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

ZAMBIA

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Executive summary

This study provides background information on soybean and groundnut production in Zambia and an overview of the roles played by value chain stakeholders in groundnut and soybean pest management.

An analysis of the legal framework relating to pest and pesticide management in Zambia was conducted and the relevant legislation has been identified and listed, the most important being the Environmental Management Act (2011) and associated Environmental Management (Licensing) Regulations, 2013). A comparison of Zambian legislation against international regulatory best practices from the UN Food and Agriculture Organization (FAO), the International Labour Organization (ILO) and the OECD was conducted. The findings show that there are significant gaps in all areas of Zambian legislation relating to pesticide management, such as registration, labelling, packaging, sale, marketing, disposal, storage, licensing and occupational safety and health. Supporting standards are either not available or not accessible. Analysis of the Zambian list of registered pesticides (2015) showed that 171 active ingredients (AI) are registered in Zambia, 50 of which met one or more of the Highly Hazardous Pesticide (HHP) criteria and 54 belonging to the "danger" category.

Some common biopesticides, including commercially produced neem products, are not yet registered for use in Zambia and cannot therefore be legally recommended as alternatives to synthetic pesticides. The Zambia National Agricultural Policy 2012–2030 (2011) although it does not explicitly promote integrated pest management (IPM) as a pest management option, includes aspects of IPM within a conservation farming approach.

A literature review identified scientifically based approaches to controlling common soybean and groundnut field and storage pests.

Recommendations based on the study findings and gathered from workshop participants are given. These emphasise the need for awareness-raising among farmers and advisers on pest management and safe pesticide use, covering a broad range of topics. Policy-level support to incentivise the use of less toxic pesticides and increase availability and use of safer alternatives is recommended.

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Disclaimer

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

Acronyms

AI	Active ingredient(s)
AICC	African Institute of Corporate Citizenship
ACF	Agricultural Consultative Forum
CAADP	Comprehensive Africa Agriculture Development Programme
CABI	Centre for Agriculture and Bioscience International
CFU	Conservation Farming Unit
COLEACP	Europe-Africa-Caribbean-Pacific Liaison Committee
COMACO	Community Markets for Conservation
COMESA	Common Market for Eastern and Southern Africa
EPFC	Eastern Province Farmers' Cooperatives
FAO	Food and Agriculture Organization of the United Nations
FRAC	Food Research Action Centre
GAP	Good Agricultural Practice
GCM	Good Crop Management
GHS	*Globally Harmonized System of Classification and Labelling of Chemicals*
GIAE	Grüne Innovationszentren in der Agrar und Ernährungswirtschaft (in English: "Green innovation centres for the agriculture and food sector")
GIZ	Gesellschaft für Internationale Zusammenarbeit (in English: "Corporation for International Cooperation")
GNA	Good Nature Agro
Ha	Hectare
HHP	Highly Hazardous Pesticide
ICRISAT	International Crops Research Institute in the Semi-Arid Tropics
IITA	International Institute of Tropical Agriculture
ILO	International Labour Organisation
IPM	Integrated pest management
ISO	International Organization for Standardization
KATC	Kasisi Agricultural Training Centre
KDWDA	Katete District Women Development Association
MEAS	Modernizing Extension and Advisory Services
MRL	Maximum Residue Level
NAIP	National Agricultural Investment Plan
NCSRP	North Central Soybean Research Programme
ODS	Ozone-depleting substance
OPPAZ	Organic Producers and Processors Association of Zambia
OSH	Occupational Safety and Health

PAEPARD	Platform for African – European Partnership in Agricultural Research for Development
PAN	Pesticide Action Network
PIC	Prior informed consent
PIN	Production Index Number
POP	Persistent organic pollutant
PPE	Personal Protective Equipment
SADC	Southern African Development Community
SNDP	Sixth National Development Plant
SNV	Netherlands Development Organisation
USAID	United States Agency for International Development
WHO	World Health Organization
ZARI	Zambia Agricultural Research Institute
ZDA	Zambia Development Authority
ZEGA	Zambia Export Grower's Association
ZEMA	Zambia Environmental Management Agency

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Introduction

CABI is working with Gesellschaft für Internationale Zusammenarbeit (in English: “Corporation for International Cooperation”) (GIZ) to conduct a baseline study in the 14 countries where the “Green innovation centres for the agriculture and food sector” (Grüne Innovationszentren in der Agrar und Ernährungswirtschaft) are located. These are Burkina Faso, Benin, Cameroon, Ethiopia, Ghana, India, Kenya, Malawi, Mali, Mozambique, Nigeria, Togo, Tunisia and Zambia. The aim of the study is the same for all 14 countries: to provide baseline information to enable GIZ to systematically assess and identify practical solutions to address areas of concern relating to crop and post-harvest protection. These concerns are: imperfections in the legal framework and level of enforcement, lack of availability of less toxic pesticide alternatives and low levels of knowledge and application of effective and safe pest and pesticide management.

The study collected information through desk research in all 14 countries and through in-country surveys in eight countries.

This report represents the findings from the Zambia desk study and covers the following areas:

- national agriculture sector characteristics and key stakeholders
- organizational arrangements within the national governments for pest and pesticide management
- existing legal framework for pest and pesticide management in comparison to relevant international, EU, German and voluntary standards
- good agricultural practice (GAP) / good crop management (GCM) and other voluntary standards applied in focal crops
- the state of science on crop protection
- pesticide hazards, assessment of risks and documented harmful effects of pesticides.

Methodology

A review of literature from the public domain and literature to which CABI has access was conducted to provide an overview of the agriculture sector within the country and to map the value chains for soybean and groundnut. The national pesticide legislation and other policies relating to pests and pesticides management were identified, and a cross comparison was made with international guidelines (e.g. from the FAO and the ILO) and other regulatory best practices (e.g. OECD). This was used to compile a preliminary description of the policy setting process in Zambia.

Existing literature on crop protection studies and advisory documents were also reviewed to identify the current crop protection methods being applied within the value chain for soybean and groundnut.

Utilising a tool developed by CABI, the most up-to-date version of the national list of registered pesticides was analysed to identify the full list of AI and products which are registered for use in Zambia. For each AI registered, a profile was developed which includes the chemical class, use type and associated hazards to human health and the environment. The *Guidelines on Highly Hazardous Pesticides (FAO 2016)* define HHPs as “pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or environment according to internationally accepted classification systems”, and it lists criteria for determining whether or not an AI is an HHP. HHPs which are registered for use in the country were identified using these criteria. The toxicological profiles and information on target pests was also used to assess the availability of lower toxicity alternatives to the HHPs for specific crop pests.

Limitations of the methodology and data

The limitations of the desk study mainly relate to the low level of access to relevant documents – and, in particular, up-to-date policy and legislative documents. The list of registered pesticides in Zambia contains limited information and this restricted the depth of the analysis that was possible.

In most cases, up-to-date organograms and data on staffing levels were not publicly available.

Results/findings

Agriculture sector characteristics and key stakeholders

Overview of agriculture sector performance and contribution to the economy

Agriculture plays a vital role in the economy of Zambia, employing around 53% of the total labour force. Selected agricultural indicators for Zambia are shown in Table 1.

Table 1 Agriculture sector information

Selected indicators – agriculture sector generally	2007	2010	2014	Most recent (date)	Source
Total area of land under agriculture (1000 hectares (ha))	22,984	23,436	23,836		FAOstat
Arable land per person (ha)	0.232	0.245	0.243	0.236 (2015)	World Bank
GDP per capita (current US$)	2,589	3,212	3,819	3,933 (2016)	World Bank
Agricultural value added (% of GDP)	13.23	9.7	7.27	6.54	World Bank
Agricultural labour force (% of total labour force)	-	63.4%	54.7%	53.3% (2017)	ILOStat
Rural population (% of total in millions)	62% of 12.1 million	61% of 13.2 million	59% of 15 million	58% of 16.5 million (2017)	World Bank
Value of total agriculture production (agricultural net **Production Index** Number (PIN) current million US$	507.7	1,702.7	2,087.2		FAOstat

General information about the focal crops and value chain

The main crops in Zambia are maize, groundnuts, cassava, sorghum, wheat, rice and high-value crops such as cotton, sugarcane and tobacco. Groundnuts are produced by approximately 700,000 smallholder farmers and account for nearly 9% of the cultivated land in the country.

Groundnuts can be consumed as peanuts or processed into a variety of products, such as peanut butter, sweets and cooking oil. Eighty percent of groundnuts are used for local consumption, with the remainder sold to markets (US Agency for International Development (USAID)). Groundnut is grown in all the agroecologies in Zambia, with Eastern Province being the main contributor, with around 25% of production (Agricultural Consultative Forum, ACF 2012). Groundnut yield has been chronically low, at around 0.3 - 0.6 MT/ha. This is due to a range of factors, such as low soil fertility, recycling of seed by farmers and production practices. Groundnut is susceptible to aflatoxin contamination, which limits opportunities for Zambia in the international groundnut market.

In Zambia, the soybean is mostly a commercial crop used for processing into flour, oil and products such as soy chunks. The by-product (cake) is fed directly to animals or processed with other ingredients into animal feedstock. As an animal feed, soy by-products provide relatively low-cost, high-quality protein to feed rations. Soy flour is also a valuable source of protein for human consumption, forming the main ingredient in enriched flours used to address malnutrition. Industrial demand for soy nationally and internationally is likely to increase and growing soybean offers significant income opportunity for smallholder farmers in Zambia. The area of soybean grown in Zambia has increased steadily over the last decade but yields have remained at around 1.8MT/ha.

Figure 1 shows the relative export values for groundnut and soybean in Zambia. The area of soybean and groundnut cultivation in Zambia is shown in Figure 2 and their yields are shown in

Figure 3. Soybean and groundnut value chains are shown in Annex I, Figure 8 and Figure 9, respectively.

Figure 1 Annual groundnut and soybean export values (FAOstat)

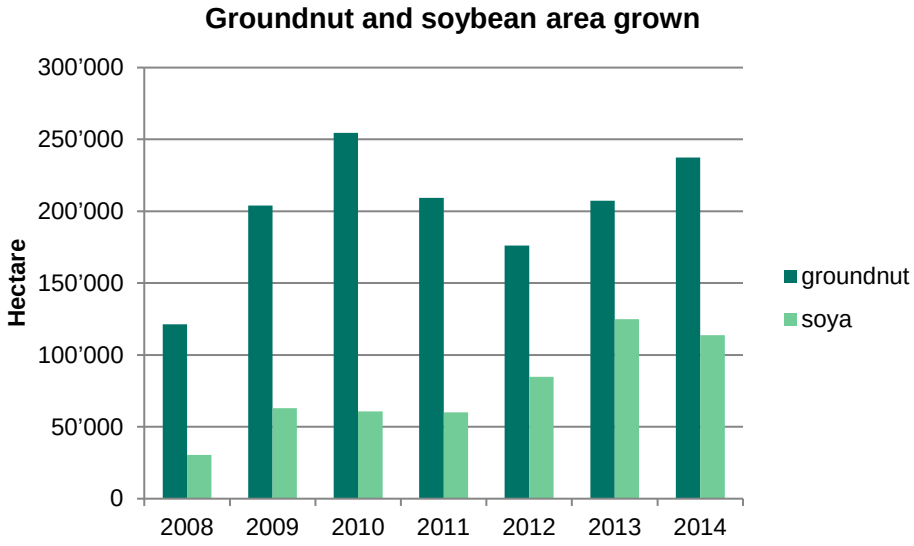

Figure 2 Area of groundnut and soybean grown (FAOStat)

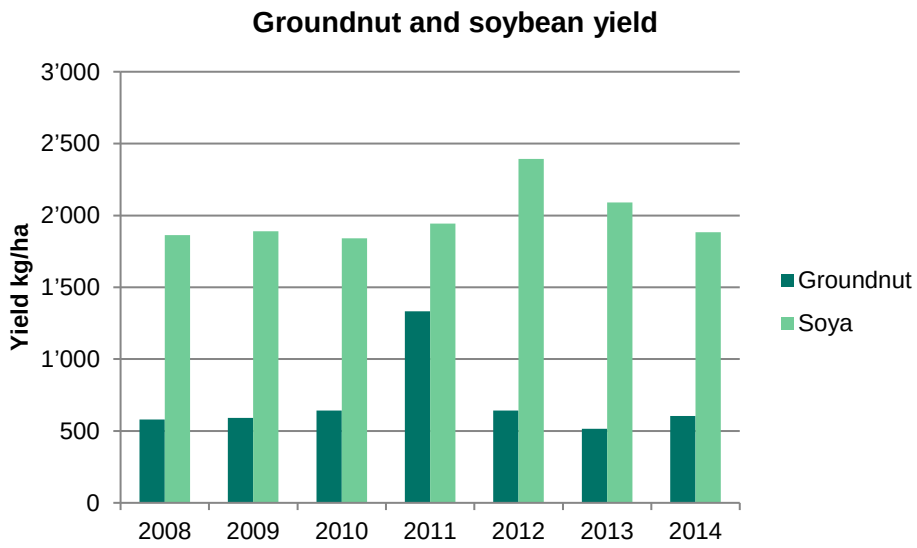

Figure 3 Annual groundnut and soybean yield (FOAStat)

Value chain stakeholders, including sources of inputs

Inputs

The Zambian import values for pesticides (Figure 4) show that herbicides and insecticides imports have grown rapidly up between 2007 and 2013. This implies that the availability of pesticides to farmers is also growing.

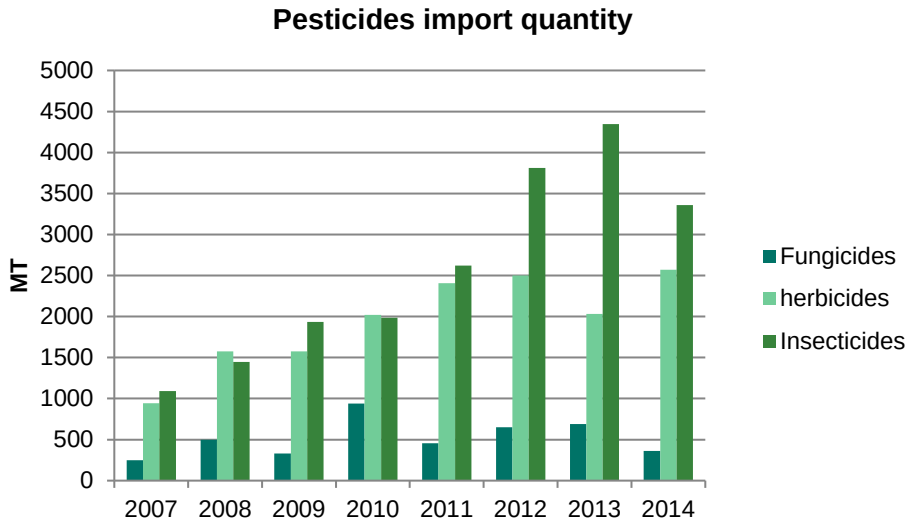

Figure 4 Import quantity of pesticides (FAOStat)

The Farmer Input Support Programme Electronic Voucher initiative launched by the Zambian Ministry of Agriculture in the 2015-2016 farming season provides Zambian farmers with access to a great variety of agro-inputs. In addition to fertilizer and seed for maize, since 2016 farmers have been able to exchange vouchers for herbicides, insecticides for their own crop choices and application equipment, such as sprayers. Such incentives encourage the use of synthetic pesticides by farmers.

A wide range of stakeholders are involved in the value chains for soybean and groundnut in Zambia. A selection of these are shown Table 2.

