworm Monitoring and Early Warning System
FAO	Food and Agriculture Organisation of the United Nations
FAW	Fall Army Worm
FBI	Food Borne Illness
FBO	Faith Based Organisation
FFS	Farmer Field School
FoSCU	Food Safety Coalition Uganda
FRA	Food Rights Alliance
FSIS	Food Safety and Inspection Service
GAP	Good Agricultural Practices
GHP	Good Hygienic Practices
GMP	Good Manufacturing Practices
HACCP	Hazard Analysis Critical Control Point

HHP	Highly Hazardous Pesticide
ICIPE	International Centre for Insect Physiology and Ecology
IEC	Information Education and Communication
IITA	International Institute of Tropical Agriculture
INGO	International Non-Governmental Organisation
IPM	Integrated Pest Management
JMPM	Joint Meeting on Pesticides Management
KRC	Kabarole Research and Resource Centre
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MDAs	Ministries Departments and Agencies
MGLSD	Ministry of Gender Labour and Social Development
MIA	Ministry of Internal Affairs
MMB	Mango Mealy Bug
MoFPED	Ministry of Finance, Planning and Economic Development
MoH	Ministry of Health
MoLG	Ministry of Local Government
MRL	Maximum Residue Limit
MTIC	Ministry of Trade Industries and Cooperatives
MWE	Ministry of Water and Environment
NARI	National Agricultural Research Institutes
NARO	National Agriculture Research Organisation
NDA	National Drug Authority
NDP	National Development Plan
NEMA	National Environment Management Authority
NGO	Non-Governmental Organisation
NOGAMU	National Organic Agricultural Movement of Uganda
NPA	National Planning Authority
NPPO	National Plant Protection Organization
NUFLIP	Northern Uganda Farmers' Livelihood Improvement Project
PAN	Pesticide Action Network
PELUM	Participatory Ecological Land Use and Management

PPPP	Public Private People Partnership
PRISE	Pest Risk Information Service
RUCID	Rural Community in Development
UBOS	Uganda Bureau of Statistics
UCDA	Uganda Coffee Development Authority
UFEA	Uganda Flowers Exporters Association
UIRI	Uganda Industrial Research Institute
UN	United Nations
UNACOH	Uganda National Association of Community and Occupational Health
UNADA	Uganda National Agroinput Dealers Association
UNBS	Uganda National Bureau of Standards
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USD	United States Dollar
WHO	World Health Organisation
WTO	World Trade Organisation
ZARDI	Zonal Agricultural Research and Development Institutes

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CHAPTER 1

Introduction

1.1 Why this report?

This report has been triggered by the need to better understand the prevailing food safety situation in Uganda, with emphasis on how it is influenced by the farmers' approach to one of the main challenges at the production node of food supply chain- crop protection from pests and diseases. The report is based on secondary data gathered from different sources- scientific articles, conference papers, reports, policy documents, pieces of legislation, and public presentations—mainly accessed electronically through systematic internet search.

1.2 Agriculture and National Development

An estimated 80% of Uganda's land is arable, though only 35% is cultivated- due to challenges such as pest and disease infestations, high dependence on rain fed agriculture, land tenure system, limited access to affordable financing and low mechanization among others (National Planning Authority, 2024). Nevertheless, agriculture- crop growing, livestock keeping, and fisheries- for decades, remains the major source of employment and livelihood for majority of households in the country. According to the 2024 national census, an estimated 62% of households were directly engaged in agriculture- representing an 18% reduction in comparison with 10 years ago (Uganda Bureau of Statistics, 2024). The sector's contribution to the country's gross domestic product averaged 22.9%, 23.8% and 24.1% in the financial years 2017/2018, 2020/2021, and 2021/2022 respectively (National Planning Authority, 2024). In terms of exports, agricultural products constitute an estimated 80% of the country's total exports, mostly from coffee, tea and cotton- with the main export partners being South Sudan, Kenya, Democratic Republic of Congo, Netherlands, Germany, South Africa and United Arab Emirates (Bank of Uganda, 2024).

In pursuit of her development agenda, in her third 5-year (2020/2021-2024/2025) national development plan, the government of Uganda prioritised ten commodities- coffee, tea, fisheries, cocoa, cotton, vegetable oil, beef, maize, dairy, and cassava (NPA, 2020). For the fourth national development plan (2025/2026-2029/2030), the country's first (of the five) strategy is to 'sustainably increase production, productivity and value addition in agriculture (among other sectors)' through key actions such as: strengthening pest, vector and disease management; promoting organic farming for responsible and sustainable use of energy, natural resources and increased access to premium markets for agricultural products; improving market access through certification, adherence to standards, traceability, establishment of export quarantine facilities and certification laboratories; investing in appropriate post-harvest handling, storage and agro-processing facilities and technologies (NPA, 2024).

1.3 Food Sectors and Supply Chains

In Uganda, food is produced and supplied from the three main subsectors of crop, livestock, and fisheries, in that order. As the leading subsector, crop is constituted by almost all households (61%) that are engaged in agriculture- as reported by the 2024 national census- representing a reduction of 14% in comparison to the 2014 census. Maize, beans, sweet potatoes, banana, ground nuts, cassava, sorghum, simsim (sesame), millets, and soybeans in this order were reported as the top ten household level crop-based enterprises. On the other hand, the proportion of households keeping livestock was reported at 37% (a reduction of 21% compared to 10 years ago), with the top five kept livestock being chicken, goats, cattle, pigs, and sheep, in that order (UBOS, 2024).

Typical food supply chains include nodes of production, aggregation, processing, distribution and marketing, and consumption- as illustrated below in a representative crop-based (ground nuts) supply chain.

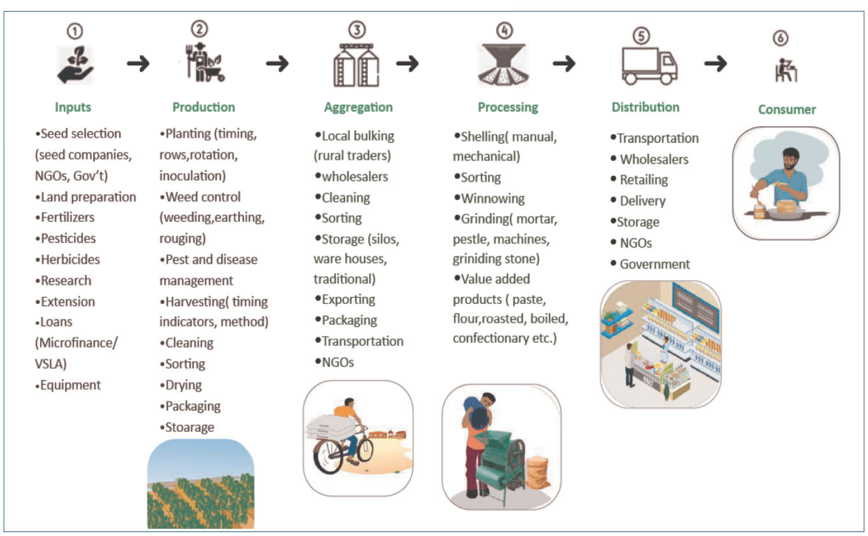

Figure 1: Representation of a typical crop-based food supply chain *(Source: FoSCU 2023)*

1.4 Food Safety

Food safety aims at ensuring that along the supply chain, food is handled in a way that minimizes the risk of spoilage, contamination and causing or transmitting harm to consumers. Globally, an estimated 1 in 10 people fall ill after eating contaminated food each year, resulting in 420,000 deaths and the loss of 33 million healthy life years (**d**isability **a**djusted **l**ife **y**ears-DALYs) (World Health Organization- WHO, 2024). Therefore, in the process of production, distribution, and preparation, food must be kept safe to guarantee a healthy consumer life, economic dividends, nutritional benefits, and reduce the vicious cycle of disease. This can be achieved through food safety- defined as a science-based process or actions that prevent food from containing substances that could harm a consumer's health.

1.4.1 Food Safety Hazards

Contamination of food may be from air, water, soil, equipment, improper storage, production and handling practices, and inappropriate temperature among others (FAO, 2024a). Food contaminants/hazards are biological, chemical, or physical properties that may cause food to be unsafe for human consumption (United States Department of Agriculture's Food Safety and Inspection Service-FSIS, 2023).

Biological food hazards include bacteria (e.g. *Escherichia. coli, Staphylococcus aureus, Salmonella typhi*), fungi (e.g. *Aspergillus flavus*), viruses (e.g. *Hepatitis A & E,* Rotavirus, Norovirus) that are associated with pathogenicity, accounting for different Food-Borne illnesses (FBIs). In Uganda, this category of hazards accounts for most of the acute food-related ill conditions. For instance, about 1.3 million people in Uganda were diagnosed with FBIs in the year 2021, commonly typhoid, diarrhea, brucellosis, dysentery and cholera- accounting for an estimated 14% of all diseases treated in the country in that year (Daily Monitor, 2021). Notably, diarrhea has been reported as the most frequent manifestation of food-borne illnesses in Uganda (Omona et al., 2020).

Physical food hazards are visible foreign, aesthetic unpleasant, undesirable materials that may be found in food such as broken glass, metal, plastic, stones, sand, paper, pits, wood, hair, animal droppings, insects (dead or live) and/or their parts that may lead to injuries such as choking, cuts, or broken teeth if consumed along with the food (Safefood 360°, 2024). For instance, the presence of insects and/or insect parts of quarantine pests such as caterpillars, fruit flies, mediterranean fly have been reported in Uganda's agricultural produce, posing international trade challenges for the country, due to failure to meet the food safety and quality requirements, in line Sanitary and Phytosanitary standards (World Trade Organisation-WTO, 2018). It is worth noting that insects can be considered both physical foreign bodies (as you can see them) and biological hazards (due to the pathogenic risks associated with them).

Chemical food hazards originate from drugs, food additives, pesticides, industrial chemicals, environmental pollutants and natural toxins among others. This category of hazards is of increase concern in Uganda, in different food supply chains- notably chemical crop protection products. For instance, scientific studies in the country have reported high residues of dithiocarbamates exceeding the Codex Maximum Residue Limit in tomatoes (Atuhaire et al., 2017), antimicrobials of tetracyclines and β-lactams in cattle carcasses (Basulira et al., 2019), heavy metals in vegetables (Kasozi et al., 2018).

In 2023, FoSCU undertook a tailored desk review of common hazards and associated practices in supply chains of beef, dairy, ground nuts, maize, fruits and vegetables- an overview of which is presented in the table below. The table below presents

Table 1: An overview of the three main hazards in food and commonly associated practices along food supply chains

Hazard Category (....and types/examples)	**Exposure practices/contributing factors (both in crop and animal-based food supply chains)**
Chemical High residues of *pesticides, veterinary drugs, food additives, sanitary products* in animal and crop-based food products	▫ Consuming/eating chemical-treated seed, meant for planting ▫ Use of highly hazardous pesticides (HHPs), including acaricides on the farm/field and in storage. ▫ Use of wrong/inappropriate pesticides and vet drugs due to easy access over the counter. ▫ Non-adherence to recommended dosage (mixing rates) and pre-harvest interval/withdrawal period. ▫ Overuse (too high application frequency) of pesticides and veterinary drugs e.g. antibiotics. ▫ Accidental and/or deliberate adulteration of food or poisoning animals with chemicals. ▫ Slaughter of intoxicated cattle *(e.g. those which have failed to recover from chemical poisoning).* ▫ Inadequate antemortem and postmortem inspection of cattle. ▫ Abuse of public health chemicals and pesticides as preservatives, to *control pests/flies, and/or to improve aesthetic value of food products during storage and/or marketing of produce such as grains, fruits and vegetables, beef, milk etc.* ▫ Use of non-food grade utensils and equipment in transportation, storage, preparation, and serving. ▫ Use of unapproved sanitary products to clean utensils and equipment.