Table 2 Stakeholders

Extension and advisory services (public and/or private)		
Good Nature Agro (GNA)	GNA provides support to community leaders to become qualified Private Extension Agents (PEAs) who in turn oversee and train farmers.	
Cargill	Provides inputs and extension in return for repayment at harvest	
The Conservation Farming Unit (CFU)	CFU supports farmer-to-farmer training services and specialized service provision; organization of self-owned farmer groups and associations	
Katete District Women Development Association (KDWDA)	Support members improve groundnut production, buying and processing as a business.	
Participatory Ecological Land Use Management (PELUM)	PELUM supports the mobilization and training of small-scale farmer communities	
Green Living Movement	Training and sensitisation for farmers and extension services in production and application of biopesticides	
National Institute for Scientific and Industrial Research	Disseminates information via radio messages	
The Conservation Farming Unit (CFU)	Provides training on climate smart agriculture, safe use of pesticides, provide a platform for private sector integration/participation	
MET/Weather	Provides data on forecasting and early warning	
Trading and processing		
COMACO	Community Markets for Conservation – Provides soy powder for supermarkets, NGO sector and World Food Programme,	
Good Nature Agro	Trades in soybean, groundnuts, cowpea, sugar beans and seeds Works with farmers to produce certified legume seed.	
Share Africa, Zambia	Purchases groundnuts for peanut butter	
Mount Meru	Conducts oil extraction (6% purchased from small farmers)	
Tiger Animal Feeds	Provides livestock products including soya based animal feed. 20% of trade is purchased from small farmers	
Cargill	Trading in grain (and groundnuts)	
LWK commodities, Mount Meru Lusaka	Manufactures peanut butter, soy drinks and cooking oil	
NWK Agri-Services	Agribusiness; engages in maize and soya buying; provide grain storage solutions; and operate agricultural retail stores.	
KDWDA	Trades in soybean stock feed	
EIG	Trades in grain	
Agro-chemicals		
Zambia Agrochemical Association		
Herbicides, fungicides	Farmaz Development	Developer, exporter, importer
AI for pesticides	Biltico Bax Ltd, Ndola	Importer
pesticides	Henlix Zambia co. Ltd, Lusaka	Developer, exporter, importer
Agri-chemicals	Mcfi Zambia Ltd	Importer
Pesticides	Avro Investments Ltd	Developer, exporter, importer, manufacturer, trader,
Agro-inputs	Alek Farmers Market, Chipata	Distributor, exporter, importer, manufacturer, trader
Agro-inputs	Cargill	Supplier to own farmers
Agro-inputs	Dunavant	Supplier
Agro-inputs	NWK	Supplier and commodity trader
Herbicides	BASIF/Cropchem	Trader and distributer
Agro-inputs and spray equipment	ATS (Chipata Cotton)	Importer, distributer
Herbicides and seeds	MRI	Distributor and supplier

Agro-inputs and Personal Protective Equipment (PPE)	ETG	Import distribution
Agro-inputs	CFU	Supplier
Seed	Zambia Seed Company, Zamseed, Lusaka	Supplier
Seed	MRI Seed Zambia Ltd, Lusaka	Supplier
Seed	Paneer Seed	Supplier
Seed	Sunshine Seedling Services, Zambia	Supplier
Seed – new varieties	Zambia Agricultural Research Institute (ZARI)	Supplier, multiplier, distributer
PPE	G Fox & Co., Lusaka	Supplier
Inoculum	ZARI	Producer, supplier
Development aid initiatives		
USAID (USAID) 2014–2017	Feed the Future Innovation Lab on Peanut Productivity and Mycotoxin Control, University of Connecticut – Project to generate and transfer economic knowledge needed to intensify groundnut production, and its subsequent use. Feed the Future Innovation Lab on Peanut Productivity and Mycotoxin Control, University of Georgia – Project to use breeding and outreach to enhance the production, quality and marketability of peanut in target countries. Developing and improving high-yielding varieties, including the release of new cultivars through existing and established breeding programmes. North Carolina State University – Project to address a wide range of production, post-harvest handling, and processing issues relative to peanuts throughout the value chain and the cumulative effect of these efforts measured against traditional production and marketing practices.	
Platform for African – European Partnership in Agricultural Research for Development (PAEPARD) (2014–2017)	Project to conduct research on aflatoxin reduction practices and technologies to benefit smallholder farmers, reach scale and sustainability, and address policy constraints. Stakeholders: National Smallholder Farmers' Association of Malawi (NASFAM), Eastern Province Farmers' Cooperatives (EPFC) Limited, South Africa Food Agriculture and Natural Resources Policy Analysis Network, Natural Resources Institute – University of Greenwich, Malawi Department of Agricultural Research Services, ZARI.	
EU (2104–2017)	The project intervenes at three levels: (1) validation of promising pre- and post-harvest practices and technologies through participative evaluation in selected rural households; (II) documentation of appropriate dissemination tools and methodologies are elaborated, and building farmer capacities; and (iii) generating evidence for advocacy and policy dialogues at the local, national and regional levels. Stakeholders: NASFAM, ZARI, University of Greenwich, EPFC.	
World Bank (2014–2017)	Reducing Mycotoxin Contamination of Maize, Groundnuts and Beans to Improve Food Safety and Enhance Health and Trade. The goal of this project is to improve household food safety and security in order to enhance the well-being of the citizens of the region. This will be achieved through the development/adaptation of an integrated mycotoxin contamination reduction strategy feasible for an agrarian setting (Malawi, Mozambique and Zambia), with the aim of reducing dietary exposure for locals and producing safe products that are globally acceptable. Stakeholders: National Institute for Scientific and Industrial Research (Zambia).	
International Institute of Tropical Agriculture (IITA), USAID, GIZ, Africa Rising and other partners (2012 – ongoing)	Activities include: research on aflatoxins and biocontrol technologies (Aflasafe) on maize, groundnuts; awareness-raising and farmer education; and harmonization of aflatoxin levels for raw groundnuts and peanut butter by the Zambia Bureau of Standards. Stakeholders include the National Institute for Scientific and Industrial Research, and other national partners.	
Common Market for Eastern and Southern Africa (COMESA) – Climate Smart Agriculture	The Common Market for Eastern and Southern Africa Secretariat, under its Climate Change Programme will develop a regional strategy to promote the use, production and application of biopesticides in the COMESA and Southern African Development Community (SADC) sub-regions.	
Collectives/associations		
COMACO	Promotes sustainability and environmental protection; farmers are rewarded for good practices through price incentives.	
Zambia National Farmers' Union	The Union's core functions include: lobbying and advocacy; providing members' services and support; information dissemination; and communication with members.	

	http://www.znfu.com.zm
Conservation Farming Unit	CFU is an independent organization registered in Zambia with the mandate to promote conservation farming in Zambia and the East and Southern African Region. The CFU has a memorandum of understanding with the Zambia National Farmers' Union.
Europe-Africa-Caribbean-Pacific Liaison Committee (COLEACP)	Civil society organization whose main purpose is to support the development of a sustainable and competitive agriculture and agribusiness. COLEACP is a network and a technical assistance tool for the sustainable and inclusive development of the private sector (SMEs).
The Zambia Occupational Health and Safety Association	Established in late 2010 to provide advocacy on occupational safety and health aiming to promote positive changes in people's attitudes towards occupational safety and health.
Zambia Federation of Employers	Umbrella organisation for employers in Zambia. Aim is to promote and protect the interests of employers, including in relation to occupational safety and health.
Voluntary standards organisations	
Organic Producers and Processors Association of Zambia (OPPAZ)	OPPAZ is a national organic movement operating in Zambia and in the southern Africa region. Provides technical and specialist services to create an opportunity for income generation for farmers through organic and fair trade agricultural production and processing.
COLEACP	Implements a sustainability charter as a condition of membership
ZEGA	ZEGA has a 'good business management' tool that provides guidance to members and sets standards for the following: storage, use and disposal of pesticides; workers' welfare; GAP and protection of the environment; and due diligence in the production, harvesting, grading and packaging of produce. Focus of horticultural produce.

Other key non-governmental stakeholders and their roles

NGO	
National Agriculture Development Programme, Zambia	The programme's purpose is to replicate the natural agriculture and seed saving project throughout Zambia, to increase cost-effective and environmentally friendly crop production and increase crop yields. A gender and nutrition component is integral to this.
The Netherlands Development Organisation (SNV	SNV supports Agri-ProFocus, a business network that connects organised farmers, traders, suppliers, processors and exporters – both nationally and internationally. Agri-ProFocus Zambia also links development agencies to government and knowledge institutes. The network supports farmers in becoming strong entrepreneurs, able to make informed decisions for their businesses.
World Vision	Seed distribution to small-scale farmers
PELUM Zambia	Participatory ecological land use management in small-scale farming. Part of PELUM Association (a network of civil society organizations in Africa)
Kasisi Agricultural Training Centre (KATC)	KATC aims to empower rural communities to improve their livelihoods and facilitate holistic and democratic rural development through training, extension, research, market development, lobbying and advocacy and appropriate technologies in sustainable organic agriculture. Has established neem nurseries.
Development aid initiatives	
Zambian Forum for Agricultural Extension and Advisory Services	An independent organisation launched in 2016 by the Government of Zambia to regulate the quality of agricultural extension and advisory services in Zambia in a gender-responsive and nutrition-sensitive manner. The organisation aims to help improve agricultural extension and advisory service delivery to farmers and strengthen stakeholder engagement in agricultural extension.
Zambia National Plant Genetic Resources Centre (NPGRC)	The Zambian gene bank.is part of the SADC Plant Genetic Resource Centre. The aim is to conserve and preserve the genetic diversity and viability of Southern African plant stocks. This includes collecting genetic material collected from local farms.
Inter-governmental	
IITA	Soybean and cassava breeding. New technology development and dissemination. Integrated soil fertility management. Aflatoxin level research and farmer training.
International Crops Research in the Semi-Arid Topics (ICRISAT)	Research on Aflatoxin management interventions; education within the peanut value chain in Zambia. An integrated global breeding and genomics approach to intensifying peanut production and quality.

Research	
Kasisi Agricultural Training Centre (KATC)	Conducts research and documents sustainable organic agriculture techniques including verification trials of both indigenous and exotic technology, e.g. Impact of organic agriculture practices on soil fertility
ZARI	Operates projects focussing of aflatoxin management: 1) "Reducing mycotoxin contamination of maize, groundnuts and beans to improve food safety and enhance health and trade". 2) "Stemming aflatoxin in pre- and post-harvest waste in the groundnut value chain (GnVC) in Malawi and Zambia". The research focuses on developing and improving high-yielding varieties, including the release of new cultivars.
National Council for Scientific Research	The Council is a statutory body through which the Government of Zambia directs policy on the development and application of science and technology.

Organizational arrangements within the national government for pest and pesticide management

Support in relation to pest and pesticide management in groundnut and soybean production also comes from the Zambian Government, in the form of activities such as policy setting, enforcement, research and training. Table 3 provides an overview of government bodies with responsibility for some aspect of pest and pesticide management.

Table 3 Government entities with pest or pesticide management responsibilities

Role	Ministry name	Department/agency responsible	Specific functions (relating to pest and pesticide management)	Number of staff per function, level and location (national, district)
Registration of pesticides	Ministry of Lands, Natural Resources and Environmental Protection	Environmental Management Agency	Manages and oversees the pesticide registration process. Environmental education and awareness programmes to educate and raise awareness of the role of the public in the protection of the environment. Collection, production and dissemination of environmental information.	
Enforcement of pesticide regulations	The Ministry of Lands, Natural Resources and Environmental Protection;	Environmental Management Agency	Enforcement of regulations and standards on all aspects of the environment.	
	Ministry of Commerce, Trade and Industry	The Zambia Bureau of Standards	Developing voluntary and compulsory standards: e.g. ZS 555: 2006 Handling of pesticides – Code of practice.	
National plant protection	Ministry of Agriculture and Livestock	ZARI	The overall objective of the department is to provide a high-quality, appropriate and cost-effective service to farmers, generating and adapting crop, soil and plant protection technologies.	
Food safety	Ministry of Commerce, Trade and Industry	Zambia Bureau of Standards	The ZABS sets relevant standards for food safety including for aflatoxin levels in cereals, nuts and derived foodstuffs.	

Role	Ministry name	Department/agency responsible	Specific functions (relating to pest and pesticide management)	Number of staff per function, level and location (national, district)
	Ministry of Health	Food Safety and Occupational Health Food and Drugs Control Laboratory Health Inspectorate. The Inspectorate's mandate is to lead the inspectorate function in accordance with Public Health Cap 295 and Food and Drugs Act Cap 303 of the Laws of Zambia, Local Government Act and its By-Laws. Its main function is to suppress and control communicable diseases.	The Food and Drugs Control Laboratory is the official Codex Focal Point for Zambia	
Occupational health and safety	The Ministry of Labour and Social Security	Department of Labour and the Department of Occupational Safety and Health. The Workers' Compensation Fund Control Board.	The Department of Occupational Safety and Health comprises several sections, one of which is Occupational Hygiene. Each Section is under the supervision of a Chief Inspector.	18 professional staff (not clear if these have a role in pesticide industry): one director; three chief inspectors of factories; one principal inspector of factories; seven senior inspectors of factories; six inspectors of factories
Plant variety registration	Ministry of Agriculture and Livestock	Seed Control and Certification Institute	Seed crop inspections and certification.	
Environment	Ministry of Lands, Natural Resources and Environmental Protection		Environmental education and awareness programmes to educate and raise awareness of the role of the public in the protection of the environment. Collection, production and dissemination of environmental information.	

Role	Ministry name	Department/agency responsible	Specific functions (relating to pest and pesticide management)	Number of staff per function, level and location (national, district)
Agricultural research	Ministry of Agriculture and Livestock	ZARI	The overall objective of the department is to provide a high-quality, appropriate and cost-effective service to farmers, generating and adapting crop, soil and plant protection technologies. The technical divisions are Crop Improvement and Agronomy, Soils and Water Management, Plant Protection and Quarantine, and Farming Systems and Social Sciences. Central Services provides biometrics, library, documentation and information services to the department. There are eight research programmes under the Crop Improvement and Agronomy Division. ZARI has 10 research stations.	
		National Institute for Scientific and Industrial Research	Conducts research programmes in food safety and nutrition, biotechnology, water and environment, and nuclear energy application.	
Extension	Ministry of Agriculture and Livestock	Department of Agriculture: Agricultural Advisory Services Branch	Dissemination of relevant agricultural extension information relating to activities such as crop production, farm management, extension methodology, food and nutrition.	At least one Extension Officer position is attached to each of 346 Agricultural Blocks and the 1,757 Agricultural Camps within the Blocks (76% of places not filled in 2014).
Farmer training	Ministry of Agriculture and Livestock	National Agricultural Information Services	Supporting the extension services of the ministry through the dissemination of agricultural information through the mass media.	