Biological
Foodborne Bacteria (e.g. *E. coli, Staphylococcus aureus, Salmonella typhi, Bacillus cereus, Enterococcus faecalis, Listeria monocytogenes…)*
Foodborne Viruses (e.g. *Hepatitis A & E, rotavirus, norwalk virus..)*
Pathogenic fungi *(e.g. Aspergillus flavus..)*
	▫ Milling poor quality grain (broken, diseased, shriveled)
	▫ Inadequate produce drying to safe storage moisture content (≤14%)
	▫ Inadequate produce storage allowing for moisture pick (rewetting) and pest infestation e.g.
	  ▫ Storage of produce directly on the floor and wall;
	  ▫ Leaking roofs, poorly ventilated and highly humid stores;
	  ▫ Storage of produce in shelled form for a long time or generally long storage period for more than 6 months;
	  ▫ Storage of damaged, discoloured, rotten, immature, sprouted kernels
	▫ Use of winnowing baskets smeared with cow dung *(…resulting in microbial contamination)*
	▫ Use of poor packaging materials susceptible to mould and pest infestation
	▫ Leaving produce to dry in the field or delayed harvesting after physiological maturity
	▫ Drying on bare ground or ground smeared with cow dung
	▫ Inappropriate transportation means e.g.
	  ▫ bicycles & open trucks- predisposing produce to moisture/rain, high temperature/heat accumulation when transported in big volumes (e.g. fruits and vegetables),
	  ▫ opportunistic infection from mechanical injuries (..due to rough roads, improper staking, and loading/offloading by head
	▫ Use of non-food grade preparation tools and ingredients
	▫ Poor hygiene and sanitation *(…in pack house, milking parlors, abattoirs/slaughterhouses, kitchens/restaurants…)*
	▫ Spreading produce (e.g. fresh fruits and vegetables) on wet & dirty ground and stalls
	▫ Sprinkling dirty water on fruits and vegetables to rehydrate them
	▫ Covering produce (e.g. fresh fruits and vegetables) with wet & dirty materials/sacks
	▫ Inadequate food cooking/roasting e.g. meat
	▫ Intentional food spoilage *(….consuming of spoilt or rotting beef as a culture in some communities)*
	▫ Inadequate animal disease prevention and control, resulting in presence of pathogenic microbes in food e.g. meat (*…Frequent ill animal health may be due to poor animal husbandry practices such as unhygienic animal houses, contaminated feed and water troughs, poor feeding and waste disposal)*

	▪ Accidental or deliberate intoxication of cattle e.g. bioterrorism. ▪ Intentional slaughter of sick/diseased cattle ▪ Inadequate quality control e.g. identification and traceability of cattle and meat ▪ Improper elimination of condemned parts or whole carcass ▪ Food (e.g. milk) adulteration with non-portable contaminated water ▪ Lack of or ineffective implementation of Hazard Analysis Critical Control point (HACCP) ▪ Inadequate waste or effluent management ▪ Insufficient Cleaning In Process (CIP) system in most road milk tankers ▪ Milk spoilage/microbial contamination due to regular breakdown of milk carriers on poor rural roads ▪ Inadequate disease diagnosis and management, resulting in shedding of pathogenic microbes in milk *(---e.g. insufficient management plan for mastitis and brucellosis on most dairy farms)* ▪ Microbial contamination due to poorly regulated temperature *(...refurbished milk coolers with reduced effectiveness and increased breakdown).* ▪ Mixing overstayed milk with fresh milk
Physical Foreign material *(...dust, soil, stones, glass, metal fragments, surface wear, wood pieces, hair, nails...)*	▪ Processing of produce using weary grinding stones, resulting in stone particle peel offs ▪ Use of rusty/corroded milling equipment ▪ Improper cleaning of equipment before and after processing leading to physical cross-contamination ▪ Use of equipment made of fabricated mineral fragments/mild steel (...that easily peel off/wear out) ▪ Transportation using uncovered/open trucks (... sometimes with littered surfaces or old/peeling surfaces), resulting in pick-up of physical foreign contaminants e.g. dust ▪ Drying on bare ground (...leading to pick up of physical foreign material) ▪ Inadequate cleaning/sorting of chaff, thus keeping poor quality/contaminated (diseased, shriveled, broken) produce e.g. ground nuts, sometimes with other foreign material ▪ Inadequate packaging that allows the grains to spill, getting contaminated ▪ Milling low quality (soiled and poorly sorted) grains into flour ▪ Dropping produce e.g. maize on bare ground in soil during harvest

	• Selling or preparing from open spaces without proper protection from dust and other physical contaminants • Not adhering to good food preparation practices (e.g. covering) • Use of old weary equipment for storing/selling milk • Physical foreign material from poorly cleaned and irregularly maintained coolers/storage containers. • Adulteration of milk with dirty non-portable water • Unhygienic housing, milking equipment, inadequate cleaning practices, poor milking practices may result in physical foreign material contaminating the milk on the farm

The synthesis of gaps/irresponsible practices in the above table that predispose consumers to food safety hazards, and the associated health effects underpin the importance of observing, at all times, as a basic minimum, the food safety principles of cleaning, cooking, separation, and chilling, as practicable as possible. This responsibility is for every player along the food supply chain- producers, processors, transporters, aggregators, cooks, vendors, and consumers- through implementation of Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP) among others, (FAO, 2016; FoSCU, 2023). In addition, to the supply chain actors, governments are mandated to play a central role in developing legislation, implementing policies, conducting inspections, enforcing regulations, educating and communicating with the public, as well as responding to food safety incidents and emergencies when they happen (FAO, 2024a). In this report, the focus will lie on the primary production node of the value chain, more specifically pest and disease management, that is crop protection.

Benefits that accrue from ensuring that food is safe include, but not limited to: i) boosting of national economies, trade and tourism, stimulating sustainable development, ii) building of consumer confidence and trust in the food supply chain, facilitating continued purchase of food products- which is crucial for the sustainability and growth of the food industry at both local and global levels, iii) reducing of food loss or wastage to spoilage or contamination, thus improving the overall availability and accessibility of safe food for populations worldwide- underpinning the close interlinkage that exists among food safety, nutrition, and food security, iv) reducing of food-borne illnesses and protection of public health in general, v) minimizing the risk of disruptions in the food supply chain, thus promoting economic stability, vi) minimizing of the ecological footprint of food production.

1.5 Challenges in Crop Protection

The demand for food, animal feed, fibres, fuels, feedstocks- hence the need for crops is growing (UNEP, 2022). At the same time, the spread, intensity and distribution of crop pests, at different levels, has increased dramatically in recent years due to climate change, variable weather patterns, globalization, trade, deforestation, agricultural intensification leading to reduced resilience in production systems, among others (FAO, 2024b). In Uganda, pests and diseases have consistently presented a notable production challenge for smallholder farmers (Atuhaire et al., 2016)- with outbreaks creating shocks and wearing down the resilience of farming systems and farmers' livelihoods (CABI, 2017). In the 2024 national census, households reported diseases, pests, lack of improved or certified seed, and on farm theft as the most common challenges encountered in agricultural production (UBOS, 2024).

At national level, the problematic crop pests and diseases documented in the recent past include, but limited to: fall army worm, fruit flies, false codling moth, coffee stem borer, quelea birds, aphids, thrips, mites, African bollworm, white flies (**insect pests**); banana bacterial wilt, coffee twig borer, coffee leaf rust, cassava brown streak virus disease, Pseudocercospora fruit & leaf spot in citrus, maize lethal necrosis, bacterial wilt, early and late blight (**plant diseases**); and parthenium, striga, couch grass and sedges (**weeds**) (CABI, 2017; MAAIF, 2014, 2018, 2020; NUFLIP, 2018).

At the subregional level, a recent survey by FAO and CABI, reported the priority emergent/transboundary pests of concern for Eastern Africa (Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan and Uganda) to include **insect pests:** desert locust, fall armyworm, tomato leaf miner, oriental fruit fly, papaya mealybug, red palm weevil, cochineal, mango mealybug, polyphagous shot hole borer and brown marmorated stink bug; **plant diseases:** maize lethal necrosis disease, wheat rusts, banana bunchy top virus, potato cyst nematode, citrus huanglongbing (greening) disease, and banana fusarium wilt disease tropical race 4; **noxious weeds:** parthenium weed, mesquite, and water hyacinth (FAO, 2024b).

Pesticides continue to be the main tool used for pest management worldwide. There is steady expansion in the global demand, production and use of pesticides (and fertilizers)- with combined global sales values growing at annual rate of about 4.1% and are projected to reach USD309 billion by 2025 (UNEP, 2022). However, there are growing human health (in addition to environmental and biodiversity) concerns over pesticide use making chemical pest management approach unsustainable in the long-term.

The next chapter of this report explores the specific situation of Uganda's crop protection - and it's different actors, legislation, and methodological approaches.

CHAPTER 2

Crop Protection and Food Safety

2.1 Introduction

Insect pest and weed infestation, and pathogen infection compromise crop health and the resultant yield- quantity and quality. FAO estimates an annual global crop yield reduction of 20-40% as a result of plant pests and diseases (FAO, 2024d). The importance of sustainable crop protection to guarantee sufficient quality food for the increasing global population has therefore become increasingly critical. In Uganda, management of pests and diseases is continuously reported among the major production constraints for the country's agriculture sector, notably the resource constrained smallholder farmers (Staudacher et al., 2020; Atuhaire et al., 2016; Karungi et al., 2016; Tusiime, 2014). Successful crop health protection is, however, impeded by among others, weak phytosanitary capacity in pest and disease risk analysis, diagnostics, surveillance, control and policy interventions (Kroschel et al., 2014; CABI, 2017).

The type, incidence and severity of pest infestation and pathogen infections require different management measures to protect the crop's health and the prospective harvest. The **type**, **application method**, and **timing** of crop health protection measures, however, have implications on the safety and quality of food produced, and consumed. For instance, if one chooses to use a chemical crop protection method (insecticides against insect pests, and fungicides/ bactericides against disease pathogens), application close to the time of harvesting (non-adherence to recommended pre-harvest interval) will result in a **chemical food hazard**, compromising food safety, due to the high/unsafe levels of pesticide residues in the harvested food. In addition to timing, the amount applied has food safety implications (Atuhaire et al., 2017; Kaye et al., 2015).

2.2 Crop Protection Actors

In general, pest and disease management actors in Uganda include State (Ministries, Departments, and Agencies) and non-state (UN Agencies, INGOs, Local NGOs, and private sector) as per the overview in the table below.

Table 2: Overview of actors in efforts towards management of pests and diseases in Uganda

Actor-category	**Actor- details**	**Key role(s) relevant to food safety and sustainable pest management**

State (Ministries and Departments)	- MAAIF-Directorate of Crop Resources' key Departments:
	  - Crop protection
	  - Crop inspection and certification
	  - Crop production
		- Providing and monitoring the availability and use of sustainable options for crop pests and disease management
		- Establishing and maintaining plant quarantine facilities and seed
		- Registration and certification of seeds, planting materials, plant and plant products and biological pest control products
		- Reviewing, updating, formulating and implementing policies, legislation, regulations, standards, strategies and plans for inspection and certification of plants/plant products, seeds, planting materials and biological pest control products
		- Creating awareness on phytosanitary, seeds, planting materials and agro-chemicals (bio-products) legislation & regulations
		- Capacity building and quality assurance on good agricultural practices and advisory services on crop production, primary processing, marketing and food and nutrition

State (Authorities and Agencies):	- NARO (NARIs, ZARDIs) - UCDA	- Quality control of pest management methods and agricultural products e.g. coffee - Research and development of resistant varieties - Capacity building trainings (pest/vector and disease management and post-harvest handling/value-chain management)
Non-State actors	- INGOs e.g. CABI, CIMMYT - UN agencies e.g. FAO - Local CSOs/NGOs - Private Sector	- Supporting policies and technologies appropriate to reduce negative impact of pesticides. - Supporting national capacity development and strengthening in sustainable crop protection - Awareness creation on pest and disease diagnosis and management - Promoting agroecology and organic agriculture - Development and facilitating availability of alternative pest management technologies e.g. sex pheromone traps

2.3 Crop Protection Approaches

The approach to management of insect pests, weeds, and disease pathogens in Uganda is predominantly curative-oriented, no or minimal integration of the different methods, and minimally research based. Broadly the used methods can be categorized into two approaches-chemical (synthetic pesticides) and non-chemical (cultural, host plant resistance, mechanical/physical, biological) methods.

2.3.1 Chemical Approach

2.3.1.1 Introduction

A curative-oriented approach, chemical use is the most dominant, often the first and only method used by smallholder farmers in managing pests and diseases, due to their quick knock-down action (Atuhaire et al., 2016; Staudacher et al., 2020; Andersson and Isgren, 2021). However, chemical pesticides possess known and unknown risk to human health, the environment and biodiversity. They are often inappropriately used by farmers with high disregard for manufacturers' label instructions- resulting in high residues in food, putting at risk the health of consumers (Atuhaire et al., 2017; Kaye et al., 2015), the farmers and their families (Mueller et al., 2024; Fuhrimann et al., 2021, 2024), and the environment (Fuhrimann et al., 2020; Oltramere et al., 2022).

2.3.1.2 Pesticide use trends

According to official government chemical registers, at end of the year 2023, at least 115 active ingredients (ais) and 669 brands of synthetic pesticides were legally registered for use in Uganda. These included insecticides (37 active ingredients-ais, 248 brands), herbicides (46 ais, 246 brands), fungicides (28 ais, 162 brands), fumigants (2 ais, 10 brands), and rodenticides (2 ais, 3 brands) (MAAIF, 2023; NDA, 2023).

Although national data gathering and reporting on quantity and value of pesticides is scanty, data progressively compiled by FAO in the recent years (2010-2022) shows (figure 2) that the total quantity of agricultural pesticides used in Uganda doubled in 12 years (2010- 2022), from 2,990.23 tonnes to 6,009.78 tonnes, with the peak quantity reported in 2015 at 6298.13 tonnes. Disaggregation of this quantity by type (target pest) shows increments of: Insecticides- 1,427.16 to 2,868.31, herbicides- 271.84 to 546.34, fungicides and bactericides- 1,291.24 to 2,595.13 in the period between 2010 and 2022 (FAOSTAT, 2024).

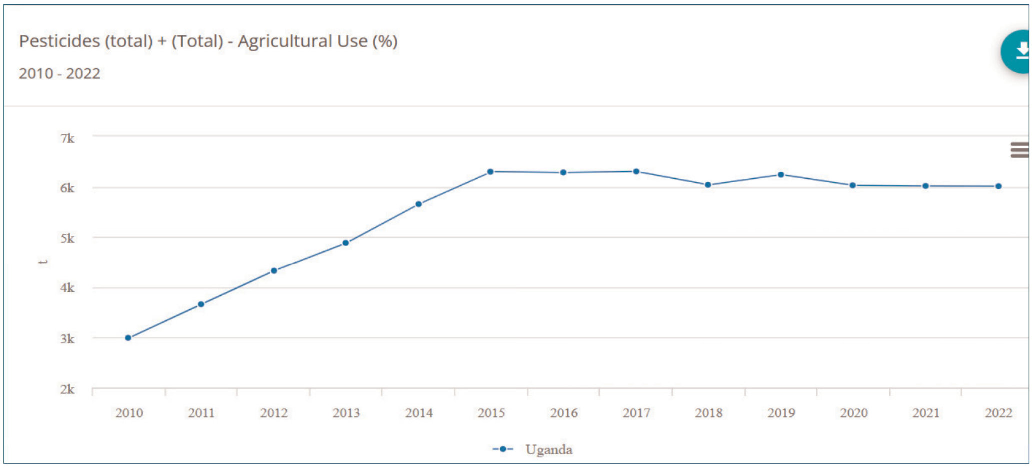

Figure 2: Reported agricultural use of pesticides in Uganda between 2010 and 2022 *(Source: FAOSTAT, 2024).*

In terms of imports, the monetary value of total pesticides imported more than double (2.3-fold increment) from USD 32.57 million in 2010 to USD 75.87 million in 2022, with a peak import value of USD108.57 million reported in 2020.

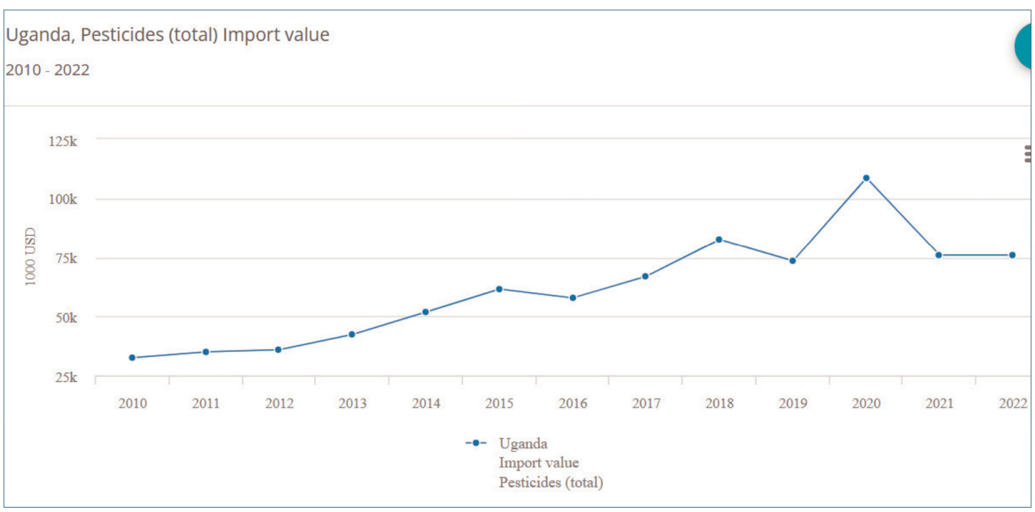

Figure 3: Reported trend pesticide import value in Uganda between 2010 and 2022 *(Source: FAOSTAT, 2024).*

2.3.1.3 Legislation of pesticides

In terms of legislation, pesticides in Uganda are mainly regulated through two laws, that is, the *Agricultural Chemicals Control Act, 2006* and the *National Drug Policy and Authority Act, 1993* (chapter 206). The former governs the manufacture, storage, distribution, and trade in, use, importation and export of agricultural chemicals-insecticides, fungicides, herbicides, miticides, nematicides, bactericides, rodenticides, avicides, bio-pesticides, chemical fertilisers, growth regulators, bio-fertilisers, wood preservatives, bio-rationals (*parts of potent plants or chemical extracts of plant origin)* or any other chemicals used for promoting and protecting the health of plants, plant products and by products. On the other hand, the latter provides for the control of import, export, placing on the market and prescription of drugs (including acaricides) in Uganda- with drug defined as any substance or preparation used or intended to be used for internal or external application to the human or animal body either in the treatment or prevention of disease or for improving physiological functions, or for agricultural or industrial purposes. However, it should be noted these two pieces of legislation are rather old and would benefit from a tailored review to align with the current context of legislating agricultural protection products.

2.3.1.4 Actors in pesticide use

Actors in Uganda's pesticide lifecycle management are majorly government (as regulators), private sector actors (as importers and distributors), and farmers (as end users of pesticides). On behalf of government, two main institutions- MAAIF (specifically ACB) and NDA- hold the main mandate to register and regulate trade in and use of pesticides. ACB (working through Crop Certification and Inspection department of MAAIF), oversees crop-based pesticides (including commercial biological control products and fertilizers), while NDA regulates veterinary (including acaricides), human and public health drugs (Agricultural Chemicals (Control) Act, 2007; National Drug Policy and Authority Act, Cap 206).

The private sector-the importers and distributors- is the lead promoter of synthetic pesticide use in the country. Key actors include individual large scale commercial corporations (floriculture, sugarcane, tea farms), local pesticide importers (some registered under the umbrella of CropLife Uganda and others not), and local distributors and retailers (some registered under the umbrella of UNADA and others not) (UFEA, 2024; CropLife Uganda, 2024; UNADA, 2024).

Figure 4 below further gives an overview of other relevant stakeholders involved at the different stages of the pesticide lifecycle in the country.

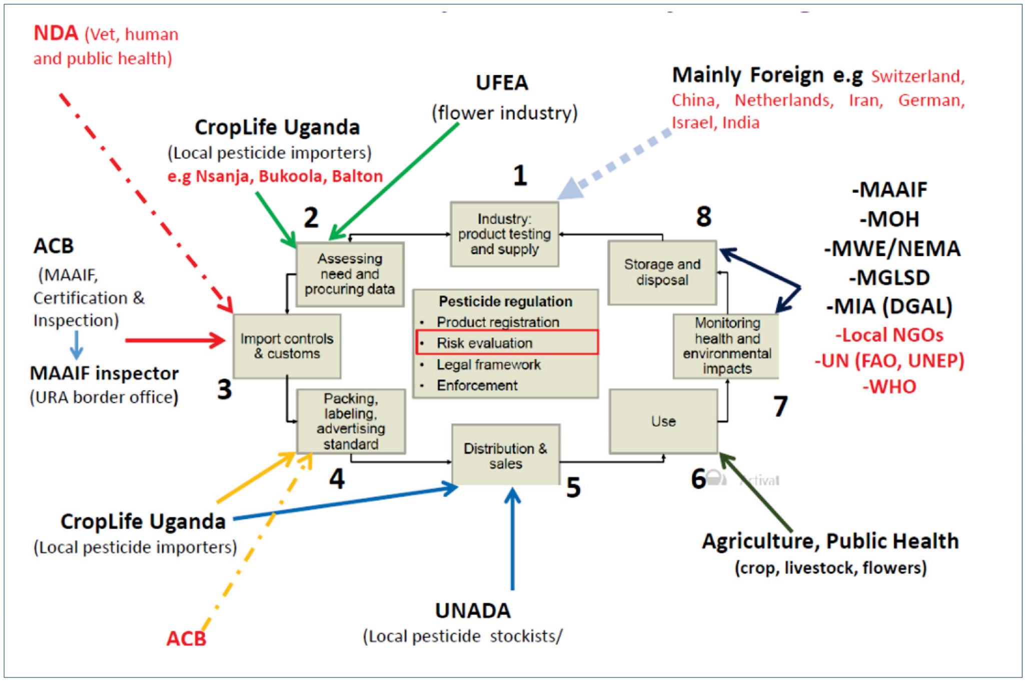

Figure 4: Overview of pesticide lifecycle in Uganda- stages, key actors, and stakeholders *(Source: Atuhaire, 2017).*

2.3.1.5 Pesticide use-food safety concerns

Concerningly, the most commonly used pesticides by smallholder farmers are categorized as highly hazardous pesticides (HHPs)- presenting particularly high levels of short or long-term hazards to health or environment, based on internationally accepted classification systems or listed in relevant binding international agreements/ conventions or appearing to cause severe or irreversible harm to health or the environment under conditions of use in a country- according to the International Code of Conduct on Pesticide Management (FAO/WHO, 2014). Presence of high HHPs residue levels in food and drinking water is a pertinent issue of concern in Uganda (Atuhaire and Sekimpi, 2019).