Role	Ministry name	Department/agency responsible	Specific functions (relating to pest and pesticide management)	Number of staff per function, level and location (national, district)
Commodity boards	Soybean – ZAMACE		ZAMACE has developed quality standards that are acceptable to and recognised by the agricultural industry. Exchange contracts adhere to these standards. Provides a laboratory service for independent quality testing.	
Setting and overseeing policies relating to integrated pest management, GAP, organic agriculture and/or sustainable agriculture situation analysis	The Ministry of Lands, Natural Resources and Environmental Protection	Environmental Management Agency	Advising government on the formulation of policies, standards and regulations related to environmental management.	
Setting and overseeing financial instruments, such as subsidies, incentive programmes, and taxes on inputs	Zambia Development Authority (ZDA)	The Zambia Investment Centre, Zambia Privatisation Agency, Export Board of Zambia, Small Enterprise Development Board and Zambia Export Processing Zones Authority	The ZDA is responsible for promoting trade and investment coordinating private sector-led economic development. The agency is also responsible for developing an internationally competitive Zambian economy.	
	Strategic Approach to International Chemicals Management (SAICM)	Director General Zambia Environmental Management Agency (ZEMA)	Implementation of the SAICM policy framework to promote chemical safety around the world.	
Official contact points / designated national authorities for multilateral environmental agreements	Basel Convention	Inspectorate, ZEMA, Ministry of Tourism, Environment and Natural Resources		
	Rotterdam Convention	ZEMA		
	Stockholm Convention	ZEMA		
	Montreal Protocol	ODS Unit, Ministry of Tourism, Environment and Natural Resources		

A report published by the USAID project Modernizing Extension and Advisory Services in 2014 (MEAS 2014) indicated that staffing levels within the Ministry of Agriculture extension service are around 76% filled, with Table 4 below showing the breakdown per block and camp across the Eastern Province. The Sixth National Development Plant (SNDP) contains plans to increase the number of extension officers to 4,965 agricultural extension officers.

Table 4 Ministry extension staff numbers, Eastern Province

District	Block	Camp	Filled	Vacant
Chadiza	2	16	11	5
Mambwe	3	14	11	3
Nyimba	3	16	14	2
Chipata	8	58	49	9
Katete	4	20	20	0
Sinda	4	24	22	2
Vubwi	2	10	7	3
Lundazi	5	44	19	25
Petauke	5	37	21	16
Total	**36**	**239**	**174**	**65**

Analysis of existing legal framework for pest and pesticide management

Description of policy setting process and transparency

The Zambian legal framework relating to pesticide management is described in detail below and a summary of the relevant legislation is shown in Table 5. The main piece of relevant legislation is the Environmental Management Act of 2011.

Table 5 National legislation relating to pesticide management

Legislation	Summary
The Environmental Management Act, No. 12 of 2011	Ensures the continued existence of the Environmental Council and re-names it as the Zambia Environmental Management Agency. Provides for integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources. Provides for the preparation of the State of the Environment Report, environmental management strategies and other plans for environmental management and sustainable development. Provides for the conducting of strategic environmental assessments of proposed policies, plans and programmes likely to have an impact on environmental management. Provides for the prevention and control of pollution and environmental degradation. Provides for public participation in environmental decision-making and access to environmental information. Establishes the Environment Fund. Provides for environmental audit and monitoring. Facilitates the implementation of international environmental agreements and conventions to which Zambia is a party.
Environmental Management (Licensing) Regulations (S.I. No 112 of 2013)	These Regulations, set out under Sections 43 and 134 of the Environmental Management Act, cover air quality control, waste management, hazardous waste and other substances harmful to the environment, such as pesticides and ozone-depleting substances (ODSs). The Regulations also include legislation on the recycling of waste; the packaging, labelling transportation and storage of hazardous waste, pesticides and toxic substances; and waste management planning.
Noxious Weeds Act No. 13 of 1994	Provides for the eradication of noxious weeds.

Legislation	Summary
The Plant Pests and Diseases Act No. 13 of 1994	Provides for: (i) the eradication and prevention of the spread of plant pests and diseases in Zambia; and (ii) the prevention of the introduction into Zambia of plant pests and diseases.
Plant Variety and Seeds Act No. 21 of 1995	The act provides for: (i) the regulation and control of the production, sale and import of seed for sowing and of the export of seed; (ii) the testing and for minimum standards of germination and purity thereof; and (iii) the certification of seed.
Occupational Health and Safety Act, 2010 [No. 36 of 2010]	Establishes the Occupational Health and Safety Institute and provides for its functions. Provides for the establishment of health and safety committees at workplaces and for the health, safety and welfare of persons at work. Provides for the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work. Provides for the protection of persons, other than persons at work, against risks to health or safety arising from, or in connection with, the activities of persons at work. Provides for matters connected with, or incidental to, the foregoing.
The Competition and Consumer Protection Act, 2010 and Amendment No 9 2013	Ensures the continued existence of the Zambia Competition Commission and re-names it as the Competition and Consumer Protection Commission. Safeguards and promotes competition. Protects consumers against unfair trade practices. Provides for the establishment of the Competition and Consumer Protection Tribunal.
The Agricultural Statistics Act (2006)	Provides for the collection of agricultural statistics. Provides for the compilation and publication of statistics.
The Food and Drugs Act 1972 (2006)	Protects the public against health hazards and fraud in the sale and use of food, drugs, cosmetics and medical devices. Provides for matters incidental thereto or connected therewith. Regulates, among other matters, the placing on the market of food, drugs including drugs for animals. Provides for the constitution of the Food and Drugs Board. The act consists of 34 sections divided into five parts: preliminary (i); general provisions (ii); importation and warranty (iii); administration and enforcement (iv); legal proceedings (v).
National Agriculture Investment Plan (NAIP) 2014–2018, Government of the Republic of Zambia, Ministry of Agriculture and Livestock Zambia	The NAIP, under CAADP, seeks to identify and prioritize key investment and policy changes in Zambia that are critical to enhancing the desired agricultural productivity growth. The NAIP has been fully aligned to the Zambia CAADP Compact and the SNDP, and seeks to operationalize the National Agriculture Policy (NAP 2012). The NAIP is organized into four interrelated programmes: (i) sustainable natural resources management; (ii) agricultural production and productivity improvement; (iii) market access and services development, and; (iv) food and nutrition security and disaster risk management.
Zambia National Agricultural Policy 2012–2030 (2011)	The objectives of the policy are to:(i) promote a sustainable increase in agricultural productivity of major crops with comparative advantage; (ii) continuously improve agricultural input and product markets so as to reduce marketing costs of agribusiness, including small-scale farmers and farmers' groups; (iii) increase agricultural exports to preferential markets at regional and international levels; (iv) improve access to productive resources and services for small-scale farmers, especially women and young farmers, in outlying areas to enable them to increase production of staple foods, including fruits and vegetables, for own consumption and the surplus for income generation; and (v) continuously strengthen public and private sector institutional capabilities to improve agricultural policy implementation, resource mobilisation, agriculture research, technology dissemination, and implementation of regulatory services.

Legislation	Summary
SNDP 2011–2015 (2011)	The SNDP 2011–2015 is the successor to the Fifth National Development Plan, aimed at actualising the aspirations of the Vision 2030 of becoming “a prosperous middle-income nation by 2030”. The theme of the SNDP is “*sustained economic growth and poverty reduction*”. The objectives of the SNDP are to accelerate infrastructure development, economic growth and diversification, and rural investment and poverty reduction; and to enhance human development.

Zambia is a member of several international organizations (African Union, COMESA, FAO, ILO, International Programme on Chemical Safety, United Nations Environmental Programme, SADC, WHO) and participates in several international agreements. These are outlined below.

Adherence to and implementation of international agreements relating to pesticides

- Zambia became a party to the **Montreal Protocol** (on Substances that Deplete the Ozone Layer) in 1990 (Accession) and has a country programme and ODS regulations in place to phase out and replace methyl bromide and other ODSs (Republic of Zambia, 2014).
- Zambia became a party of the **Rotterdam Convention** (on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade) in 2011. The country has submitted six import responses, the most recent being 12 December 1999. It has failed to provide import responses for 41 pesticides. Information on notice of final regulatory action is not available for Zambia. No proposals for listing Severely Hazardous Pesticide Formulations in Annex III were submitted by Zambia.
- Zambia became a party to the **Stockholm Convention** (on Persistent Organic Pollutants) in 2006 and has taken the following step to implement it: formulated a National Implementation Plan for the management of persistent organic pollutants (POPs) 2007. (There is no information on whether the plan has been enacted). Chlordane POPs are still allowed for the purpose of controlling termites in construction and DDT is allowed for Malaria vector control.
- Zambia became a party to the **Basel Convention** (controlling the transboundary movement of hazardous wastes) in 1994. Regulations related to adherence to and implementation of the Basel Convention include: the Environmental Management Act 2011 and the Hazardous Waste Management Regulations, 2001. These impose restrictions on the import and export of hazardous wastes and other wastes for recovery and final disposal; and restrict the transit of hazardous wastes and other wastes as a requirement.
- Zambia is not a party to the **ILO Safety and Health in Agriculture Convention (C184**). Within Zambia, agriculture falls within the scope of the Occupational Health and Safety Act 36 of 2010: "This Act applies to all places of work, except as otherwise provided by this Act". Zambia also ratified C129 – the Labour Inspection (Agriculture) Convention, 1969 (No. 129) in 2013; and C012 – The Workmen's Compensation (Agriculture) Convention, 1921 (No. 12) in 1964. Responsibility for occupational safety and health administration and enforcement in Zambia falls under the Department of Occupational Safety and Health within the Ministry of Labour and Social Security. The Occupational Health and Safety Act 36 of 2010 makes provision for the establishment of an Occupational Health and Safety Institute, one role of which is to investigate and detect occupational diseases and injuries at workplaces.

Overview of national regulation related to pest and pesticides management

The definition of a pesticide provided in the Environmental Management Act (Act No. 12 of 2011) is: “any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease or unwanted species of plants or animals causing harm or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood, wood products or animal feed, or which may be administered to animals for the control of insects, mites, spider mites or other pests in or on their bodies, and includes substances intended for use as a plant growth regulator, defoliant, desiccant, or agent for thinning fruit or preventing the premature fall of fruit, and substances applied to crops

either before or after harvest to protect the commodity from deterioration during storage or transport."

Policies to promote reductions in unnecessary pesticide use, such as policies on IPM, GAP, organic production and sustainable agriculture

Section 2.2.1 of the Zambia National Agricultural Policy 2012–2030 (2011) aims to "Promote Sustainable Increase in Crop Productivity". Although it does not explicitly promote IPM as a pest management option, the policy includes aspects of IPM, such as conservation farming, through "Promoting environmentally friendly farming systems…"

The promotion of GAP takes place under the current Zambia NAIP 2014–2018, complemented by the second National Agricultural Policy 2016. One aim of this plan relates to crop protection: to promote GAP, such as pest control, fertilizer application and weed management.

Research

The aim of the NAIP 2014–2018, under the section Agricultural Production and Productivity Improvement for Crops, is to improve the following: i) crop productivity; (ii) access to inputs; and (iii) GAP. A key component is strengthening knowledge support systems relating to (i) research; (ii) seed; (iii) extension; (iv) and agricultural education and training institutions.

Regulations related to the manufacture of pesticides

No pesticides are currently manufactured in Zambia. However, the Environmental Management (Licensing) Regulations, 2013, include provision for a licence to manufacture pesticides. For example, Section 31: "A person who intends to manufacture, import, export, store, distribute, transport, blend, process, re-process or change the composition of a pesticide or toxic substance or re-process an existing pesticide or toxic substance for a new use shall apply to the Agency for a pesticide and toxic substance licence." The licence form requests pesticide registration information.

Although the regulations do not define what **engineering standards and operating practices** are required in order to obtain a licence**,** there is a general requirement under Regulation 31 (2), in that the Agency will approve the licence application only if the applicant meets the following requirements: "a) demonstrates technical capacity to manufacture, import, export, store, distribute, transport, blend, process, re-process or change the composition of a pesticide or toxic substance or re-process an existing pesticide or toxic substance; and (b) has measures and facilities to ensure the safe manufacture, importation, exportation, storage, distribution, transportation, blending, processing, re-processing or changing of the composition of a pesticide or toxic substance or re-processing an existing pesticide or toxic substance."

No provisions exist specifically covering pesticide manufacturing plants or specific safety and environmental pollution control relating to manufacture of pesticides.

Precautions to protect workers are included generally in Regulation 34: "(4) A person may, with the approval of the Agency, re-pack a pesticide or toxic substance into another container if — (a) the person takes appropriate measures for the safety of any other person who may be at risk from exposure to the pesticide or toxic substance; and (b) the person makes adequate provision for facilities and qualified personnel to administer first aid or other emergency treatment. (5) A person re-packing a pesticide or toxic substance shall — (a) take the necessary precautions in the handling of the pesticide or toxic substance as specified in regulation 36; and (b) ensure that the persons involved in re-packing are educated on the toxic nature of the pesticide or toxic substance and wear the appropriate personal protective equipment." Regulation 51 States that "(1) A holder of a pesticide and toxic substance licence, waste management licence or a hazardous waste licence shall provide appropriate personal protective equipment to an employee exposed to pollution from the — (a) manufacture, blending, processing, re-processing or storage of a pesticide or toxic substance; (b) use, sale, distribution or transportation of a pesticide or toxic substance; (c) importation, transit or exportation of a pesticide or toxic substance; or (d) handling of waste or hazardous waste."

Proper siting of stores and control of waste is partially covered under Regulation 37: “(9) The warehouse should have drains which should not be directly linked to waterways or public sewers. They should instead be linked by a closed system, to an evaporation tank.”

Legal framework for non-chemical preventive and direct control measures

This area is not covered by legislation in Zambia.

Price and trade policy, including subsidies

A subsidy scheme is in place within Zambia under the Farmer Input Support Programme with the aim to promote diversification to cash crops, including soybeans, A total of 1 million farmers are targeted to receive vouchers in the 2017/2018 agriculture season. These vouchers allow farmers to purchase subsidised seeds and fertilizer pesticides. The e-voucher will be value-based rather than input-based. Consequently, farmers will have flexibility to purchase inputs for crops other than maize.

Registration (synthetic pesticides and biopesticides)

No specific regulations covering registration of pesticides in Zambia were identified. Registration of pesticides is mentioned in the application for a licence to “manufacture, import, export, store, distribute, transport, blend, process, re-process or change the composition of a pesticide or toxic substance or re-process an existing pesticide or toxic substance for a new use”. The application process requires that the applicant provide information on the registration status of the pesticide product for which the licence is being sought. (The Environmental Management (Licensing) Regulations, 2013, Application for a Pesticide and Toxic Substance Licence. Form VIII, Product Identification Section 4 d).

There is no provision included in the legislation for the use of unregistered pesticides in emergency situations.

Biocontrol agents

Importation of organisms, such as invertebrates, are covered under the Plant Pests and Diseases (Importation) Regulations 2006 (1960). However, there is no specific legislation containing a provision for the import and release of biological control agents and other beneficial organisms.

Packaging and labelling

Requirements that packaging should be made of inert material and be sufficiently robust are set out under the Environmental Management Regulation 34 (1): “A person shall pack a pesticide or toxic substance in a container or package that— (a) cannot react chemically or physically with the pesticide or toxic substance it is to contain; and (b) is capable of preventing the leakage or spillage of the pesticide or toxic substance during handling and transportation”.
There is no requirement that packaging must be safe according to the following specifications: containers must be liquid tight and have resealable caps; fragile containers like glass should be avoided; a child-safety mechanism should be used.