As of July 2023, about 115 active ingredients in 669 brands/products were officially registered as pesticides in Uganda. Of these, up to 55 active ingredients (47.8% of total registered) and 459 brands (68.6% of total registered) qualified as HHPs, according to Pesticide Action Network (PAN) Criteria for HHPs (PAN, 2021). With regard to the FAO/WHO (JMPM criteria), this equivalent proportion of HHPs was 18 active ingredients (15.6% of total registered) 129 brands (19.2% of total registered) (JMPM, 2008). In comparison with registration status in the exporting countries, majority (65.5%) of the 55 flagged active ingredients were not approved for use in the European Union (figure 5).

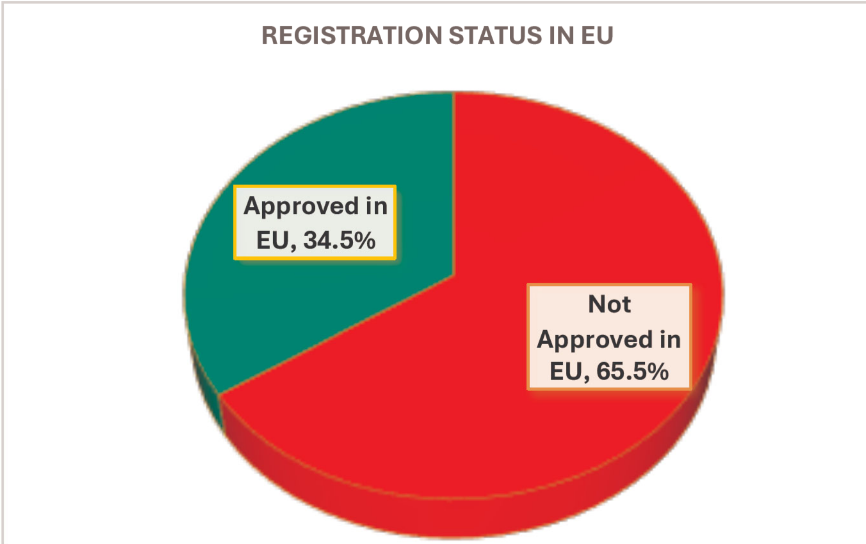

Figure 5: Registration/approval status in the European Union, of the identified 55 pesticides flagged as HHPs *(Source: FoSCU, 2023).*

High toxicity to bees was the most dominant factor of concern for these identified HHPs, with the other top 5 main concerns related to human health- carcinogenicity, fatality, and reproductive toxicity (figure 6) (MAAIF, 2023; NDA, 2023).

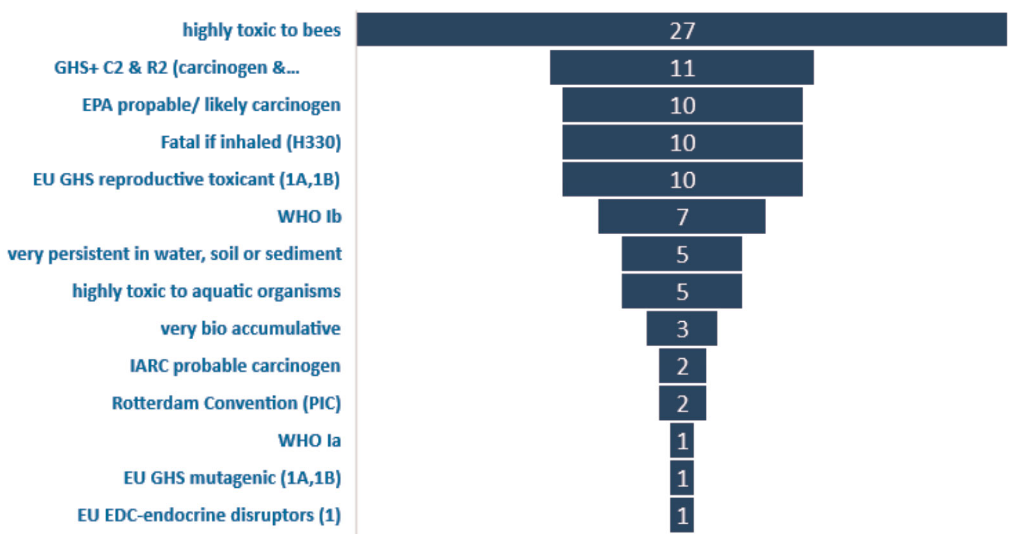

Figure 6: Number of identified pesticides (active ingredients) by HHP inclusion criterion *(Source: FoSCU, 2023).*

Detail description of the HHP criteria (PAN and JMPM), detailed lists of the identified HHPs, and registration status in the EU are presented in Annexes *1,2,3,4,* and *5* of this report.

In addition to use of HHPs, other specific gaps in farmers' pesticide-related knowledge, attitude, practices (KAP) that compromise food safety include use of pesticides on the wrong crops, non-adherence to recommended mixing rates and pre-harvest (Ssemugabo et al., 2022; Atuhaire and Sekimpi, 2019; Atuhaire et al., 2017; Kaye et al., 2015). Their impact on food safety is often exacerbated by socio-demographic factors, weak crop protection and food control regulatory and institutional support systems (Atuhaire, 2016; Oesterlund et al., 2014). These gaps, compounded with other inappropriate post-harvest use of synthetic chemicals results in unsafe agricultural products delivered to consumers- putting their health at risk, as well as jeopardizing trade relations- due to violation of food trade quality standards on maximum residue limits.

2.3.1.6 Principles to consider in identifying alternatives to HHPs

In the quest for sustainable crop protection, finding effective and safer alternatives to highly hazardous pesticides presents a key challenge. According to UNEP (2023) and FAO (2024c), below are some of the key principles that ought to be considered in the process of identifying alternatives to HHPs.

- **Proper understanding of the pest problem**

A given pesticide (that one intends to replace) may be used on different crops and/or against a wide range of pests (and pathogens). Therefore, to ensure that these crops continue to be protected, upon stopping the use of this pesticide, one ought to understand the spectrum of the pest problem so as make an informed decision on the range of alternatives that could be applied or tried as replacements for a given HHP(s), notably in the framework of IPM.

- **Avoid replacement of one chemical with another**

The decision to stop and replace a certain pesticide should create an opportunity for rethinking one's pest management strategies. A sustainable crop protection strategy should embrace less chemical and more ecological methods. Replacement of one chemical with another may result in another set of chemical related problems- a process known as "regrettable substitution", hence should be avoided, as practical as possible.

- **Provide solutions rather than products**

In searching for alternative to HHPs, suitable options that remove hazards and minimize human and environment risks as much as possible should be considered. Pesticide regulators should not be simply seen as a mechanism for the approval or rejection of pesticide products on the grounds of safety and efficacy. Instead, regulators should lead a multi-stakeholder engagement process, involving extension services, researchers, agricultural input suppliers, farmers and other relevant stakeholders- to find safe and effective alternatives for pest and disease management.

In addition, other key principles that ought to be considered include: risk assessment of alternative options that are being considered, and ensuring that the process of HHP replacement is fast-tracked.

2.3.2 Non-chemical Approach

2.3.2.1 Introduction

Although chemical approach remains the dominant approach to pest management, there is increasing demand for chemical-free food, due to concerns over human health associated with pesticides. There is growing evidence of pesticides and their degradation products being detected in food chains, and the environment, including soils, sediments and surface and groundwater (UNEP, 2022; Atuhaire and Sekimpi, 2019; Atuhaire et al., 2017; Kaye et al., 2015). In addition, positive association between exposure to pesticides and negative health outcomes has been established- for instance impaired visual memory and poor sleep problems among smallholder farmers in Uganda exposed to glyphosate and mancozeb (Fuhrimann et al., 2021, 2022). More still, intensive pesticide use has resulted in pest control crises- outbreaks of secondary pests and pest resurgence following development of pesticide resistance.

The foregoing narrative therefore justifies the urgent need for alternative methods to synthetic chemicals that can sustainably manage target pests (from causing economic damage), while putting into consideration the integrity of human health, the environment, and biodiversity. Different non-chemical methods exist- *cultural, host plant resistance, mechanical/physical, and biological-*, however their adoption among Uganda's smallholder farming fraternity is still low (Atuhaire et al., 2016). This may be attributed to limited availability and access to commercial ready to use products (non-synthetic chemical) on the Ugandan market, passive information seeking behaviour of smallholder farmers, sources of pest management information, and capacity of local agro-input shop outlets (Staudacher et al., 2020; 2021). In the context of food safety, facilitating farmers' access to effective alternatives minimizes the over-reliance on synthetic pesticides, progressively eliminating the chemical hazard footprint in the food supply chain.

2.3.2.2 Innovations/technologies used

(i) Cultural/ ecological

Broadly referred to as ecological management, the traditional methods under this category aims to: i) reduce favorability of the ecosystem for the pest, ii) disrupt the continuity of the required food sources for the pest, iii) divert pest populations from the crop, and iv) reduce the impact of injury inflicted by pests. Examples of methods under this category used by smallholder farmers in Uganda, and on which research and scaling is increasingly promoted include **sanitation, spacing, crop rotation, planting time, tillage, intercropping, and soil fertility management** among others. For instance:

Close spacing (i.e. higher plant density) has been shown to be successful in management of aphids in cowpeas and ground nuts in eastern Uganda (Adipala et al, 2000; Karungi et al, 2000; Nampala, 2002). Close spacing reduces aphid colonization and fecundity by interfering with their visual stimulation- denser plants increase soil cover, reducing the strength of visual contrast between soil and plants.

Early planting has been reported in Uganda to be critical in reducing the severity of the pests- maize stalk borer and fall army worm in maize (Durocher-Granger et al., 2024; Gebre-Amlak et al., 2008). Evidence based manipulation of planting dates disrupts the crop-pest synchrony, allowing the crop to go through its critical growth stages without coinciding with the pest's life cycle.

Intercropping has been used in effective control of both stemborer moths and striga weed in Uganda (especially in the cereal growing areas of eastern region) through *push-pull method*-technique introduced by International Centre of Insect Physiology (ICIPE) (Khan et al., 2011).

(ii) Host Plant Resistance

This involves the use of planting materials that possess a form of resistance to pests and diseases. Plant resistance may be either **true** (e.g. antixenosis, antibiosis, tolerance) or **pseudo** (induced, escape, host evasion) (MAAIF & UNACOH, 2017). In addition, grafting or budding technique is also used to enhance resistance of crops- especially fruits and vegetables- by grafting a desirable (but susceptible crop) onto a root stock with true resistance (farmkioskAfrica, 2021).

(iii) Mechanical/physical and Behavioral

This involves the use of physical measures to combat pests and diseases. Examples of methods include **rouging, screening using insect proof mesh, use of protective collars, handpicking, pitfall traps**. In addition, the behavior of pests, especially their preference for certain colours, can be manipulated using **coloured sticky traps** to attract and capture different pests. For instance, yellow traps are known to attract whiteflies and leafminers, while blue traps attract thrips. This behavioral manipulation helps to monitor as well reduce pest populations. In Uganda sticky traps are commercially available on the market, distributed by select private entities (MAAIF & UNACOH, 2017)

(iv) Biological

This approach involves control of pest population and damage by purposeful use or manipulation of their natural enemies. Natural enemies/biological control agents mainly include parasitoids, predators, and biopesticides.

Parasitoids- these are insects that lay their eggs on or in the body of their host (targeted pest), the larvae then feed on the host from inside, eventually killing it. A parasitoid is only parasitic in its immature stages while the adult is free living. Parasitoids are mostly wasps (e.g. trichogramma species) and some flies (e.g tachinid fly).

Predators- these are mainly free-living arthropods (insects and some arachnids) that directly kill and/or consume the whole prey (target pest). Predators in most cases attack all stages of development of their prey. In Uganda, intentional use of predators is mainly in commercial farms- especially flower farms- under protected environment/screen houses. Common predators, naturally occurring in many open fields in Uganda include beetles (ladybird, ground, rove), damsel bug, braconid, hoverfly, and spiders.

Biopesticides- these may be grouped into biochemical and microbial.

- **Biochemical** are naturally occurring substances that can be further grouped into semiochemicals and plant extracts (botanicals). *Semiochemicals* include *pheromones* (intraspecific interactions- released by one member of a species to cause a specific interaction with another member of the same species) and *allelochemicals* (interspecific interactions), with the moderated behaviour described in terms of arrestants, attractants, repellents, deterrents, stimulants. Pheromones may be further classified on the basis of the interaction mediated, such as *sex, alarm, aggregation pheromone.* Sex pheromones are of particular interest in pest management- mainly used for detection and monitoring, and mating disruption (MAAIF & UNACOH, 2017; FoSCU, 2023).
- **Microbial** are a form of biopesticides whose active ingredient is a microorganism such as a bacterium, fungus, virus that can cause disease to the target pest. These microbes reduce their target pests' population through mechanisms such as pathogenism, competition, and production of allelochemicals. To successfully utilize microbial pesticides, one ought to understand their mode of action, ecological adaptations, host range, and dynamics of the pathogen-arthropod-plant interactions (MAAIF & UNACOH, 2017).

2.3.2.3 Legislation and policy

Legislation that is relevant to non-chemical pest management and food safety is generic and includes *the Plant Protection and Health Act, 2015* and *the Seeds and Plant Act, 2006.* Key provisions/result areas in this legislation, that are relevant to food safety and sustainable plant protection include: i) protection and enhancement of the country's reputation regarding agricultural exports and imports, ii) sustainable plant and environmental protection, iii) regulation of import and export of plants and plant products, iv) protection of plants against destructive diseases, pests, and weeds, including reforming and consolidating the related law, and v) prevention of the introduction and spread of harmful organisms.

Policies with the most relevant provisions include the *National Organic Agriculture Policy (2020-2025),* the *third National Development Plan- NDPIII (2020/21–2024/25),* and *National Agroecology Strategy (2023/24–2028/29)*. NDPIII's notable targets include strengthening systems for management of pests, vectors and diseases (e.g. infrastructure and facilities for disease diagnosis and control, human capacity for management of pests, vectors and diseases) and promoting sustainable land and environment management practices in line with the agroecological needs e.g. reducing agro-chemical contamination. The National Organic Agriculture Policy's aims at enhancing organic agriculture-related research, technology development and dissemination, and promoting organic agriculture education and training among others (MAAIF, 2019). On the other hand, final approval and launch of the *National Agroecology Strategy* is foreseen by the end of 2024 (Biovision, 2024).

2.3.3 Integrated Pest Management (IPM) Approach

2.3.3.1 The concept

Due to variability of field conditions, range of pests and their life stages, as well as range of crops, studies show that an informed mix of different methods is the realistic, effective and sustainable approach to crop protection- as opposed to use of a single method or approach (either chemical or non-chemical) in isolation (Karungi et al., 2002, 2003, 2016; Adipala et al., 2000; Bonabana-Wabbi, 2002; Bonabana-Wabbi et al., 2006). IPM is thus that approach that aims at careful consideration of all available pest control techniques and their subsequent integration in an appropriate manner that discourages the development of pest populations, while minimizing the use of synthetic chemical pesticides and their associated effects to human health and the ecosystem. Globally, FAO has been promoting IPM, mainly through the Farmer Field School (FFS) approach and the different case study outcomes are accessible at its dedicated webpage. As illustrated in figure 7, IPM prioritises non-chemical methods, without eliminating the option of chemical use.

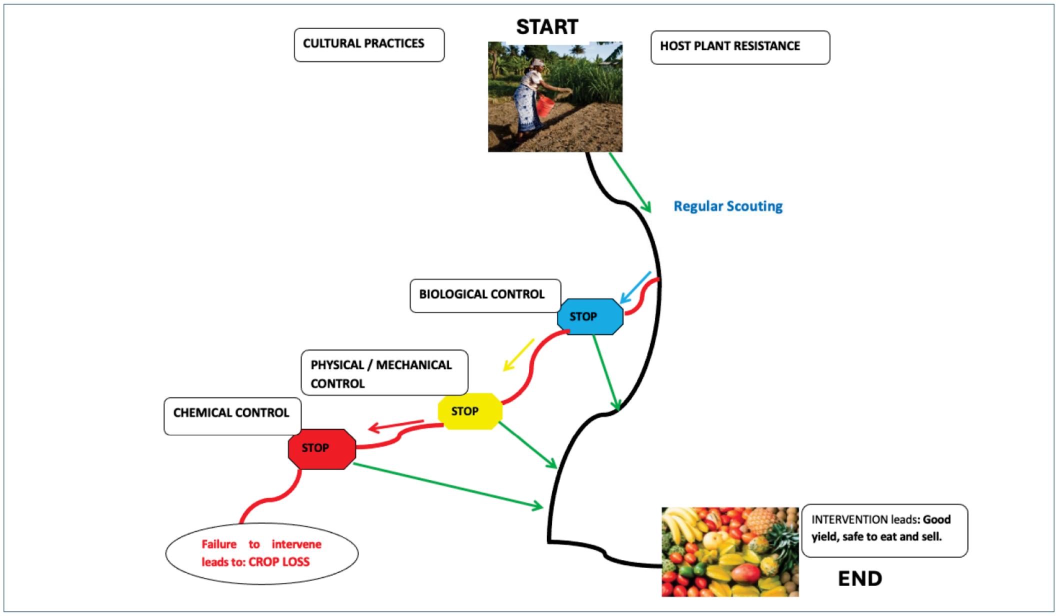

Figure 7: An illustration of IPM winding road showing different possible methods that can be considered for integration in a typical cropping season *(source: FoSCU, 2024)*

2.3.3.2 IPM packages

In Uganda, different IPM packages have been developed, tested, and their adoption in a range of pest-crop combinations assessed.

For instance...

- IPM package for managing key pests (thrips, aphids and whiteflies) of hot pepper (Karungi et al., 2013). The methods integrated included:
    - weekly foliar sprays of dimethoate, => *(chemical)*
    - close spacing at 60cm*50cm, => *(cultural)*
    - 1.5m high net perimeter screen around the plot, and transparent plastic mulch => *(mechanical)*
- An IPM package for management of key pests (bollworm, aphids, thrips, and white flies) and diseases (late blight, bacterial wilt, viruses) for tomato (Karungi et al., 2002). Methods combined were:
    - bacteria wilt resistant tomato variety MT56, grafting using resistant rootstock *(host plant resistance)*
    - mulching, staking, *(cultural)*
    - minimum pesticide spray schedule of 3-4 pesticide sprays per season, *(chemical)*

- seedling production using low tunnel systems for pest/vector exclusion *(mechanical)*

2.3.3.3 IPM Adoption

In Uganda, the adoption of IPM and non-chemical methods, in general, has been relatively low, especially by smallholders. The documented hinderances range from technology delivery mechanisms, social factors, market forces, and management factors among others. For example:

- In assessing adoption of an IPM package *(intercropping, crop rotation, two improved varieties, incorporating an 'exotic weed chaser', optimal planting dates, optimal planting density and fertilizer use)* for managing cowpea and ground nut pests in Eastern Uganda, Bonabana-Wabbi et al (2006) found the factors that influenced IPM adoption the most, were:
  - economic/market forces (such as labour availability, technology resource requirements, technology complexity) and
  - the level of expected benefits, across both crops and all technologies.
- In ascertaining adoption of an IPM package for tomato pests in Central Uganda, Namirembe-Ssonko et al (2008) documented the limitation factors reported by farmers to include:
  - wide range of tomato diseases,
  - limited availability and access to developed resistant varieties,
  - labour demand/ tedious nature of certain practices such as staking,
  - scarcity of materials for mulching and staking,
  - other pests such as termites attacking mulch and stake, and
  - lack of a speciality market for tomatoes produced without or less chemical pesticides.

In addition to the aforementioned factors, use of IPM as the dominant approach to pest management in Uganda's is limited by, among others:

- IPM research is still at 'population level', that is, development of narrow packages for managing one or a few pests.
- The dissemination (communication component) of successful IPM research packages is largely lacking or not sufficiently popularised amongst farmers.
- The country's policy environment largely favours easy access to synthetic chemical pesticides, hence making majority of farmers opt for this quick fix approach.

Nevertheless, notable efforts towards improving crop protection and food safety in the country, have been undertaken by different stakeholders. The next chapter of this report explores some of these interventions/initiatives.

CHAPTER 3

Local Interventions

3.1 Interventions on cross-cutting food safety gaps

3.1.1 Regulatory and Institutional framework

Currently different relevant government institutions tackle food safety bits in isolation without any harmonized and coordinated approach. These include Ministry of Local Government, Ministry of Health (MoH), Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Ministry of Trade, Industry and Cooperatives (MTIC, through UNBS) (Kankya, 2020). To address this gap, the government is in the final stages of passing a national law that establishes the 'food and agriculture authority'- an entity that will hold the lead mandate for regulating and coordinating food safety in the country.

3.1.2 Policy

In the most recent past a state and non-state collaborative policy specific to food safety, that was launched in 2018 under MAAIF, is the National Action Plan and Strategy for Aflatoxin Control in Uganda- aimed at facilitating a national campaign towards the control of mycotoxins with special emphasis on aflatoxins.

3.1.3 Generic awareness creation and advocacy

Dissemination of general food safety information through radio talk shows, twitter campaigns, video documentaries, face-to-face dialogues and through other relevant forms of information, education and communication (IEC) materials has been undertaken by local non-state entities such as FoSCU, KRC, UAA, Caritas Uganda, CONSENT, FRA among others.