There is no requirement that packaging or re-packaging only take place on licensed premises. There is no requirement that original packaging must not resemble that of consumable goods, but this is a requirement for re-packaging: Environmental Management Regulation 34 (3): “A person shall not re-pack, decant or dispense a pesticide or toxic substance into a food or beverage container”. Sale of unsafe products also falls under the Competition and Consumer Protection Act No. 24 of 2010, Section 52 (4) of which states that “The Commission may, where it has reasonable grounds to believe that a person or an enterprise is selling goods which are unsafe, after consulting the Zambia Bureau of Standards and such other relevant competent body as it considers appropriate, apply to the Tribunal for an order that— *(a)* goods of a certain description are unsafe and that the sale of such goods to any consumer is prohibited”.
Regulation 35 requires that an officially approved label is a mandatory part of the product packaging: “(1) A person shall not deal in a pesticide or toxic substance in a container or package without a label or a container or package that has a label which is not approved by the Agency. The approved label must currently contain the following information: product name, active

ingredient (chemical name), net content, manufacturer, hazard and safety information (conforming to the Globally Harmonized System (GHS) of Classification and Labelling of Chemicals) and warning against reuse of container. Information on how to store the pesticide, directions for use, batch number, registration number, use type and formulation are not required on the label, according to Zambian Regulation 25 (Form X). “Directions for use” are required on the label, but are general in nature, with no qualifying statements on the need to describe the crops and target pests, dose rates, mixing instructions, application methods, equipment, timing and frequency of applications, maximum number of applications, interval between applications, incompatibility issues, information related to resistance management (e.g. Insecticide Resistance Action Committee/Food Research Action Centre (FRAC)/ Herbicide Resistance Action Committee codes or guidance for rotation). The labelling information does not currently include: a legal requirement that pesticides be used in a way which is consistent with the label; how the information in the label should be communicated (e.g. languages, system of weights and measures, requirements to read the label aloud, provision of additional information like safety data sheets); an outline of the physical requirements of the label (e.g. minimum size of packaging, use of a durable material, fade-resistant ink); information on whether a handbook or manual is available to guide label design and/or review. There is no stipulation that the labelling colour coding must conform to GHS**.**

The Competition and Consumer Protection Act 2010, Section 50 (1), states that: “a product that is sold in Zambia shall have a label to clearly indicate the product name, the ingredients used in the product, the date of manufacture and expiry of the product, the manufacturer’s name, the physical location of the manufacturer, the telephone number and any other contact details of the manufacturer.”

Marketing

Advertising of pesticides is covered in the Environmental Management Regulations 2013, and specifically Regulation 39 addressing pesticide advertising. Advertising regulations broadly cover all forms of pesticide. Regulation 39 prohibits false or misleading advertising: “(1) A person who intends to advertise a pesticide or toxic substance shall ensure that the advert—(a)contains statements which are technically justified and (2) An advert of a pesticide or toxic substance […] shall not— (a) contain any statement or visual presentation that is likely to mislead the public with regard to the safety, nature, composition, suitability for use, official recognition or approval of the pesticide or toxic substance”. In addition, Regulation 39 (3) states: “A person advertising a pesticide or toxic substance shall not […] (d) misuse research results or quotations from technical and scientific literature to make the claims in the advert appear to have a scientific basis that they do not possess.”

Regulation 39 (1) states: “A person who intends to advertise a pesticide or toxic substance shall ensure that the advert […] (e) encourages purchasers and users to read the label carefully or have the label read to them if they cannot read.”

Regulation 39 (3) states: “A person advertising a pesticide or toxic substance shall not — (a) advertise a pesticide which is legally restricted for use by trained or registered operators, unless— (i) the advert is contained in a journal for trained or registered operators.”

The Environmental Management Act 2011 Section 66 states that the Environment Agency is responsible for enforcement. According to this section, “the Agency shall—*(a)* control the importation, exportation, manufacture, storage, distribution, sale, use, packing, transportation, disposal and advertisement of pesticides and toxic substances […]”

Advertising standards are also covered generally in the Competition and Consumer Protection Act 2010, and it may be assumed that these cover pesticide advertising: Section 47 of the act states: “A person who, or an enterprise which […] *(a)* falsely represents that […] (i) any goods are of a particular standard, quality, value, grade, composition, style or model; or *(b)* makes a false or misleading representation […] is liable to pay the Commission a fine […]”

Transport

The Environmental Management Regulations 2013 cover transport of pesticides: under Regulation 31 (1) a licence is required to transport pesticides: “A person who intends to manufacture, import, export, store, distribute, transport, blend, process, re-process or change the composition of a pesticide or toxic substance or re-process an existing pesticide or toxic substance for a new use shall apply to the Agency for a pesticide and toxic substance licence”. Partially covers the requirements for vehicles and containers are covered by the Environmental Management Regulations 2013, Tenth Schedule Regulation 33 of (2): A driver or person in charge of a vehicle or other conveyance transporting a pesticide or toxic substance shall - (a) secure the container or package of the pesticide or toxic substance during transportation; (b) use hazard warning symbols on the vehicle or conveyance which comply with the standards for the classification and labelling of chemicals and the standards on the transportation of dangerous goods prescribed under the Standards Act; and (c) be trained in the transportation of dangerous goods and be in possession of the relevant competence certificate at all times during the transportation of the pesticide or toxic substance. (3) A person shall not transport […] (a) a banned, restricted or severely restricted pesticide or toxic substance without the approval of the Agency; or (b) a package of a pesticide or toxic substance that is damaged, corroded or is likely to leak. (4) An owner of a vehicle or conveyance in which a pesticide or toxic substance is transported shall comprehensively insure the vehicle or conveyance transporting the pesticide or toxic substance.”

There is no provision prohibiting the transport of pesticides in the same vehicle or in the same space as passengers, animals or feed.

Import and export

Specific requirements concerning the import and export of pesticides are covered in the Environmental Management Regulations 2013. Regulation 31 (1) states: “A person who intends to manufacture, import, export, store, distribute, transport, blend, process, re-process or change the composition of a pesticide or toxic substance or re-process an existing pesticide or toxic substance for a new use shall apply to the Agency for a pesticide and toxic substance licence”. In addition they need to (a) demonstrate technical capacity to manufacture, import, export; and (b) have measures and facilities to ensure the safe manufacture, importation, exportation”. Information on pesticide registration is requested in the licence application. The application procedure for importing pesticides is covered under the licence.

No mention of the following was found in any legislation: the criteria for decisions on granting import permits; a requirement for the inspection of pesticides at the point of entry; collaboration between the competent national authority and the customs department at points of entry; exceptions for donations or imports by public entities for specific purposes; and a requirement that exported pesticides meet the same quality standards as comparable domestic ones. There is requirement that descriptions of warning codes for shipping containers conform to regulations of the FAO, WHO or Groupement International des Associations Nationales de Fabricants de Produits Agrochimiques (GIFAP).

Requirements for sale

Section 122 (1) of the Environmental Management Act states that: “A person shall not— *(a)* detach, alter or destroy the labelling of a pesticide or toxic substance; or *(b)* use or dispose into the environment a pesticide or toxic substance in contravention of this Act. (2) A person shall not distribute, sell, offer for sale, store, import, export, transport, manufacture, change the composition of, or deal in any manner with any unregistered pesticide or toxic substance or without a licence.”

The regulations governing licensing do not specifically mention the ‘sale’ of pesticides in the licensing categories (only distribution). There is also no specific mention that each person selling pesticides requires a licence. However, Regulation 39 (4) covers the need for training: “A member of staff involved in the sale or promotion of an advertised pesticide or toxic substance shall be adequately trained and possess sufficient technical knowledge to present complete, accurate and valid information on the products sold”.

There are no specific requirements regarding packing and labelling at point of sale under the regulations pertaining to the sale of pesticides. However, Regulation 37 (B 1-2) generally states that “All products should be stored under lock and key with proper warning signs displayed clearly to keep away unauthorised persons. Pesticides and toxic substances must be stored in a separate warehouse, away from any other goods especially food and stock feed […]. 2. Before storing any pesticides ensure that they are properly labelled and are of good quality and acceptable condition. If any of the products are not in good condition, do not store them together with other products but take appropriate action.”

Licensing

No pesticides are currently manufactured in Zambia. However, the Environmental Management (Licensing) Regulations, 2013, include provision for a licence to manufacture pesticides. For example, Regulation 31 states: “A person who intends to manufacture, import, export, store, distribute, transport, blend, process, re-process or change the composition of a pesticide or toxic substance or re-process an existing pesticide or toxic substance for a new use shall apply to the Agency for a pesticide and toxic substance licence in Form VIII set out in the First Schedule.” The licence form requests information on the registration status of the pesticide being licensed.

There is no specific demand for a licence to ‘sell’ pesticides although this could be covered by the term “distribute” quoted above. Regulation 39 (4) of the Environmental Management Regulations requires that “A member of staff involved in the sale or promotion of an advertised pesticide or toxic substance shall be adequately trained and possess sufficient technical knowledge to present complete, accurate and valid information on the products sold”. However, there is no demand for this person to be “licensed”.

Regulation 54 of the Environmental Management Regulations states that “a licence shall be valid for three years and may be renewed for a like period”, so long as the conditions of the licence are met. There is a procedure to amend a licence, covered under Section 55 and Section 60 of the Regulations, which set out the criteria for rejection of a licence: “60 (1) Subject to the provisions of the Act and these Regulations, the Agency may suspend or cancel a licence if— (a) the holder obtained the licence by fraud or deliberate or negligent submission of false information or statement; (b) the holder contravenes the terms and conditions of the licence, the Act or any other relevant written law; (c) the holder fails to maintain any required records for purposes of the Act; or (d) the holder fails to submit annual returns. (2) The Agency shall, before suspending or cancelling a licence in accordance with sub-regulation (1), give notice to the holder thereof of its intention to suspend or cancel the licence in Form XVIII set out in the First Schedule. (3) The Agency shall not suspend or cancel a licence under this regulation if the holder takes remedial measures to the satisfaction of the Agency within the period specified in the notice referred to in sub-regulation (2). (4) Where a holder of a licence who is notified under sub-regulation (2) fails to show cause to the satisfaction of the Agency or does not take any remedial measures within the time specified in the notice, the Agency shall suspend or cancel the licence and notify the holder in Form XIX set out in the First Schedule.”

There is no specific mention that more restrictive requirements are imposed on severely restricted pesticides or for special applications.

A specific license is required for the use of ODSs, according to Environmental Management Regulation 42 (1): “The following persons shall apply for a licence under this Part— (a) an importer, exporter, producer or distributor of a controlled substance or ozone depleting substance.”

Availability

No information is available on legislation containing any provision to regulate the availability and use of pesticides in accordance with the hazards involved and the existing levels of user training.

Handling and use, including regulations on application equipment

Generally, the licencing requirements for a pesticide and toxic substance are covered in Regulation 31 section (2), which states: “The Agency shall…. (1), approve the application if the applicant […] -

(b) “has measures and facilities to ensure the safe manufacture, importation, exportation, storage, distribution, transportation, blending, processing, re-processing or changing of the composition of a pesticide or toxic substance or re-processing an existing pesticide or toxic substance”.

Under the general provisions of the environmental and pesticide regulations, specifically, Regulation 51 states that: “51. (1) A holder of a pesticide and toxic substance licence, waste management licence or a hazardous waste licence shall provide appropriate personal protective equipment to an employee exposed to pollution from the — (a) manufacture, blending, processing, re-processing or storage of a pesticide or toxic substance; (b) use, sale, distribution or transportation of a pesticide or toxic substance; (c) importation, transit or exportation of a pesticide or toxic substance; or (d) handling of waste or hazardous waste.”

There is no specific mention of operators or farm workers.

Zambia Standard ZS 555: 2006 Handling of pesticides: Code of practice (Zambia Bureau of Standards) specifies practices which reduce risks in the handling of pesticides, including minimizing the adverse effects on human and the environment and preventing accidental poisoning from improper handling. However, the standard is only accessible via purchase and is not freely publicly available.

Environmental Management Regulation 36 covers some aspects of protection, e.g. Regulation 36 (1): “A person handling or using a pesticide or toxic substance shall use personal protective equipment if—(a) the pesticide or toxic substance is in the form of powder, vapour or spray droplets, the container of which bears or is required to bear a label with the word ‘danger’ or ‘warning’; (b) the application of the pesticide or toxic substance is in a confined place; or (c) the container of that pesticide or toxic substance bears or is required to bear a label with the word ‘danger’ or ‘warning’.” Regulation 36 (2): “A person shall not authorise or order the wearing of a respirator when the canister or cartridge in the respirator exceeds the service life specified by the manufacturer.”

Requirements for training

No specific policy can be found that aims to disseminate educational materials on pesticide use. Mandatory training requirements are covered in the following:

Environmental Management Regulation 33 (2): “A driver or person in charge of a vehicle or other conveyance transporting a pesticide or toxic substance shall (c) be trained in the transportation of dangerous goods and be in possession of the relevant competence certificate at all times during the transportation of the pesticide or toxic substance.” Regulation 39 (3): “A person advertising a pesticide or toxic substance shall not — (a) advertise a pesticide which is legally restricted for use by trained or registered operators, unless— (i) the advert is contained in a journal for trained or registered operators; or (ii) the advert prominently and clearly states the restricted usage.” Regulation 39 (4): “A member of staff involved in the sale or promotion of an advertised pesticide or toxic substance shall be adequately trained and possess sufficient technical knowledge…”

Restrictions related to vulnerable groups

The Environmental Management Regulation 36 (3) contains provision to protect vulnerable people: “A child or pregnant woman shall not be employed in the handling of pesticides or toxic substances”. There is no mention of nursing mothers and the legislation does not specifically ban the sale of pesticides to these groups.

Requirements for PPE

According to Environmental Management Regulation 51, PPE shall include the following: “(a) acid resistant or chemical resistant overalls or dust coats with buttons to the neck;

(b) acid resistant or chemical resistant trousers and coat or suit; (c) Polyvinyl Chloride (PVC) gloves; (d) Polyvinyl Chloride (PVC) aprons; (e) rubber boots; (f) respirator canisters with filters specific for dust, mist, fumes, gases and vapour; (g) face shields; and (h) any other appropriate

personal protective equipment." Environmental Management Regulation 51 (3) states: "An employee to whom personal protective equipment is provided under sub-regulation (1) shall maintain the personal protective equipment in sanitary and proper conditions."

Storage

Storage and warehousing is covered generally under Regulation 37 A 1-10 and B 1–9 of the Environmental Management Regulations 2013. The regulations do not differentiate between private, end-user or home storage and bulk or commercial storage, and do not impose record-keeping requirements.

The regulations include the following text: "Pesticides and toxic substances must be stored in a separate warehouse, away from any other goods especially foods and stockfeeds." (Regulation 37 A 1). Regulation 37 also states that storage facilities must be built in a manner that is structurally sound and robust: "The floors in the building should be of concrete with a load bearing capacity sufficient to withstand the weight of the stock, ranking and any mechanical handling equipment to be used. Floors should be impervious to liquids, free from cracks and smooth to facilitate cleaning." A prescription for ventilation is included in Regulation 37 (8): "The roof of the warehouse should be able to effectively keep out rain, be able to provide ventilation."

Disposal of unused pesticides

Disposal of unused pesticides is covered in the 13th schedule of the Environmental Management Regulations 38 on Disposal Options for Pesticides and Toxic Substances. However, there is no mention of an existing or planned inventory or of a policy being in place to address obsolete or unusable pesticide stock or pesticide containers. Section 8 of Regulation 38 states: "Where no safe disposal facilities exist in Zambia, export of pesticide and toxic waste to another country with facilities shall be done in accordance with these Regulations and the applicable law in that country." Section 9 of Regulation 38 states that one disposal option is to return pesticides or toxic substances wastes or expired obsolete stocks to the manufacturer if the manufacturer is willing to accept them. Sections 1–6 of Regulation 38 states that pesticides and toxic substance waste, expired pesticides or toxic substances and spillages, obsolete and leftover products, and packaging materials for pesticide and toxic substances shall be disposed of in the following manner: "through product recycling, high temperature incineration (high temperature thermal oxidation), chemical treatment or long term storage."

Pesticides that are hazardous or potentially hazardous to human health or the environment are classed as pollutants (Environmental Management Act, Section 2). As such, Regulation 4 (1) of the Environmental Management Regulations 2013 states: "A person who intends to emit or discharge a pollutant or contaminant into the environment shall apply to the Agency for an emission licence".