3.2 Interventions specific to chemical crop protection

3.2.1 Final Regulatory Action

Government (MAAIF) has in the last 10 years undertaken final regulatory action to ban up to 12 hazardous pesticides from further importation and use in the country's agriculture sector. These include methyl bromide, endosulfan, paraquat, dichlorvos, dimethoate, ametryn, diuron, carbofuran, atrazine, butachlor, and chlorpyrifos (MAAIF, 2024). This action eliminates, from the food supply chain, the would-be chemical hazard footprint from these banned pesticides.

3.2.2 Enforcement of legislation

Government (MAAIF) has also implemented the final stages (Solicitor general and signing by the Minister) of enacting the long overdue regulations that operationalize implementation of the main law that governs agrochemicals in the country, that is the Agricultural Chemicals Control Act, 2006.

3.2.3 Targeted awareness creation and advocacy

Over a 10-year period (2010-2020), a local NGO (UNACOH) created awareness on responsible pesticide use and handling among farmers, extension officers, health care workers, village health team members, agro-input dealers, local leaders, and the public through face-to-face and electronic fora, in at least 20 districts across the country. In addition, in 2023, a local NGO (CEFROHT) developed a video documentary titled 'the cancer we eat' highlighting the gaps in pesticide use, regulation, associated dietary exposure and health risks. More still, in 2020/2021, two local NGOs (CEFROHT/SEATINI) spearheaded a campaign on protection of human health from pesticides, including submission of a position paper urging Government of Uganda to ban the use of glyphosate-based herbicides in the country's agriculture sector.

3.2.4 Technical capacity building

In addition to a series of trainings for farmers and other stakeholders in crop protection, a local NGO (UNACOH) in collaboration with MAAIF (crop protection department) developed a training curriculum/manual of sustainable pest and pesticide management, covering five modules, including one dedicated to integrated pest management. Thousands of copies were printed and distributed to extension officers through MAAIF's structures.

3.2.5 Research and evidence generation

Over the last 10 years, tailored research studies on crop protection, pesticides, and food safety that have been undertaken in Uganda to inform policy decision, as well as influence practices and attitudes (Fuhrimann et al., 2024, 2022, 2021; Sekabojja et al., 2023, 2020; Ssemugabo et al., 2022; Röösli et al., 2022; Staudacher et al., 2021, 2020; Andersson and Isgren, 2021; Atuhaire and Sekimpi, 2019; Atuhaire et al., 2017, 2016; Clausen et al., 2016).

3.3 Interventions specific to non-chemical crop protection

3.3.1 Biological

- **Semiochemicals**

Under the sub-category of semiochemicals, sex pheromone traps are currently promoted and used in Uganda targeting pests such as fall armyworm, false codling moth, and fruit fly among others. For instance, a **fruit fly trap** is used to monitor and control fruit flies through attracting, trapping, and killing the adults. The critical period for trapping this pest is during flowering and fruiting, however, constant trapping is recommended. The trap is constituted of a suitable substrate/absorbent material (treated with a lure- synthetic para-pheromones mixed with insecticide), hook/hang, and container (e.g. bucket or bottle). Further details are available are https://foscu.org/infovid.php

- **Botanicals**

In Uganda, botanicals are commonly prepared from plants such as neem tree, papaya, marigold, tephrosia, onion, garlic, pepper that possess natural pesticide properties. The preparation procedures are, however, still rudimentary and on a small scale. Local non-state organisations actively involved in training farmers and promoting botanicals include but not limited to KULIKA Uganda, AFIRD, and RUCID Organic college.

- **Microbials**

Microbial pesticides are legally registered by the government through MAAIF and commercially available on the market, mainly through Koppert biological systems- a private company. For instance, as of July 2023, at least 10 microbials were legally in use, including *Steinernema feltiae, Stratiolaelaps scimitus, Transeius montdorensis, Trichoderma asperellum, Trichoderma viride, Verticillium lecann*i (MAAIF, 2023). However, their knowledge and use are still limited among smallholder farmers.

- **Parasitoids**

In Uganda's open fields, one of the most successful use of parasitoids has been use of the parasitic wasp *(anagyrus lopezi)* to control the cassava mealy bug. In 2022, two parasitoid wasps *(Gyranusoidea tebygi* and *Anagyrus mangicola)* were released (specifically in the hotspot area of Ntungamo district) to control the mango mealybug (MMB) pest, by MAAIF, supported by FAO and IITA (FAOUganda, 2022).

3.3.2 Resistant varieties

In Uganda, the National Agriculture Research Organisation (NARO), Makerere University, and other research institutions involved in plant breeding continue to develop and release different resistant crop varieties, for instance for maize, beans, coffee, potato, tomato, rice, wheat and cassava among others. A national variety list is regularly published on MAAIF's website (MAAIF, 2024).

3.3.3 Cultural/traditional/agroecology

A local non-state actor, PELUM Uganda, currently spearheads efforts towards agroecological crop production and protection, as a means towards sustainable and safe food production. Examples of recent specific grassroot interventions include:

- **2023-2024:** upscaling utilisation of organic farming inputs among 200+ smallholder farmers in the districts of Mukono, Wakiso, Luwero, Rukiga and Kaberamaidho. Reported outcomes so far include: increased crop yields by farmers attributed to application of soil amendments in form of Biochar and Bokashi, and increase in farmer groups' capacity to produce biochar- up to 2000kgs per week.
- **2018-2022:** promotion of agroecology farming among 200+ households in Wakiso and Mukono districts. Notable outcomes reported include: increased biodiversity in farmers' cropping systems through intercropping, companion planting, and agroforestry; consumption of healthy and diversified diets; shift to agrochemical free farming system.

A community mindset inclined towards use of conventional practices, exposure of farmers to different models in a short period of time, unpredictable weather patterns, and community mindset of dependency on handouts/freebies are some of the hinderances to adoption of agroecology at community level, as documented by PELUM Uganda during the course of delivering the two above interventions.

3.3.4 Policy (non-chemical related)

The most recent policies that have specific targets of promoting non-chemical crop production and protection include National Organic Agriculture Policy (2020-2025), National Development Plan- NDPIII (2020/21–2024/25), National Agroecology Strategy (2023/24–2028/29). For instance, promotion of sustainable land and environment management practices in line with the agroecological needs, one of the areas targeted by NDPIII.

In addition to the successful and promising local initiatives, as presented in this chapter, more needs to be done to ensure sustainable management of pests and diseases, without compromising the quality and safety of the food produced. In the next chapter, we make recommendations on what different actors and stakeholders could further do, in this endeavour.

CHAPTER 4

Recommendations

Under this chapter, FoSCU advances its recommendations to relevant stakeholders, disaggregated by category, on how the country's food safety situation can be improved, through tackling gaps specific to crop protection, as well as agri-food system challenges in general.

We recommend...

4.1 Knowledge brokers– public and private research institutions, academia and think tanks

1. To dedicate efforts to spearhead the road map for research and development of new, affordable, and effective Integrated Pest Management (IPM) packages as a realistic approach to minimize over-reliance on synthetic chemical pesticides. Crops that are vulnerable to pests and diseases, such as tomatoes and passion fruits, often require intensive use of synthetic pesticide and should therefore be the primary focus. Notably, such research and development should involve sufficient field trials to assess adaptability to different agroecological zones.
2. To lead and intentionally facilitate wide-spread dissemination of existing and successful crop protection innovations- as per the overview of examples shared in chapter three of this report- to enable access and use by smallholder in different parts of the country. This should be pursued through strategic collaborations with a wide network of media outlets and farmer associations across the country.
3. To intentionally partake in strategic Public-Private People Partnerships (PPPPs) to share crop protection-food safety data and provide scientific guidance to trigger action- policy and practice.
4. To lobby for resources to undertake regular surveillance studies to understand enablers and hinderances to uptake/adoption of the available non-chemical crop protection technologies.

4.2 Private sector– importers, distributors, and retailers of crop protection products

1. To lead efforts to commercialize effective botanicals with pesticide properties into readily available crop protection products for farmers' easy access on the local market. For instance, through strategic collaborations/partnerships with knowledge brokers (e.g. local public and private research institutions) and/or with their trade partners/manufacturers, from where pesticides are imported.
2. To take responsibility and spearhead national efforts to import and use less hazardous pesticides, cognizant of local farmers' poor use practices that result in chemical contamination of food supply chain with high residue levels.
3. To intentionally increase trade in and marketing/creating awareness on commercial ready to use effective biopesticides. This could be pursued through collaboration among the country-wide network of retailers/agro-dealers, farmer associations, extension officers, and CSOs/CBOs that support farmers.

4.3 Advocacy actors –CSOs, CBOs, FBOs, Cultural institutions, producer and consumer associations

1. To mobilize, support, and sensitise smallholder farmers towards producing safe food through embracing non-chemical alternative crop protection methods and using pesticides judiciously while adhering to recommended mixing rates and pre-harvest interval, and disposing of pesticide waste in a safe manner, among others.
2. To strategically advocate for government's fast-tracking of the enactment of key food safety legislation, for instance, the Consumer Protection Bill to facilitate harmonized setting of quality, safety, and reliability of goods, including agricultural products, remedies of non-compliance and prohibition of unfair trade practices.
3. To design and lead:
   - coordinated behaviour change campaigns on mitigation and impact of unsafe food production and consumption on food security, human and animal health, trade, and livelihoods in general.
   - tailored information dissemination to duty bearers and key stakeholders on regulatory and non-regulatory measures for improving sustainable pest and pesticide management in safe food production.
4. To prioritise research and evidence-based alternative policy advice/proposals to duty bearers with regard to safe food production.

4.4 Donors and development partners

1. To do due diligence and support building the technical capacity of farmers and food supply chain actors in relevant food safety aspects such as good agronomic practices, IPM, sound pesticide lifecycle management, post-harvest handling, and compliance to standards and guidelines- along with a proper sustainability plan.
2. To fund sound government efforts to strengthen technical and infrastructure/ logistical capacity of extension service providers to reach and guide farmers on tailored sustainable crop protection.
3. To support the prospective country's food and agriculture authority spearhead coordination of key food safety functions such as inspection, certification, monitoring, surveillance, traceability systems, and infrastructure.
4. To develop strategic collaborations with relevant government entities to support mainstreaming of regular food safety surveillance for food safety hazards, in their existing structures. For instance, equipping existing infrastructure such as laboratories (under UNBS, DGAL, UIRI) with sufficient tools to test for key food safety and quality parameters e.g. chemical, microbial, mycotoxin levels.

4.5 Government –Ministries (MAAIF, MOH, MTIC, MWE, MoFPED...) and Agencies/Authorities

1. MAAIF, as the lead regulator of pesticides, through its Department of Crop Inspection and Certification (DCIC) should join ongoing global efforts against HHPs. The Ministry should protect consumers by taking a final regulatory action to ban or severely restrict the use of identified HHPs in the country's agriculture sector. With the regulator leading the way, such a process (of phasing out a pesticide and finding alternatives) must also involve key stakeholders, including but not limited to farmers, farmer associations and other users of pest control tools, agro-dealers, importers, extension service providers, researchers, health and environment authorities, media, public-interest groups, and consumers. In this endeavour, FoSCU strongly recommends that MAAIF uses relevant global guidance and decision-making tools, for instance, the FAO pesticide registration tool kit, to guide national decision making processes on pesticides.
2. MoH, MAAIF, MTIC, MoLG (and the relevant departments and agencies/ authorities thereunder) to improve the enforcement of existing regulatory provisions and non-regulatory interventions relevant to food safety, under their dockets.
3. MAAIF and other involved government entities, to fast-track the establishment of the food and agriculture authority, as a means to harmonize institutional food safety mandate - as well as support the authority to establish a national food control management system that is evidence-based, operating on a risk

analysis framework to take policy and regulatory decisions and actions- to ensure safety of food produced and distributed/marketed in the country.

4. MAAIF in collaboration with other involved stakeholders, to fast-track the finalisation, launch, and implementation of the national agroecology strategy.

5. MAAIF and MOH to pursue and strategically enable complementary roles of their central and local government levels. For instance, delegating, facilitating and supervising local governments to lead the inspection of grassroot activities- related to food production and distribution services, to ensure regular and timely compliance monitoring.

6. MAAIF should guide and spearhead the national road map towards sustainable crop protection approaches. Relevant strategic actions may include: i) promoting cropping systems that reduce the need for application of pesticides e.g. agroecology, notably, integrated pest management (IPM) as the principal approach to pest management, ii) supporting the development, availability and affordability of non-chemical alternative pest and vector control products and methods, including exploitation of synergies between cropping systems and livestock systems.

7. MAAIF should strengthen its pest and disease early warning and reporting capacity through i) establishing plant health early warning mechanism, ii) early warning dissemination and communication, iii) undertaking public awareness campaigns (targeting the general public and farmers' organizations), iv) establishing pest reporting mechanisms, v) training in and using key early warning tools such as Pest Risk Information Service (*PRISE)* and Fall Armyworm Monitoring and Early Warning System *(FAMEWS).*

8. MTIC, MoH, MoFPED and other relevant authorities with the appropriate mandate should incentivize healthy and sustainable consumer choices and consumption, through measures such as i) ensuring fair pricing systems, facilitating market access, and labelling schemes for food produced in a sustainable manner, including creating an attractive environment for marketing it, ii) making consumers more aware of the pollution and health footprints of synthetic chemical crop protection products, so that they can make informed choices, and iii) encouraging other stakeholders such as CSOs to undertake awareness campaigns among consumers on product sustainability.

9. MAAIF's DCIC- the country's National Plant Protection Organization (NPPO), in collaboration with the Crop Protection Department, should dedicate sufficient effort towards strengthening the national capacity to undertake pest risk analysis, apply sound phytosanitary measures and institutionalize risk-based approaches e.g. maintaining a general pest list, including that of quarantine pests occurring in the country. In addition, FoSCU recommends the building and sustaining of MAAIF's surveillance capacity and pest diagnostics. For instance, ensuring the availability of pest diagnostics skills, protocols and equipment for quick diagnosis of emerging pests.

10. MAAIF (in collaboration with relevant ministries and authorities, where applicable) should adopt integrated and life cycle approaches for sound pesticide management. For example, i) In the registration process, in addition to evaluating biological efficacy, environmental and human health risks, assess the local needs for individual pesticides (including complexity of application and possible risk of false application), as well as compare the pesticide-associated risks with those of other pest management approaches, ii) shifting from the current focus on the regulation of pesticides to the promotion of sustainable and holistic approaches in pest management solutions, and iii) facilitating registration of biological and other low-risk pesticides, reducing registration costs and fast-tracking their evaluations.

11. MAAIF (and its relevant agencies) should reinforce its authority and capability to control nationally important pests. Relevant measures may include i) putting in place clear guidelines for tracking and monitoring identified high-risk planting material with routine inspection and data collection for decision-making, ii) establishing quarantine and biosecurity facilities for evaluation of high-risk plant health materials, including biological agents, iii) developing and implementing regulations that support the confiscation and destruction of high risk materials, and iv) establishing national guidelines/programmes/activities for controlling emerging pests.

12. Ministry of Finance, Planning and Economic Development (MoFPED), in collaboration with MAAIF and other relevant government actors to use economic instruments and promote direct finance to create a level playing field for greener/lower-risk products and approaches. For instance, i) establishing smart subsidies and taxes to promote sustainable pest management and remove counterproductive subsidies and tax exemptions, ii) progressively internalizing the environmental and human health costs of the use of pesticides in their pricing to level the economic playing field for greener/lower-risk products and approaches, iii) sensitizing policymakers about the importance of basic public funding as a requirement to ensure sustainable pesticide management and to minimize indirect environmental, health and economic costs to society, iv) redirecting revenues from economic instruments towards supporting farmers in shifting to more sustainable practices, as well as towards research and development that support such shifts.

13. MAAIF should, in collaboration with the Office of the Prime Minister's entity responsible for relief, disaster preparedness and refugees, improve the country's pest management contingency planning and incident management. For instance, i) establishing standard operating procedures and emergency action team, with clear actions to be undertaken, roles and responsibilities, established by legislation or by binding agreements, and ii) ensuring that contingency funds are established and available when urgently needed during a phytosanitary emergency.

14. MAAIF to spearhead efforts to promote circularity and resource efficiency, through measures such as: i) promoting the use of modern technologies that contribute to improved pesticide use efficiency, such as modelling to forecast pest development, adoption of economic thresholds, lure and kill, and targeted application of pesticides, ii) establishing national systems for the collection and recycling of empty pesticide containers and environmentally sound treatment or disposal of other pesticide waste, particularly through public-private-people partnerships, iii) implementing more circular agricultural production systems that reduce the need for synthetic chemical pesticides, based, for example, on crop rotation, organic agriculture, resistant crop varieties adapted to low-input agriculture, agroecology and conservation agriculture.

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Annexes

Annex 1: JMPM Criteria for HHPs

In the year 2008, the FAO/WHO Joint Meeting on Pesticide Management (JMPM) defined eight (8) criteria for identifying HHPs. Accordingly, a pesticide is considered an HHP if it meets at least one of the eight, below:

1. Its formulations meet the criteria of classes **Ia or Ib of the WHO** Recommended Classification of Pesticides by Hazard
2. Its active ingredient and formulations meet the criteria of **carcinogenicity** Categories 1A and 1B of the Globally Harmonized System on Classification and Labelling of Chemicals (**GHS**)
3. Its active ingredient and formulations meet the criteria of **mutagenicity** Categories 1A and 1B of the Globally Harmonized System on Classification and Labelling of Chemicals (GHS)
4. Its active ingredient and formulations meet the criteria of **reproductive toxicity** Categories 1A and 1B of the Globally Harmonized System on Classification and Labelling of Chemicals (GHS)
5. Its active ingredient is listed by the **Stockholm Convention** in its Annexes A and B, and those meeting all the criteria in paragraph 1 of Annex D of the Convention
6. Its active ingredient and formulations are listed by the **Rotterdam Convention** in its Annex III
7. It is listed under the **Montreal Protocol**
8. Its active ingredient and formulations have shown a **high incidence of severe or irreversible adverse effects** on human health or the environment.

<table>
<tr><th>JMPM Criteria</th><th>Description/ overview</th><th></th></tr>
<tr><td>1</td><td>WHO Ia or Ib</td><td>
<table>
<tr><th colspan="6">Hazard classification (2009)</th></tr>
<tr><th></th><th>Class Ia
Extremely hazardous</th><th>Class Ib
Highly hazardous</th><th>Class II
Moderately hazardous</th><th>Class III
Slightly hazardous</th><th>Class U
Unlikely to present acute hazard in normal use</th></tr>
<tr><td>Oral toxicity (LD_{50} – mg/kg bw)</td><td><5</td><td>5 – 50</td><td>50 -2000</td><td>2000 – 5000</td><td>> 5000</td></tr>
<tr><td>Dermal toxicity (LD_{50} – mg/kg bw)</td><td>< 50</td><td>50 – 200</td><td>200 – 2000</td><td>2000 – 5000</td><td>> 5000</td></tr>
</table>
These are pesticide formulations classified by WHO as having extreme (Ia) and high (Ib) acute toxicity. Oral and dermal toxicity are used, with the strictest classification of these two prevailing for HHP identification.</td></tr>
<tr><td>2</td><td>Carcinogenicity (GHS 1A & 1B)</td><td>

GHS category 1A = based on human evidence-pesticides known to have carcinogenic potential for humans.
GHS category 1B = based on animal evidence-pesticides presumed to have carcinogenic potential for humans.

</td></tr>
<tr><td>3</td><td>Germ cell mutagenicity (GHS 1A & 1B)</td><td>

GHS category 1A = pesticides known to induce heritable mutations in germ cells of humans
GHS category 1B = pesticides which should be regarded as if they induce heritable mutations in the germ cells of humans

</td></tr>
<tr><td>4</td><td>Reproductive toxicity (GHS 1A & 1B)</td><td>

GHS category 1A = Known human reproductive toxicant
GHS category 1B = Presumed human reproductive toxicant

</td></tr>
</table>

5	Stockholm Convention (Annexes A, B, D {para1})	• **Annex A:** Persistent Organic Pollutants to be eliminated • **Annex B:** Persistent Organic Pollutants • **Annex D**: Screening criteria for POPs
6	Rotterdam (Annex III)	Annex III: Chemicals subject to the prior informed consent procedure
7	Montreal Protocol	Pesticides listed on under the Montreal Protocol can easily be found on its web site. Presently, the only pesticide listed is methyl-bromide
8	High incidence of severe or irreversible adverse effects	No international databases/lists exist of pesticides meeting HHP criteria 8. Assessment is at the discretion of national regulatory authorities. Whether or not a pesticide shows a high incidence of severe or irreversible adverse effects depends on **local use circumstances and availability of reliable data.** In making a decision on this criterion, Countries can use indicators such as: • Local surveillance showing high incidence of poisoning or environmental impact • Local surveillance showing high exposure risks • Regulatory measures taken by countries with comparable pesticide use situations • Surveillance from comparable countries indicating high incidence of poisoning or environmental impact

Annex 2: Officially registered pesticides in Uganda, found to meet the JMPM criteria for HHPs

	CRITERIA 1: Acute Toxicity (oral & dermal)- WHO 1a & 1b	CRITERIA 2,3&4: CMR (carcinogen, mutagen, reproductive toxicant)- GHS 1A & 1B	CRITERIA 5: Stockholm convention- Annexes A,B,D	CRITERIA 6: Rotterdam Convention- Annex III	CRITERIA 7: Montreal protocol	CRITERIA 8: High incidence of adverse effects						
S/N	Active Ingredient	Official registered use in Uganda	WHO Ia	WHO Ib	EU GHS carcinogen (1A, 1B)	EU GHS mutagenic (1A,1B)	EU GHS reproductive toxicant (1A,1B)	Stockholm convention (POP)- Annexes A, B, &D (paraI)	Rotterdam Convention (PIC)	Montreal Protocol	High incidence of severe or irreversible adverse effects	JMPM-TOTAL
1	Abamectin	Insecticide		1								1
2	Beta cyfluthrin	insecticide		1								1
3	Brodifacoum	rodenticide	1				1					2
4	Bromoxynil	herbicide					1					1
5	Bromoxynil Octanoate	herbicide					1					1
6	Carbendazim	Fungicide				1	1					2
7	Carbofuran	Insecticide		1					1			2
8	Carbosulfan	Insecticide							1			1
9	Chlorfenvinphos	acaricide		1								1
10	Chlorpyrifos	Insecticide					1					1