Disposal of empty pesticide containers

Regulations governing the disposal of empty pesticide containers are incorporated into the Zambian Environmental Management Regulations 2013, implying that the same standards are applied across the country. The 13th schedule (Regulation 38) describes disposal options for pesticides and toxic substances. Section 7 (a – c) states: "Packaging Materials Disposal - Contaminated packaging material shall be disposed of as follows: (a) Contaminated Packaging Material Cartons, boxes and bags should be cut and rendered non-usable. The waste should be packed in plastic bags to minimise the risk of exposure during handling. Disposal of these should be carried out by - (i) burning in an incinerator; and (ii) burial in an approved landfill. (b) Small Packs - Small packaging shall be well drained, triple-rinsed, shredded or crushed. Combustible packaging material should be incinerated as described in 8 (2 a). Non-combustible crushed containers should be buried in a landfill site. (c) Large Containers - The maximum amount of residue from each container must be drained prior to triple rinsing with water or a suitable solvent and disposed of as follows: (i) Steel Drums Triple - rinsed and drained drums should be crushed, to render them unusable and disposed of by steel smelting - This is the preferred option. - Burial in an approved landfill site at least one metre below ground level. (ii) Plastic Drums - After triple rinsing, plastic drums must be punctured and shredded to avoid any form of reuse and packed for disposal

by burial at approved landfill sites. Large quantities of plastic wastes must not be burned except in licensed incinerators."

No legislation exists stating that the final disposal of empty pesticide containers must be carried out by authorized companies.

Post-registration monitoring

Monitoring of pesticides is included as a responsibility of the Agency and is described under Section 66(g) of the Environmental Management Act: "The Agency shall collect data from industries on the production, use and effects on human health and the environment, of pesticides and toxic substances". It is also described under Section 66 (i): "the Agency shall do all such things as are necessary for the monitoring and control of pesticides and toxic substances."

Cases of pesticide poisoning are not mentioned. Monitoring of pollutants (including harmful substances) is conducted by the Agency as described under Sections 48, 52 and 62 of the Environmental Management Act, which states: the Agency shall "order or carry out investigations of actual or suspected water and air pollution, including the collection of data; collect, maintain and interpret data". The powers of inspectors in relation to information-gathering is covered in Section 15 of the Environmental Management Act. An inspector may, at any reasonable time: "15 (c) examine any document, material, matter, substance or article found in any industrial facility or plant, undertaking, business or other premises that has a bearing on an investigation; (d) require information to be given about any document, article, an industrial facility or plant, undertaking, business or any other premises by[…]"

Residue monitoring in food and Maximum Residue Levels (MRL)

Control of poisonous or harmful substances in food is covered by the Food and Drugs Act (1994) Part II: Prohibition against sale of poisonous, unwholesome or adulterated food. Enforcement occurs under the Food and Drugs Board. Pesticides are included within the Food and Drugs Act, under the Poisonous Substances in Food Regulations (1973). There is no reference to commodities that are for national consumption.

International trade is covered under the following: Zambian Standard ZS CXS 193: 1995 Contaminants and Toxins in Food and Feed. This describes the main principles which are recommended by the *Codex Alimentarius* in dealing with contaminants and toxins in food and feed. It lists the maximum levels and associated sampling plans of contaminants and natural toxicants in food and feed which are recommended to be applied to commodities moving in international trade. Information on standards from the Zambia Bureau of Standards is for sale only and for members.

It is not confirmed which MRL are being followed. The Poisonous Substances in Food Regulations (1973) sets out the MRL in various foods, but does not give the source of the MRL.

Other relevant human health and environmental protection regulations

No policy is found that describes a plan to carry out health surveillance programmes in respect of those who are occupationally exposed to pesticides. There is no policy in place to establish a national poison centre, or to provide guidance to health workers.

Compliance and enforcement

Legislation prohibiting the import, packaging, re-packaging, transportation, distribution or sale of a pesticide unless it is packaged in accordance with criteria provided in the law exists in part and in relation to certain areas only. There is no overarching legislation on pesticide packaging generally, to cover all handling contexts. For example, Regulation 33 states that in relation to transport "A person shall not transport— (a) a banned, restricted or severely restricted pesticide or toxic substance without the approval of the Agency […]" Regulation 34 (1) states: "A person shall pack a pesticide or toxic substance in a container or package that— a) cannot react chemically or physically with the pesticide or toxic substance it is to contain […]"

The legislation does not contain any specific procedures to facilitate the exchange of information on matters such as availability of resources, of illegal pesticide trade. However, coordination generally is mentioned under Section 9 of the Environmental Management Act (1): “The Agency shall do all such things as are necessary to ensure the sustainable management of natural resources and protection of the environment, and the prevention and control of pollution. (2) Without limiting the generality of subsection (1), the Agency shall […] (b) co-ordinate the implementation of activities of all ministries, appropriate authorities and conservancy authorities in matters relating to the environment […]”

Section 14 (1) of the Environmental Management Act states: “The Agency shall establish an inspectorate with the necessary technical staff and facilities required to administer, monitor and enforce measures for the protection of the environment and the prevention of pollution.” The powers of inspectors are described in in Section 15. This includes the power to take samples and to conduct searches. The procedures and requirements for the sample-taking are not described in detail.

Offences relating to pesticides and toxic substances are covered briefly under the Environmental Management Act, Section 122, Part 122(1): “A person shall not— (a) detach, alter or destroy the labelling of a pesticide or toxic substance; or (b) use or dispose into the environment a pesticide or toxic substance in contravention of this Act. (2) A person shall not distribute, sell, offer for sale, store, import, export, transport, manufacture, change the composition of, or deal in any manner with any unregistered pesticide or toxic substance or without a licence. (3) A person who contravenes this section commits an offence and is liable, upon conviction, to a fine not exceeding five hundred thousand penalty units or to imprisonment for a period not exceeding five years, or to both.” Section 129 (1) states that the court may “declare any matter, article, vehicle, aircraft, boat or any other conveyance used in the commission of the offence to be forfeited to the State.”

Analysis of GAP/GCM and other voluntary standards applied to focal crops

Few GAP or voluntary standards covering groundnut and soybean can be identified in Zambia. One example is the Zambian-registered non-profit company COMACO. The system established by COMACO sees member farmer cooperatives receive top prices for their produce, and farmers who are compliant with COMACO conservation compliance standards also receive a “Conservation Dividend”, set at a percentage of the total value of the crops sold to COMACO.

Organic farming initiatives exist in Zambia but do not currently cover the focal crops. Emphasis is on commodities such as honey and vegetables for export to Europe.
There are 25 operations certified by Ecocert and 30 by the Soil Association. OPPAZ is the only member of the International Federation of Organic Agriculture Movements (IFOAM) in Zambia. Zambia has been identified as a possible candidate for expansion of the Export Promotion of Organic Products from Africa (EPOPA) programme established under Swedish International Development Agency (Sida). Roundtable on Responsible Soy (RTRS) also has members in Zambia. However, Fairtrade does not cover groundnut or soybean in Zambia.

State of science on crop protection

SOYBEAN

Soybean rust (*Phakopsora pachyrhizi*)

Prevention

- Plant varieties that are tolerant of rust, e.g. TGx1740-2F, or “Mwembeshi”, which is an early maturing variety, resistant to soybean rust (IITA 2015).
- Rotate soybeans with cereals, such as maize, to break disease life cycle.
- Use plant spacing of no more than 20 plants per 10 metre row, to aid field ventilation (CABI 2015).

- Plant soybeans early to enable the crop to grow before build-up of the disease in the environment and to enable the plants to exceed the most susceptible growth stage of disease, at the four- to six-leaf stage (CABI 2015).
- Avoid transferring disease via infected equipment and clothing from one field to another.

Monitoring

- Scout weekly from two weeks after germination onwards. Look for rust spots on underside of leaves. Take action when: one to three plants per metre row are infected with spots during seedling stage. Two to four leaves per 40–50 out of 100–150 plants show symptoms, between vegetative to early maturity stage (disease spreads seven days after infection) (CABI 2015).

Control – chemical

- Apply appropriate fungicides as protectants before incidence is over 5%.
  Effective fungicides include: chlorothalonil, strobirulins, triazoles. Rotation of fungicide AI is recommended by the Fungicide Resistance Action Committee's *(*FRAC*)* (Juliatti et al. 2017)
- Spray penetration into mid to lower canopy and complete plant coverage, especially on the underside of leaves, is essential to achieve rust control.

Frogeye leaf spot (fungus: *Cercospora sojina*)

Prevention

- Plant-clean, pathogen-free seed.
- Use resistant varieties, TGx1740-2F, or “Mwembeshi” (IITA 2015).
- Rotating out of infected soybean for at least two years will help reduce the frogeye leaf spot risk.
- Burying infected soybean residue will help reduce the inoculum in a field.
- Plant-resistant soybean varieties, if fields had frogeye leaf spot in recent years (Iowa State University 2017c).
- Plant-certified seeds treated with a fungicide if the disease is expected or known in the area (Chisunka 2015).
- Plant early to ensure good crop stand (Chisunka 2015).
- Deep-ploughing of crop residues if infected (Chisunka 2015).
- Rotate soybean with maize and other cereals after a maximum of three years’ continuous cultivation with soybeans, and in any case when fungal disease infection is experienced (Chisunka 2015).
- Disease survives and overwinters in soybean residue and seeds (University of Florida, 2001).

Monitoring

- Inspect the crop weekly, from germination onwards (Chisunka 2015).
- Lesions start as tiny dark spots on leaves, but can be mistaken with other diseases. Later, lesions become circular to irregular, with brown to reddish margin, with a light grey centre (Chisunka 2015).
- Take action when five to seven plants in 10 show early infection (Chisunka 2015).

Control – cultural

- Early tillage of soybean residues directly after harvest is effective in reducing the pathogen population (Iowa State University 2017b).
- At early infection remove infected leaves or branches and bury deep (Chisunka 2015).

Control – chemical

- Fungicide seed treatments can reduce the risk of infection. Spraying applications of fungicides after growth stage R1 can reduce disease severity. However, applications made at stage R3 are considered most effective fungicides include: DMI Triazoles MBC Thiophanates. Reference should be made to the Fungicide Resistance Action Committee (FRAC) guidelines for resistance management when using fungicides.
- Seed dressing with systemic fungicides.
- Fungicides are mostly protective against new infections, they cannot usually cure already infected plants, but can protect uninfected plants. Fungicides are applied to soybeans at the R1–R4 growth stages, and only if justified by thresholds and only during humid weather (Chisunka 2015).

Purple seed stain (fungus: *Cercospora kikuchii*) *CABIa*

The causal fungus for this disease is a very close relative of the one that causes frogeye leaf spot (*Cercospora sojina*) and like frogeye leafspot, it is seed-borne (Iowa State University 2017a).

Prevention

- Plant-tolerant varieties, such as TGx1937-1F, or “Kafue”, and TGx1740-2F, or “Mwembeshi (IITA 2015).
- Soybean varieties vary in their response to Cercospora, but a high level of resistance is not currently available. Nevertheless, many commercial varieties demonstrate at least some degree of tolerance (DuPont Pioneer Agronomy Sciences 2013).
- Tillage (to around 25 cm depth) – rapid decay of infested residue prevents a build-up of the pathogen and potentially greater infection in the next soybean crop (Chisunka 2015).
- In no-till or reduced-till systems, longer crop rotations and shredding soybean straw, where this is possible, are effective (North Central Soybean Research Programme (NCSRP) 2018).
- Crop rotation with non-legume crops, like maize, sorghum, wheat and finger millet.
- Field location and plant spacing that allow for good air flow (NCSRP 2018).
- Field location with good soil drainage (NCSRP 2018).
- Avoid overhead irrigation (Infonet-biovision 2017b).

Monitoring

- Best time to scout for this disease is R3 through R6 (Iowa State University 2017c).

Control

- Apply foliar fungicides that are registered for Cercospora leaf blight. Application made during pod-filling stages can reduce the incidence of purple seed stain (Iowa State University 2017c).
- Seed lots with a high percentage of infected seed can be treated with a seed treatment fungicide (NCSRP 2018).

Aphids (aphids on soybean can include *Aphis fabae and Aphis craccivora)*

Prevention

- Encourage intercropping with maize crop (Van Rheenen et al. 1981).
- Intercropping beans with semiochemical-producing companion crops, such as fenugreek or coriander, can provide some protection for bean plants against aphids (Shalaby et al. 2016).
- Other agronomic factors, including plant nutrition, are relevant for managing soybean aphids. Deficiency of potassium can lead to higher soybean aphid populations through plant effects (Walter and DiFonzo 2007; Myers and Gratton 2006).
- Remove all weeds and volunteer plants before planting.

- Encouraging natural enemies which prey on aphids can provide effective control (Costamagna and Landis 2006).
- Plant when seeds can germinate quickly and will grow vigorously (Hodgson et al. 2012).
- If possible, grow during the cooler months, from June onwards, if irrigation is available.

Monitoring

- Aphids multiply rapidly so early detection is important. Monitor plants – particularly during seedling and shoot growth and during flowering and fruiting. Look for aphids on undersides of the leaves and buds. Threshold is 250 aphids per plant.
- Presence of ants may indicate presence of aphids, because ants come for sugary exudates produced by aphids.
- Yellow traps are useful for monitoring the arrival of winged aphids on the crop. The presence and abundance of natural enemies should also be recorded.

Control

Botanicals

- *Azadirachta indica*, *Eucalyptus globules* and *Ocimum basilicum* have shown maximum repellency against aphids (Singh et al. 2012).

Pod borer (Helicoverpa)

Prevention

- Plant-resistant varieties: TGx1937-1F, or “Kafue”, has vigorous seedling establishment. It is medium- to late-maturing and has high biomass production and nodulation. Also, TGx1740-2F, or “Mwembeshi, have the same characteristics (IITA 2015).

Natural enemies

The number of natural enemies or beneficial organisms varies with crop age, from crop to crop, region to region, and from season to season. The combined action of a number of beneficial species is often required to have a significant impact on potentially damaging helicoverpa populations. It is therefore desirable to conserve as many beneficial organisms as possible. Various natural enemies and beneficial organisms exist:

- Wasps of the families: Tachinidae, Ichneumonidae Braconidae and Trichogrammidae parasitize helicoverpa larvae (van den Berg et al 1988))
- Ants and spiders will also attack helicoverpa larvae (van den Berg et al 1988)
- Other predators such as wild birds and chickens also prey on larvae (Infonet Biovision 2017c)
- To conserve beneficial organisms, adopt the “go soft early” IPM strategy of only using biopesticides against caterpillars in vegetative crops

Intercropping

- Intercrop soybean with plants that are attractive to natural enemies (Infonet Biovision 2017c)

Monitoring

- Soybeans should be scouted for eggs and moths to pinpoint the start of infestations and increase the chance of successful control
- Inspect twice weekly from early budding until late podding (Infonet Biovision 2017c)
- Monitor crops at least weekly during the vegetative stage and twice weekly from flowering onwards (Infonet Biovision 2017c) African Bollworm http://www.infonet-biovision.org/PlantHealth/Pests/African-bollworm#simple-table-of-contents-6

- Look for helicoverpa eggs and for damage, including leaf chewing, terminal damage and damage to pods, and any natural enemies of helicoverpa (Infonet Biovision 2017c)
- Open vegetative terminals to check for small larvae feeding inside (Infonet Biovision 2017c)
- Beat sheet sampling is the preferred sampling method for medium to large helicoverpa larvae. Small larvae should be scouted for by opening vegetative terminals and flowers
- Inspect crops weekly during the vegetative stage – damage to vegetative terminals is often the first visual clue that helicoverpa larvae are present
- Soybeans should be scouted for eggs and moths to pinpoint the start of infestations and increase the chance of successful control
- Inspect twice weekly from early budding until late podding

Control

Thresholds
Approximate economic threshold of approximately 7–8 helicoverpa larvae per square metre in vegetative soybeans (Rogers & Brier, 2010).

Helicoverpa thresholds for podding soybeans currently range from 1–2 larvae/m^2 (depending on crop value and pesticide cost) (Rogers & Brier, 2010).

Biopesticides
- Prior to flowering, biopesticides, particularly helicoverpa nucleopolyhedrovirus (NPV) are recommended in preference to chemical insecticides. This helps conserve beneficial insects to buffer crops against helicoverpa attack during the susceptible reproductive stages, and avoids flaring of other pests such as whitefly and mites
- For best results, all ingestion type products require thorough plant coverage. For biopesticides, addition of Amino Feed or an equivalent product is recommended
- Selective insecticides are the preferred options to preserve beneficial organisms (IPM 2017)

Cultural control
- Where possible, avoid successive plantings of summer legumes
- Good agronomy and soil moisture are crucial as large, vigorously growing plants suffer less defoliation for a given helicoverpa population and have less risk of terminal damage
- In water-stressed crops, terminals are more attractive to larvae than wilted leaves. Vigorously growing plants with adequate available moisture are better able to replace damaged leaves and compensate for flower and pod damage

GROUNDNUT

Groundnut rust (*Puccinia arachidis*)

Prevention
- Use resistant cultivars (CABI 2017; Nigam 2014), e.g. ICRISAT's ICGV-SM 06729 (release name: MGV 6).
- Seed can be purchased from research stations and other reputable seed suppliers and sources.
- Adjust times of sowing to avoid favourable environmental conditions for rust outbreak (20–25 °C, < 85% relative humidity (CABI 2017).
- Early planting at correct spacing controls the diseases (rosette, early and late leaf spots and rust) (African Institute of Corporate Citizenship, AICC, 2015).

- Eradicate volunteer groundnut plants, since they can host the fungus (CABI 2017; Tsatsia and Jackson 2012; UF 2000; Africa Soil Health, 2014; Nigam 2014).
- Practice crop rotation with two cereal crops, one after the other (e.g. maize, sorghum, rice, sugarcane) (CABI 2017; Tsatsia and Jackson 2012; UF 2000; AICC 2015; Nigam 2014).
- Practice intercropping with cereals (maize, sorghum, pearl millet) (Nigam 2014).
- Control weeds, as the disease may be favoured by the high humidity in a dense crop canopy (CABI 2017; AICC 2015).
- Ensure a sufficiently long break of at least four weeks between successive groundnut crops where the disease is present (CABI 2017).
- Plant new crops as far as possible from infested fields. If not possible, do not plant downwind of them (CABI 2017; Tsatsia and Jackson 2012).
- At an early stage of the disease development, remove affected plants and carry them away from the field in a plastic bag and burn the debris to prevent the spores from spreading. Plant debris can also be used as fodder (CABI 2017).

Monitoring

- Monitor twice a week for symptoms on leaves, starting 30 days after germination (CABI 2017).
- Look out for (CABI 2017):
    - orange-coloured pustules that appear primarily on the undersides of the leaves, and turn reddish-brown. Pustules may later appear on the upper surfaces opposing the pustules of the lower surfaces. Rust-damaged leaves become necrotic and dry up, but remain attached to the plant. In severe damage, the crop has a burnt appearance
    - infected plants tend to mature two to three weeks earlier than those that remain healthy (CABI 2017)
    - symptoms may first be noticed within patches of a field (CABI 2017)
- Monitor carefully for rust development during favourable conditions (20–25 °C, free water on the leaf surface and high relative humidity) (CABI 2017).
- Consider applying control measures as soon as rust spots are seen, even if only on a few plants (CABI 2017; Nigam 2014).

Control – chemical

- Begin to spray fungicides, e.g. Tebuconazole 250 g/l, as soon as rust spots are seen. Spray at regular intervals: 10–14 days until 14 days before harvest (Tsatsia and Jackson 2012; UF 2000; Africa Soil Health, 2014; Nigam 2014).
- In most cases, spraying should begin no later than 30–35 days after planting (Tsatsia and Jackson 2012; Nigam 2014).

Early leaf spot (Cercospora arachidicola)

Prevention

- The best way to manage the disease is by growing resistant varieties and by selecting those that produce yields early (Africa Soil Health 2015). One variety is ICGV-SM 05534 (Wazitatu): high-yielding, 3-3 seeded, early leaf spot-tolerant.
- Plant locally available resistant varieties.
- Keep weeds under control to prevent high humidity within groundnut crops (Africa soil health 2015).
- Sow early, just before first rains, to reduce the severity of leaf spot (Kasunga et al. 2014)
- Temperatures of 25–30°C and six to eight hours of high humidity are needed for infection and disease development (Africa Soil Health 2015).

- Where possible, there should be a distinct break in time between successive groundnut crops. As the diseases are largely soil-borne, rotation with non-host crops is very important (McDonald et al. 1985).
- Rotate with cereals or pasture. Break for three to four years between successive bean crops (Kasunga et al. 2014).
- Intercrop with millet, maize, cotton, sorghum and soy bean to reduce spread of spores (Moses et al. 2016). For example, five rows of groundnuts with two rows of maize (Mandia et al. 2014).
- Plant debris should be removed from the field after harvest, burned in situ, fed to animals, or deep-buried (McDonald et al. 1985).
- Volunteer groundnut plants and 'ground-keepers' should be eradicated (McDonald et al., 1985).
- Avoid mechanical damage to plant stems and roots as fungus can enter plants though wounds (Mandia et al. 2014).

Monitoring

- Inspect the crop at least once a week (Africa Soil Health 2015).
- Normal stages of attack are the vegetative, flowering and pod-filling stages (Kasunga et al. 2014).
- Action should be taken immediately if two to three spots are observed on several plants per field (Kasunga et al. 2014).

Look out for:

- Oval spots on leaves, particularly the older leaves (this is the first symptom that appears, usually 45–60 days after sowing) (CABI 2016).
- Early leaf spots are reddish-brown on the upper surface, surrounded by a yellow halo and brown on the lower leaf surface (CABI 2016).
- Late leaf spots are dark brown to black, usually with a smaller halo or without one (CABI 2016).
- Dense spores form ring patterns on the under-surface (CABI 2016).
- Spots also appear on the stems and petioles (CABI 2016).
- Leaf and pod loss (CABI 2016).

Control – cultural

- Before sowing, plan to plant the new crops as far away as possible from older ones, especially if they are infected by leaf spots (Africa Soil Health 2015).
- If it is not possible to avoid planting near old crops, do not plant downwind from them, otherwise spores will easily spread to the new crop in wind and rain (Africa Soil Health 2015).
- If plants are infected, remove and bury deep in the soil, burn or feed to animals. Do not compost (CABI 2016; Mandia et al. 2014).

Control – chemical

- If growing the crop for sale, and fungicides are affordable and available, spray as soon as leaf spots are seen, even if they appear only on one or a few plants (Africa Soil Health 2015).
- To obtain effective control of leaf spots, fungicides are first applied before or just after the appearance of symptoms

Groundnut Rosette Virus

Prevention

- Various resistant varieties are available. Accurate targeting of varieties to appropriate agroecologies is required. One variety is ICGV-SM08503 (Virginia) from ICRISAT. Release name: MGV 7. High-yielding, rosette-resistant, large-seeded.
- Control the aphids in the field (Mansaray et al. 2013).
- Destroy virus sources; remove infected plants after harvest; remove volunteer plants or those that can harbour vector aphids (ICRISAT 2013; Mansaray et al. 2013; Haraman 2013; Nigam 2014).
- Sow early in the rainy season to take advantage of the low aphid population (ICRISAT 2013; Mansaray et al. 2013; Haraman 2013; Nigam 2014; Naidu et al. 1999).
- Plant at correct plant spacing as aphids prefer to land where plants are widely spaced (Mansaray et al. 2013).
- Do not grow groundnut in the same soil for more than one year: rotate with maize, millet, sorghum or other cereals. This hampers the spread of the aphid vector (Mansaray et al. 2013).
- Intercrop with beans, maize, millet, sorghum or other cereals (Mansaray et al. 2013; Nigam 2014).
- Intercropping and border cropping act as barriers to the vector (Nigam 2014).

Monitoring

- Look for symptoms and aphid vectors regularly, starting five days after germination to 50% flowering. Symptoms vary depending on the infection (Mansaray et al. 2013):
    - leaves: yellowing, mottling and mosaic, smaller leaves, green older leaves. Younger leaves are only slightly mottled. Older leaves can be chlorotic, with green veins and show downward rolling of leaf margins
    - branches: stunting, and bushy appearance of young plants, while in older plants a few branches are affected
    - shoots: distortion
    - pods: none or few produced
- Look for shiny black or dark brown aphids, about 2 mm in length, and for the sooty mould that grows on the honeydew they produce. Aphids prefer feeding on young and soft tissue, including leaves, flowers and pegs (Mansaray et al. 2013).
- Use yellow sticky traps to attract and monitor winged aphids. Use at least three stickers per acre (Mansaray et al. 2013).
- Consider controlling aphids as soon as you see them, or when you see the virus symptom (Mansaray et al. 2013).

Aflatoxin (*Aspergillus flavus)*

Prevention

- Broadcast Aflasafe ZM01 and Aflasafe ZM02 at 10 kg/ha 30–40 days after planting (Lohmann et al. 2015).

Post-harvest

- Harvest at the appropriate time and clean field residues after harvesting; strip and rapidly dry to ≤7% moisture level (Waliyar 2015).

Groundnut storage pests

Rodents

Prevention

- Remove dense weed cover and heavy mulches, which provide rodents with food and protection from predators and environmental stresses (Plantwise 2016d).
- Wire fences at least 12 inches above ground, with a mesh size of 1/4 inch or smaller, will help to exclude rodents from the field (Plantwise 2008). Place cow dung and pepper in rat burrows to smoke out the rodents. Pour one-week-old fermented cattle urine into burrows to chase away rats. Be alert for rodents both in the field and during storage. Look for fresh trails in the grass, burrows, droppings, fur and feeding damage in the field and storage (Plantwise 2016d). Pay particular attention to adjacent areas that have heavy vegetation, because such areas are likely sources of invasions. Consider action when evidence of rodent presence is clear. Additional crops at risk: maize, rice, sorghum, yam, cassava, sweet potato.

Control

- Trap rodents using locally made traps baited with peanut butter-fish meal mixture (Plantwise 2016d). Place traps at right-angles to runaways, with the trigger end on the runaway. Larger rodents can also be killed by hunting using catapults. To capture smaller rodents, use common household plastic or metallic water buckets dug into a hole so that the upper edge of the buckets equals the soil surface, fill the bucket half with water, place some maize bran or cereal bran onto the ground around the edge of the bucket, check for trapped rodents every second or third day (Plantwise 2012).

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

Stock-taking of HHPs which are registered, and of their use, involved analysis of the national list of registered pesticides for Zambia. The reference used was a scan of an old list. A more recently updated list was not available to the study team.

It is worth noting that this file had columns for commercial name, AI and pesticide type (insecticide, fungicide or herbicide). Neither the name of the manufacturer nor the name of the pesticide registrant was provided.

There are a number of errors in the list. Several products are miscategorised: e.g. mancozeb is listed as an herbicide. Sometimes the AI and the commercial names are reversed. Sometimes the AI is missing. Often, instead of using standard names for AI, like the International Organization for Standardization (ISO) naming system, other names are used, making it difficult to identify what are the AI for some products. Where the AI could not be determined based on the list, it was assumed that the products in Zambia contained the same AI as products of the same name registered in neighbouring countries. In some cases (27 out of 440 products) products were not registered in any other country, so it was not possible to determine the AI.

Hazard identification: identification of the HHPs and other hazards associated with pesticides which are registered in the country

The 171 AI registered in Zambia differ in terms of their overall hazard level (Figure 5): 50 of the AI which are allowed for use meet one or more of the HHP criteria; 54 AI are categorized as belonging to the “danger” category (one or more of the associated human health hazard statements indicate that the AI is “toxic” or “fatal if inhaled”); 62 AI are categorized as belonging to the “warning” category; 2 AI are categorized as “low hazard” (there are no known human health hazard statements associated with the AI); and key human health hazard data is missing for three AI. The AI which are identified as HHPs are listed in Annex II.

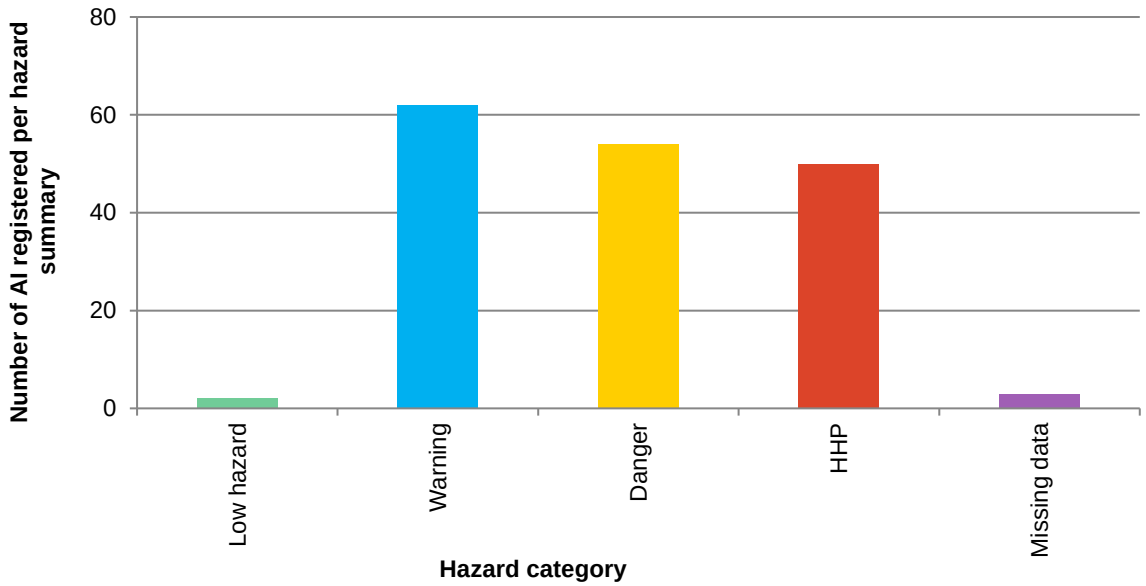

Figure 5 Number of AI in each hazard category

Of the HHPs identified, 42% are carcinogens, 38% are either extremely or highly acutely toxic, 20% are reproductive toxins and 4% are mutagens (Figure 6). Two AI (DDT and endosulfan) are POPs listed in the Stockholm Convention. Both of these pesticides also require prior informed consent (PIC) under the Rotterdam Convention. There are six other AI requiring application of the PIC procedure under the Rotterdam Convention: alachlor, aldicarb, carbofuran, hexachlorocyclohexane, methamidophos and monocrotophos. Methyl bromide, the ODS listed in the Montreal Protocol which is used in agriculture in some countries, is registered for use in Zambia.