11	Cyproconazole	Fungicide					1					1
12	Epoxiconazole	Fungicide					1					1
13	Glufosinate ammonium	Herbicide					1					1
14	Mancozeb	Fungicide					1					1
15	Propicanazole	Insecticide					1					1
16	Triazophos	Insecticide		1								1
17	Zeta-Cypermethrin	Insecticide		1								1
18	Zinc phosphide	Rodenticide		1								1
	Number of pesticides meeting a given criterion		1	**7**	**0**	1	**10**	0	**2**	**0**	0	

Annex 3: PAN Criteria for HHPs

PAN uses a criterion that incorporates a wide and detailed scope of information sources. These criteria are progressively updated by PAN, with changes in the global pesticide research and management landscape. For instance, in generating its recent (202)1 list of HHPs, PAN considered sub-criteria under these four broad groupings:

Group1: Acute toxicity: three (3) sub-criteria of;

1. Extremely hazardous (Class 1a) according to World Health Organisation
2. Highly hazardous (Class 1b) according to World Health Organisation
3. 'fatal if inhaled', hazard classification according to the EU or Japan Globally Harmonised System (GHS)

Group 2: Long term effects: nine (9) sub-criteria of;

1. Human carcinogen according to EPA
2. Human carcinogen according to IARC
3. Known or presumed human carcinogens (1A or 1B) according to EU or Japan GHS
4. Probable/likely carcinogen (including "likely to be carcinogenic to humans: at high doses") according to EPA
5. Probable carcinogen according to IARC
6. Substances known to induce heritable mutations in the germ cells of humans' (Category 1A or 1B) according to EU or Japan GHS.
7. Known or presumed human reproductive toxicant according to EU or Japan GHS.
8. Pesticides classified GHS Carcinogen Category 2 AND Reproductive Category 2 following EU or Japan GHS
9. Known as an endocrine disrupter according to EU assessment following Commission Regulation (EU) 2018/605

Group 3: Environmental toxicity: four (4) sub-criteria of;

1. Very bioaccumulative (BCF >5000) or Kow logP >5 (BCF values supersede Kow logP data)
2. Very persistent in water (half-life > 60 days), soils or sediments (half-life > 180 days)
3. Very toxic to aquatic organisms (Acute LC/EC50 <0,1 mg/l for Daphnia species)
4. Hazard to ecosystem services- highly toxic to bees (<2 µg/bee) according to US EPA as listed by FOOTPRINT data

Group 4: Conventions: three (3) conventions of;

1. Montreal protocol- Ozone depleting chemical
2. Rotterdam convention- Annex III-banned or severely restricted chemical or severely hazardous pesticide formulation
3. Stockholm convention- persistent organic pollutant

Annex 4: Officially registered pesticides in Uganda, found to meet the PAN criteria for HHPs

			Group 1: Acute Toxicity			Group 2: Long-term effects										Group 3: Environmental toxicity				Group 4: Conventions		
S/N	Active Ingredient	Official registered use in the country	WHO Ia	WHO Ib	Fatal if inhaled (H330)	EPA carcinogen	IARC carcinogen	EU GHS carcinogen (1A, 1B)	IARC probable carcinogen	EPA probable/ likely carcinogen	EU GHS mutagenic (1A,1B)	EU GHS reproductive toxicant	EU EDC-endocrine disruptors (1)	GHS+ C2 & R2 (carcinogen & reproductive tox. Category2)	very bio accumulative	very persistent in water, soil or sediment	highly toxic to aquatic organisms	highly toxic to bees	Montreal Protocol	Rotterdam Convention (PIC)	Stockholm convention (POP)- Annexes A, B, &D (paral)
1	2,4-D	herbicide												1							
2	Abamectin	Insecticide		1	1													1			
3	Alpha-Cypermethrin	insecticide & acaricide																1			
4	aluminium phosphide	fumigant			1													1			
5	atrazine	herbicide												1							
6	beta-cypermethrin	insecticide																1			
7	betacyfluthrin	insecticide		1	1													1			
8	Bifenthrin	Insecticide												1				1			
9	brodifacoum	rodenticide	1									1									
10	bromoxynil	herbicide			1							1									
11	bromoxynil Octanoate	herbicide										1			1		1				

12	Butachlor	Herbicide								1											
13	Carbendazim	Fungicide									1	1									
14	Carbofuran	Insecticide		1	1													1		1	
15	Carbosulfan	Insecticide			1													1		1	
16	Chlorantraniliprole	insecticide														1	1				
17	Chlorfenvinphos	acaricide		1														1			
18	Chlorothalonil	Fungicide			1					1											
19	Chlorpyrifos	Insecticide										1						1			
20	Cypermethrin	Insecticide																1			
21	cyproconazole	Fungicide										1									
22	Deltamethrin	Insecticide												1				1			
23	Dimethoate	Insecticide																1			
24	Diuron	herbicide								1											
25	Emamectin benzoate	Insecticide														1	1	1			
26	epoxiconazole	Fungicide								1		1		1							
27	fenitrothion	Insecticide												1				1			
28	Fenvalerate	Insecticide																1			
29	Fipronil	insecticide																1			
30	flubendiamide	insecticide														1	1				
31	Glufosinate ammonium	Herbicide										1									
32	Glyphosate	Herbicide							1												
33	Imidacloprid	Insecticide																1			
34	Indoxacarb	Insecticide																1			

35	Lambda-cyhalothrin	Insecticide			1									1				1			
36	Lufenuron	Insecticide													1	1	1				
37	magnesium phosphide	fumigant			1																
38	Malathion	Insecticide							1									1			
39	Mancozeb	Fungicide								1		1	1	1							
40	Maneb	Fungicide								1				1							
41	Metribuzin	Herbicide												1							
42	Oxyfluorfen	Herbicide								1											
43	Pendimethalin	Herbicide													1	1					
44	Permethrin	Insecticide								1								1			
45	Pirimiphos-methyl	Insecticide																1			
46	Profenofos	Insecticide																1			
47	Propicanazole	Insecticide										1									
48	propineb	fungicide								1											
49	Pyrethrins	fungicide																1			
50	tebuconazole	Fungicide			1									1							
51	Thiamethoxam	Insecticide																1			
52	Thiophanate-methyl	Fungicide								1											
53	Triazophos	Insecticide		1																	
54	Zeta-Cypermethrin	Insecticide		1														1			
55	Zinc phosphide	Rodenticide		1																	
	Number of pesticides meeting a given HHP criterion		1	7	10	0	0	0	2	10	1	10	1	11	3	5	5	27	0	2	

Annex 5: EU registration status of the pesticides in Uganda, found to meet the PAN criteria for HHPs

S/n	Registered for use in Uganda (MAAIF-as of July 2023 & NDA-as of October 2023)	Registration/ Approval Status in the European Union (As of Oct-19-2023)				
	Active Ingredient	Registered by	Registered Use	Number of products/ brands	EU- Regulation (EC) 1107/2009	Expiry of Current Approval
1	2,4-D	MAAIF	herbicide	33	Approved	Dec-31-2030
2	Abamectin	MAAIF	Insecticide	18	Approved	March-31-2038
3	Alpha-Cypermethrin	MAAIF & NDA	Insecticide & acaricide	10	Not Approved	
4	aluminium phosphide	MAAIF	fumigant	9	Approved	Nov-30-2026
5	atrazine	MAAIF	herbicide	4	Not Approved	
6	beta-cypermethrin	MAAIF	insecticide	1	Not Approved	
7	betacyfluthrin	MAAIF	insecticide	2	Not Approved	
8	Bifenthrin	MAAIF	Insecticide	3	Not Approved	
9	brodifacoum	MAAIF	rodenticide	1	Not Approved	
10	bromoxynil	MAAIF	herbicide	3	Not Approved	
11	bromoxynil Octanoate	MAAIF	herbicide	1	Not Approved	
12	Butachlor	MAAIF	Herbicide	8	Not Approved	
13	Carbendazim	MAAIF	Fungicide	5	Not Approved	
14	Carbofuran	MAAIF	Insecticide	4	Not Approved	
15	Carbosulfan	MAAIF	Insecticide	1	Not Approved	
16	Chlorantraniliprole	MAAIF	insecticide	2	Approved	Dec-31-2024
17	Chlorfenvinphos	NDA	Acaricide	1	Not Approved	
18	Chlorothalonil	MAAIF	Fungicide	3	Not Approved	
19	Chlorpyrifos	MAAIF	Insecticide	24	Not Approved	
20	Cypermethrin	MAAIF & NDA	Insecticide & acaricide	37	Approved	Jan-31-2029
21	cyproconazole	MAAIF	fungicide	1	Not Approved	
22	Deltamethrin	MAAIF & NDA	Insecticide & acaricide	7	Approved	Aug-15-2026
23	Dimethoate	MAAIF	Insecticide	11	Not Approved	
24	Diuron	MAAIF	Herbicide	6	Not Approved	
25	Emamectin benzotae	MAAIF	Insecticide	13	Approved	July-31-2024
26	epoxiconazole	MAAIF	fungicide	2	Not Approved	
27	fenitrothion	MAAIF	Insecticide	1	Not Approved	
28	Fenvalerate	MAAIF	Insecticide	1	Not Approved	
29	Fipronil	MAAIF	insecticide	3	Not Approved	

30	flubendiamide	MAAIF	insecticide	2	Approved	Aug-31-2024
31	Glufosinate ammonium	MAAIF	Herbicide	5	Not Approved	
32	Glyphosate	MAAIF	Herbicide	67	Approved	Dec-15-2023
33	Imidacloprid	MAAIF	Insecticide	19	Not Approved	
34	Indoxacarb	MAAIF	Insecticide	2	Not Approved	
35	Lambda-cyhalothrin	MAAIF	Insecticide	14	Approved	March-31-2024
36	Lufenuron	MAAIF	Insecticide	2	Not Approved	
37	magnesium phosphide	MAAIF	fumigant	1	Approved	Nov-30-2026
38	Malathion	MAAIF	Insecticide	6	Approved	July-31-2026
39	Mancozeb	MAAIF	Fungicide	55	Not Approved	
40	Maneb	MAAIF	Fungicide	1	Not Approved	
41	Metribuzin	MAAIF	Herbicide	6	Approved	Feb-15-2025
42	Oxyfluorfen	MAAIF	Herbicide	3	Approved	Dec-31-2024
43	Pendimethalin	MAAIF	Herbicide	8	Approved	Nov-30-2024
44	Permethrin	MAAIF & NDA	Insecticide & acaricide	5	Not Approved	
45	Pirimiphos-methyl	MAAIF	Insecticide	5	Approved	June-15-2025
46	Profenofos	MAAIF	Insecticide	12	Not Approved	
47	propicanazole	MAAIF	fungicide	1	Not Approved	
48	propineb	MAAIF	fungicide	2	Not Approved	
49	Pyrethrins	MAAIF	insecticide	3	Approved	June-15-2026
50	tebuconazole	MAAIF	fungicide	7	Approved	Aug-15-2026
51	Thiamethoxam	MAAIF	Insecticide	11	Not Approved	
52	Thiophanate-methyl	MAAIF	Fungicide	2	Not Approved	
53	triazophos	MAAIF	insecticide	2	Not Approved	
54	Zeta-Cypermethrin	MAAIF	Insecticide	1	Not Approved	
55	Zinc phosphide	MAAIF	Rodenticide	2	Approved	July-31-2024
				Approved-243 Not Approved-216		

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