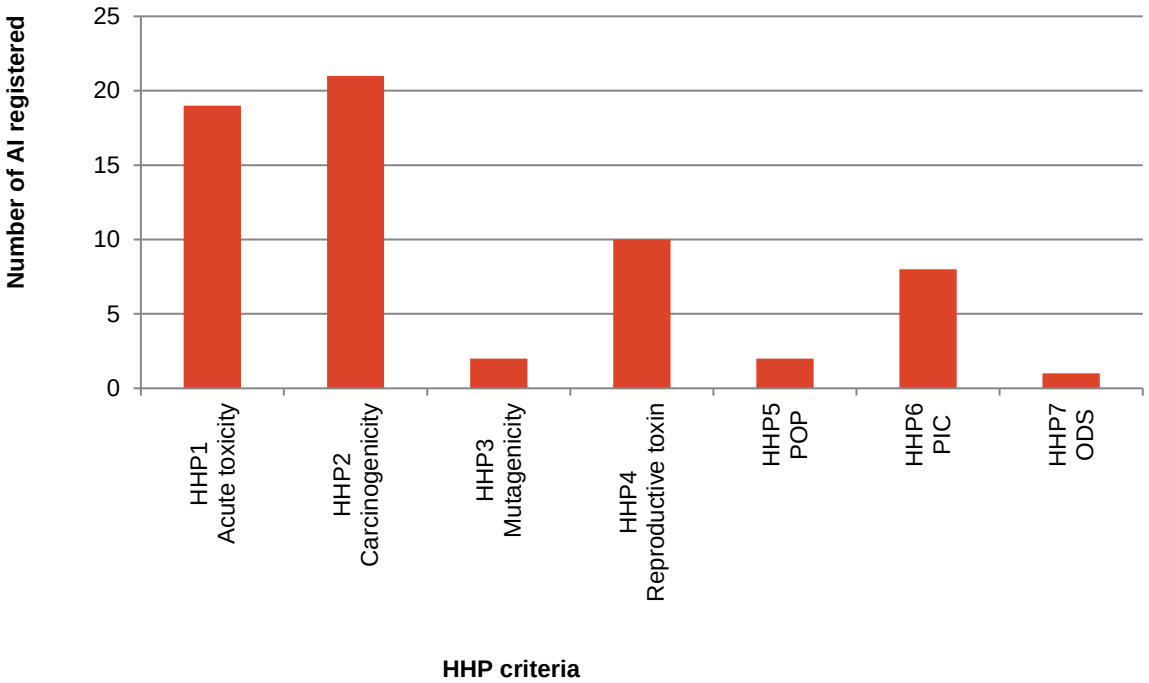

Figure 6 Number of HHP AI per HHP criteria

In addition to the information on the HHP criteria, the compiled GHS hazard statements identified other human health and environmental hazards. Irritation to the skin, eyes or respiratory tract are frequently listed as potential health effects (74 AI). Other human health effects which were identified include allergic reactions (47 AI), the potential for serious eye damage (65 AI) and the

potential for organ damage (both specific and general, 69 AI). Twenty-seven of the AI are endocrine disruptors. The human health hazard statements covering health effects are included in the determination of hazard category. With respect to environmental hazards, 129 AI are found to be very toxic to aquatic organisms, often with the potential for long-lasting effects.

None of the AI are listed as candidate POPs. Twenty-seven of the identified AI (which do not already require the PIC procedure) are currently listed in the Rotterdam database of notifications of final regulatory action. Eighty of the AI are included in the Pesticide Action Network (PAN) HHP list (2016). On an AI basis, almost 54% of the AI are allowed for use in the EU (approved = 90 AI), whereas the other 46% are not allowed for use in the EU (not approved = 61 AI) or not listed (17 AI). Refer to Annex II for information on the specific AI.

Nine of the identified AI are allowed for use in organic agriculture in that they are listed in Annex II of Commission Regulation (EC) 889/2008. Thirty-one of the AI are classified as U (unlikely to cause acute hazard under conditions of normal use) in the WHO Recommended Classification of Pesticides by Hazard (2009). Some (34 AI) of the AI identified through this study are not listed in the 2009 classification. Based on the LD50 of the AI, none of the AI which are not listed in the 2009 classification can also be considered to be class U.

Per the GIZ procurement policy, 26 AI fall into procurement category A (not allowed), 78 AI fall into procurement category B (only as exception, elaborate verification needed), 20 AI fall into procurement category C (only by authorized staff with strict protection; not for small farmers) and 36 AI fall into procurement category D (appropriate precaution). Eleven of the AI have not been classified by GIZ.

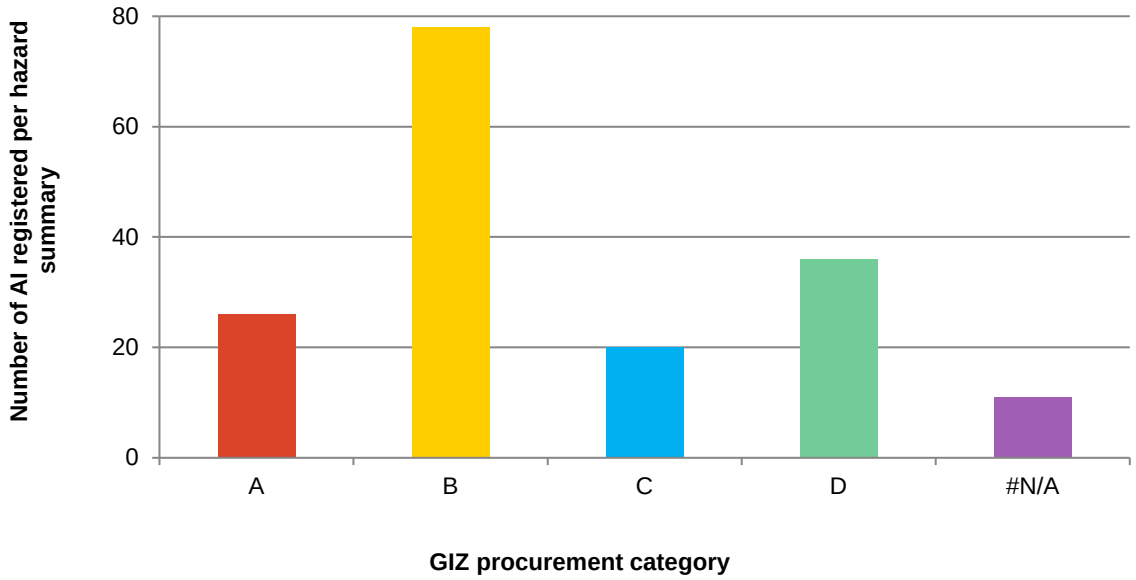

Figure 7 Number of AI per GIZ procurement category

The list of registered pesticides does not contain information on target pests and crops. This means that all products may be used on groundnut and soybean. Appropriately, non-HHP AI are registered to manage all the major pests of groundnut and soybean. On average, there are five non-HHP AI identified per target pest (minimum=1 AI, maximum=9 AI). The major pests of groundnut and soybean and the lower toxicity alternative pesticides which are registered to manage them is given in Annex V.

Conclusions

Main findings and recommendations for action

SWOT Analysis

<table>
<tr>
<td><u>STRENGTHS</u>

Legislation
• Legislation relating to pesticide management exists in the form of the Environmental Management Act and Regulations
• Zambia is a signatory to major international protocols and conventions on pesticides and plant protection

Extension services
• There is a well-established extension structure including public and private sector actors

Research
• ZARI is a well-recognised national research institute
• International support for research is provided through IITA and ICRISAT
• International support and partnerships available for research on aflatoxin management

Pesticides management
• Pesticide use in Zambia is currently at a relatively low level among small-scale farmers</td>
<td><u>WEAKNESSES</u>

Legislation
• The list of registered pesticides is insufficient and not publically available
• Existing legislation is relatively weak and vague
• The inclusion of pesticides under the Environmental Management Act means there is a loss of focus on safe pesticide use and handling from a human health perspective
• National IPM specific policy is lacking

Extension services
• Extension services are provided by a range of public and private agencies and coordination is a challenge.
• High turn-over of public extension personnel and gaps in existing structure
• Inadequate extension materials on crop protection
• Low level of knowledge on pest and pesticide management by extension service staff.
• Limited knowledge of IPM approach

Research
• Chronic underfunding and low resource levels

Pesticide management
• Lack of knowledge on pesticides available to use and registered safer alternatives
• Zambian Bureau of Standards lacks sufficient resources to adequately oversee and police pesticide legislation in Zambia
• Lack of container disposal sites in the country and knowledge of safe disposal is weak
• Agrodealers are often not registered
• Pesticides are often not labelled correctly or labels lack information
• Low awareness of existing legislation</td>
</tr>
<tr>
<td><u>OPPORTUNITIES</u>

Legislation
• Legislation relating to pesticide management exists in the form of the Environmental Management Act and Regulations
• Country is a signatory to major international protocols and conventions on pesticides and plant protection

Extension services
• Extension personal are looking for opportunities to improve their capacity
• Extension tools and systems already exist
• Demand for extension services is high</td>
<td><u>THREATS</u>

Legislation
• Little incentive and limited resources available to improve current legislation
• Legislation on safe pesticide handling is not a priority relative to other areas.

Extension services
• Extension agents resist change and there is institutional inertia (business as usual approach)
• Reducing budgetary support from government

Research
• Research fails to keep pace with demand for new products such as resistant varieties and proven</td>
</tr>
</table>

Research • Presence of a well-recognised national research institute (ZARI) and donor support available **Pesticides management** • Training and capacity building on the available legislation • Pesticide use is at a relatively low level and this provides an opportunity to replace pesticides with viable alternatives • Farmers have knowledge of and are using botanical pesticides (biopesticides) and this knowledge can be built upon. • Engagement of the private sector in production of bio pesticides	IPM technologies and farmers turn to pesticides as an alternative. **Pesticide management** • Existences of un-registered or counterfeit pesticides products on the market • Untrained and unregistered pesticide retailers continue to provide advice to farmers • Weak border control allowing unregistered products to enter country • Agriculture exports are affected by unacceptable pesticide residue levels • Farmer use of pesticides increases in the absence of supporting legislation and awareness-raising, which increases the risk to human health and the environment

Recommendations

Safe and effective pest management in groundnut and soybean requires a coordinated and multi-level approach.

Analysis of pesticide registration in Zambia reveals that some key components of pesticide legislation as defined by the FAO code of conduct and other voluntary standards are absent or not well defined. For example, the list of registered pesticides is insufficient, contains incorrect information and is not publicly available. In addition, legislation around most aspects of safe pesticide handling, including labelling, packaging, sale, training, transport and use of PPE, are absent or relatively vague. The implications of this are that enabling an environment required to support, regulate and enforce the safe handling of pesticides and encourage the preferential use of low toxic pesticides and alternatives is weak in Zambia.
Where legislation is present, the capacity to support it appears limited due to low resource levels, including staff numbers, within the relevant ministries.

In lieu of effective legislation and policy, the focus for the GIAE and its partners in Zambia should be on supporting and enabling farmers to carry out pest management in a safe and effective manner, based on IPM principles. This encompasses the rational use of low-toxicity pesticides, combined with affordable physical, cultural and biological pest management practices. The following recommendations for key programme stakeholders were proposed by partners and seconded by CABI during the study workshop in September 2017.

Farmer-level recommendations

Awareness-raising should be conducted with farmers. This should include the following topics:

- Safe use and handling of pesticides, and specifically:
  - understanding of labels and hazard warning codes and symbols
  - safe and effective application of pesticides covering dosage, timing, etc.
  - PPE awareness and use
  - disposal of unused pesticides and containers
  - awareness of re-entry and pre-harvest intervals
  - safe pesticide storage
  - awareness of national regulations (where they exist) governing pesticide sale and use. This will encourage farmers to choose to buy pesticides from registered suppliers/dealers and allow them to demand that products being sold conform to the law – e.g. that, at a minimum, pesticide containers have labels that are legible and in the local language

- Raise farmers' awareness of rational pesticide use, IPM and alternatives to synthetic pesticides. This should include:
    - crop rotation
    - resistant varieties
    - non-chemical options
- Increased availability of PPE.

Recommendations relating to extension agents

In order to allow extension agents to effectively advise farmers, support in the form of capacity building should be provided on the following topics:

- the holistic approach to pest management
- pests, disease and nutrient deficiency diagnosis – correct identification and control
- tolerant or resistant crop varieties
- beneficial insects and being able to distinguish between pests and beneficials
- crop rotation
- the impact of pesticides on the environment
- the use of alternatives to pesticides, including botanical pesticides (tephrosia, solanum, neem ash etc)
- cropping patterns to reduce infestation
- scouting and pest thresholds to support rational pesticide use
- pesticides and the various pesticide categories, to enable them to provide advice on the use of the least harmful pesticides
- safe disposal of unused pesticides and pesticide containers

In addition, extension agents should be supported to ensure they have the capacity to effectively carry out the following:

- conduct demonstrations of PPE
- advise farmers which suppliers/retailers to use for PPE, pesticides and other farming implements
- provide farmers with information on alternative non-chemical pest management options
- provide advice to retailers on farmers' needs – e.g. appropriate seed varieties in a particular area
- provide advice on pesticide application, dosage, rates frequency, calibrations and correct choice and use of PPE
- understand and support implementation of Zambian laws on pesticides, environmental protection and pollution control

It is essential that extension agents engage with farmers on pest management decision-making. This can be done via farmers' groups or lead farmers. Extension agents should be provided with the skills and the means to do this effectively.

Recommendations relating to retailers

Capacity building for pesticide retailers should be provided on the following topics:

- pesticide labels and the meaning of label information (colour codes and hazard warning symbols), proper storage, expiry dates, handling including pesticide application and use of PPE, AI, effectiveness, pre-harvest interval and re-entry interval

- pests and pest management. Retailers should be provided with booklets and images
- HHPs and the necessary safety precautions and advice to farmers (e.g. safe handling of fumigants such as aluminium phosphide)
- correct storage of chemicals – ventilation
- knowledge of first aid
- knowledge of consumer protection – knowledge should lead to behaviour change
- capacity – retailers should be able to provide advice and demonstrate the proper and safe use of chemicals and PPE to farmers

Priorities for policy action

- Gaps and weaknesses in existing laws should be addressed and legislation relating to pesticide management and handling harmonised where it exists across different government functions, e.g. health, environment, trade and industry.
- Legislation surrounding pest and pesticide management, including relevant existing standards and supporting guidelines e.g. PPE standards, should be publically and freely available through a variety of channels.
- Enforcement of existing legislation is required to prevent retailers selling manipulated or expired pesticides.
- Laws should be in place to ensure that retailers provide Material Safety Data Sheets and certificates of analysis for the agro-chemicals they sell.

Annexes

Annex I Overview of value chains

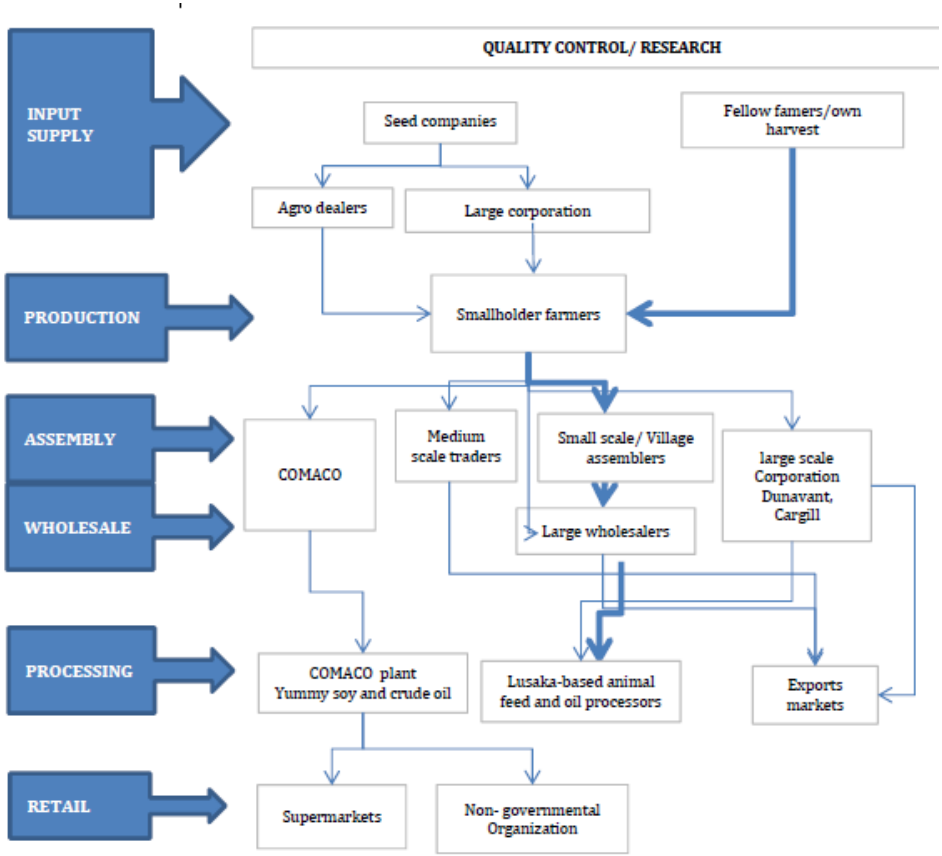

Figure 8 Soybean value chain, Eastern Province (Source: Lubungu et al. 2013)

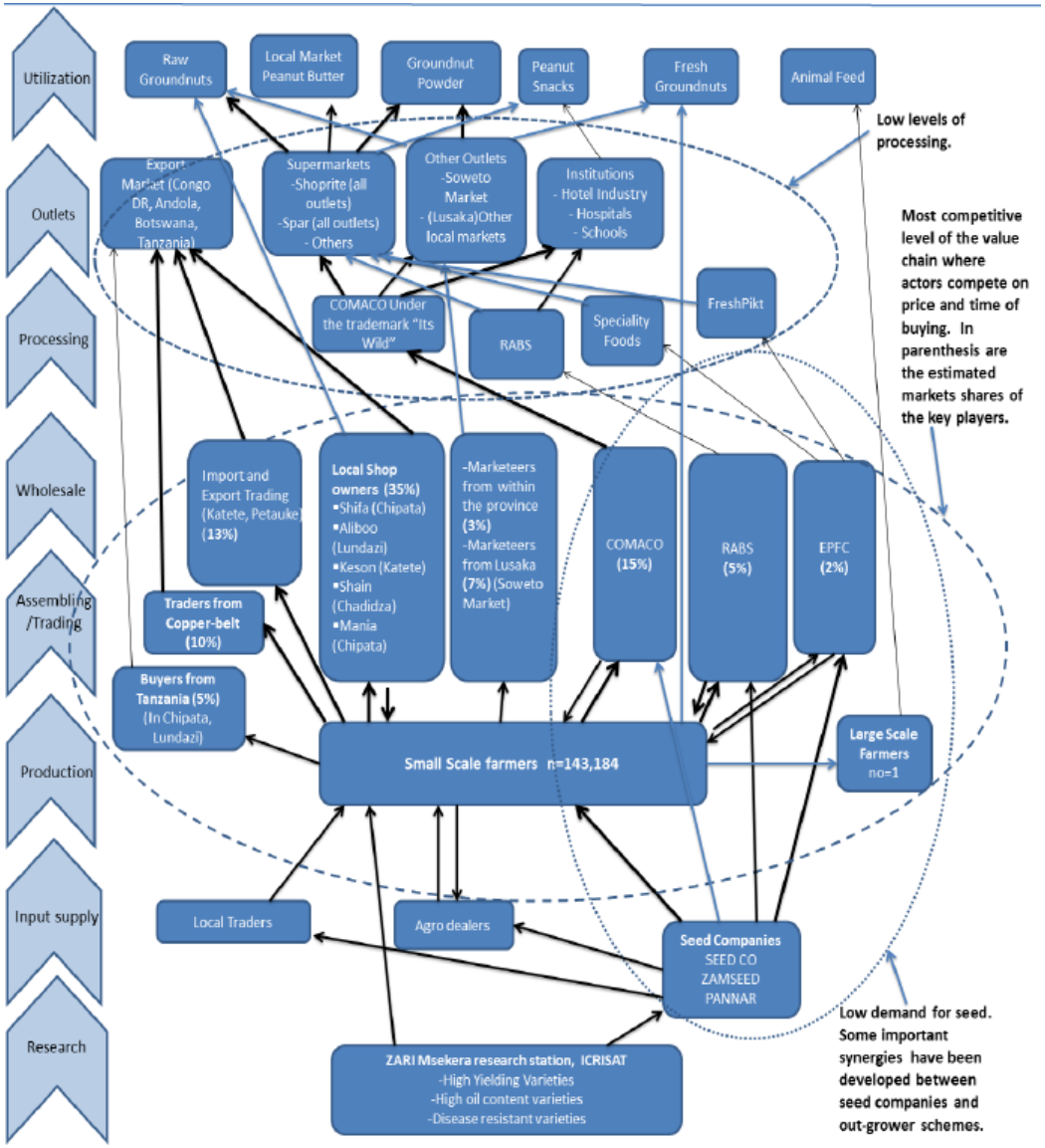

Figure 9 Groundnut value chain (Source: Mofya-Mukuka Shipekesa 2013)

Annex II. Overview of the legal framework for pesticide use in Zambia

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

Section / aspect	Present in legislation
Legal framework for non-chemical preventive and direct control measures	
Registration is required for non-chemical preventive and direct control measures	X
A subsidy scheme for non-chemical preventive and curative control methods is in place	X
Price and trade policy, including subsidies	
Distribution and trade is a market-driven supply process / there is no government purchasing	✓
A subsidy scheme for pesticides is in place:	✓
• the subsidy scheme could potentially lead to excessive or unjustified pesticide use and may divert interest from more sustainable alternative measures	X
• there are subsidies for pesticides for field applications	✓
• there are subsidies for pesticides for treatment of seed/planting material	✓
• there are subsidies for pesticides for treatment of seed/planting material and/or for post-harvest applications	✓
• the subsidy scheme is restricted to lower-risk alternatives	X
A subsidy scheme for PPE is in place	X
Registration (synthetic pesticides and biopesticides)	
The legislation establishes a mandatory registration system for pesticides, tailored to national needs	✓
The registration process involves the risk-based evaluation of comprehensive scientific data demonstrating that the product is effective for its intended purposes and does not pose an unacceptable risk to human or animal health or the environment	X
The legislation identifies the body responsible for registration	✓
The legislation sets out the powers and functions of the registration body	✓
There is a mechanism in place for regional coordination / harmonization for the registration of pesticides	X
The legislation indicates how the registration body will make its registration decisions	✓
The legislation lists the types of final decisions the registration body can take	✓
The registration indicates that the decision must be communicated to the applicant, within a certain time period, and must include a justification based on the decision criteria	✓
The legislation clearly defines the activities and types of pesticides requiring registration (e.g. all pesticide uses or a subset):	X
• there are special requirements for products used on seeds / plant material	X
• there are special requirements for products used for post-harvest application	X
• there are special requirements for non-chemical preventive and curative control methods	X
• there are provisions for experimental permits for the importation of limited quantities of unregistered pesticides for research, education or registration purposes	✓
• there are provisions for the use of unregistered pesticides in emergency situations	X

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

Section / aspect	Present in legislation
• the name of the registrant	X
• the period of registration	X
• identification of user groups (e.g. use of some pesticides is restricted – for example to certified professionals)	X
A separate list containing the pesticide products that are banned or severely restricted is published by the national authority. Likewise, biopesticides are listed identified in a separate list	X
Analysis of registered pesticide list for HHPs and alternatives	
List the time of last update	Information not available
The number of AI registered	171
The number of products registered	440
The number of registrants	Not available
For the list of banned pesticides, the last time it was updated, the number (and identity) of the banned pesticides	Not available
Biocontrol agents which are not covered by the national authority which handles registration of pesticides (e.g. macro-organisms)	**X**
The legislation contains provisions addressing export, shipment, import and release of biological control agents and other beneficial organisms. It contains the following requirements:	X
• to carry out pest risk analysis of biological control agents	X
• to obtain, provide and assess documentation as appropriate, relevant to the export, shipment, import or release of biological control agents and other beneficial organisms	X
• to ensure that biological control agents and other beneficial organisms are taken either directly to designated quarantine facilities or mass-rearing facilities or, if appropriate, passed directly for release into the environment	X
• to encourage monitoring of release of biological control agents or beneficial organisms in order to assess impact on target and non-target organisms	X
Packaging and labelling	
The legislation specifies the products to which the packaging and labelling requirements apply (e.g. apply equally to imported and domestically manufactured products)	X
The legislation specifies the technical requirements for packaging and re-packaging	X
The legislation incorporates requirements for packaging and labelling into the registration process	✓
The legislation requires packaging that is safe	✓
The legislation requires packaging which will not degrade under normal conditions (e.g. packaging material should be impermeable with respect to the contents)	✓
The legislation requires packaging which does not resemble common packaging of consumable goods	X
The legislation requires that packaging or re-packaging only takes place on licensed premises where staff are adequately protected	X
The legislation bans re-packaging when effective controls are not possible in the national context	X

Section / aspect	Present in legislation
The legislation prohibits the re-packaging or decanting of pesticides into food or drink containers or other inappropriate containers	✓
The legislation prohibits reuse of containers except under exceptional circumstances (e.g. where there is a programme in place to refill containers)	✓
The legislation requires that an officially approved label is a mandatory part of the product package	✓
The legislation lists the information which is required on the label:	✓
• product name	✓
• use type	✓
• type of formulation	✓
• AI name	X
• AI concentration	X
• co-formulants	X
• net content	✓
• name of supplier	✓
• manufacturer	✓
• batch number	X
• registration number	X
• hazard and safety information following the GHS	X
• directions for use	✓
• warning against container reuse, instructions for storage and disposal	✓
• legal requirement that pesticides be used in a way which is consistent with the label	X
The legislation lists how the information in the label should be communicated (languages, system of weights and measures…)	X
The legislation outlines physical requirements of the label, e.g. minimum size of packaging, use of a durable material, fade-resistant ink	X
A handbook or manual is available to guide label design and/or review	X
Marketing	
The legislation contains provisions specifically addressing pesticide advertising:	X
• it defines pesticide advertising broadly to cover all forms	X
• it prohibits the advertising of unregistered or illegal pesticides	X
• it prohibits false or misleading advertising of pesticides	X
• it prohibits advertising that is contrary to approved uses or label instructions	X
• it designates the authority responsible for enforcement	X
Transport	

Section / aspect	Present in legislation
A regulation addressing the transport of pesticides is in place:	✓
• it sets out requirements for vehicles and containers	✓
• it prohibits the transport of pesticides in the same vehicle as passengers, animals, food or feed	X
• it requires physical separation in cases where joint transport or storage is unavoidable	✓
Import and export	
The legislation contains provisions specifically addressing the import and export of pesticides:	✓
• it prohibits the import / export of pesticides that have not been registered	✓
• it prohibits the import / export of counterfeit, substandard or outdated pesticides, or of pesticides otherwise not meeting the prescribed requirements	X
• it establishes application procedures for a pesticide import permit	X
• it develops procedures and criteria for decisions on import permits	X
• it requires inspection of pesticides at the point of entry	X
• it fosters collaboration between the competent national authority and the customs department at points of entry	X
• it establishes exceptions for donations or imports by public entities for specific purposes	X
• it requires that exported pesticides meet the same quality standards as comparable domestic ones	X
• it requires the use of harmonized system customs codes on shipping documents	X
Requirements for sale	**X**
The legislation contains provisions specifically addressing the sale of pesticides:	X
• it sets requirements so that only those with competency and training may be licensed to sell pesticides	X
• it includes among the decision-making criteria for the granting of a licence issues such as storage, display, training, knowledge, record-keeping, safety equipment and emergency plans	X
• it prescribes the separation of pesticide from food and medicine	X
• it prescribes that pesticides may only be sold in their undamaged original container	X
• it prescribes that pesticides may only be sold with a readable label	✓
• it prescribes that pesticides **must not** be sold to minors	X
• it prescribes that shops that sell pesticides must have a firefighting equipment	X
• it prescribes that shops that sell pesticides must have a warning board	X
Licensing	**X**
The legislation contains provisions to identify which pesticide-related activities are permitted only to operators that hold a valid licence:	X
• It prescribes the holding of a valid licence for manufacture and packaging	✓

Section / aspect	Present in legislation
• It prescribes the holding of a valid licence for sale	✓
• It prescribes the holding of a valid licence for transportation, import and export	✓
• It prescribes the holding of a valid licence for special applications	X
• It imposes specific and more restrictive requirements for severely restricted pesticides	X
• It provides for back-up inspections	X
• It establishes a system to receive and evaluate applications, in order to assess risk	X
• It sets out clear criteria for the granting or denial of the licence, as well as provisions for the imposition of conditions, suspension and revocation	X
• It establishes the term of validity and the procedures for renewal of the licence	X
• It enables the authority to impose fees for services associated with licensing	X
• It sets out an appeal process linked to the licensing scheme	X
Availability	
The legislation contains provisions to regulate the availability and use of pesticides in accordance with the hazards involved and the existing levels of user training:	X
• it takes into account the type of formulation, method of application and its uses when determining the risk and degree of restriction appropriate to the product	X
• it contains provision to limit the availability of pesticides that are sold to the general public through non-specialized outlets	X
• it contains restrictions which specifically targets products used on seed/planting material	X
• it contains restrictions which specifically target products used for post-harvest applications	X
Handling and use, including regulations on application equipment	
The legislation contains provisions to prohibit the use of pesticides for a purpose, or in a manner, other than that prescribed on the label	✓
Responsibilities of pesticide operators (farmers and farmer workers) are identified in national regulations, e.g. to follow safety and hygiene norms, to follow recommendations relating to PPE use, to take reasonable precautions, to report risks	X
The legislation requires employers to take the necessary measures to protect the health of workers and the environment:	✓
• the required measures include the provision of training	X
• the required measures include the provision of protective equipment	✓
• the required measures include health monitoring of the workers	✓
The legislation ensures that all workers, including those in agriculture, are protected under the legal framework	✓
The legislation contains provisions to promote the use of pesticide application methods and/or equipment that minimize the risks	X
The legislation contains provisions to permit pesticide application equipment and PPE to be marketed only if they comply with established standards	X
The legislation contains provisions to prescribe the use of proper application equipment:	X
• respect of the recommended application	X

Section / aspect	Present in legislation
• appropriate calibration of the spraying equipment for the pesticides to be applied	X
The legislation contains provisions to prescribe the responsible cleaning of application equipment:	X
• to rinse the content of the tank with fresh water and to apply the remaining liquid on the treated field	X
• application equipment must be rinsed externally in the field	X
The legislation contains any other provision to prohibit the use of pesticides in an unsafe manner that poses a threat to human health or the environment	✓
Requirements for training	
A policy is in place to produce and disseminate relevant and clear educational materials on pesticide use and management	X
The legislation requires pest control operators to hold a licence or permit:	X
• for all products and application methods	X
• only for specific products and application methods	X
• the content of the mandatory trainings for pest control operators is described in the law	X
Restrictions related to vulnerable groups	
The legislation contains any provision to prevent the use of pesticides by, and sale of pesticides to, children or pregnant and nursing women	X
The legislation requires employers to take the necessary measures to prevent use by children and other vulnerable groups	✓
Requirements for PPE	
A policy is in place to place to promote the use of PPE which is suitable	X
The legislation prescribes the use of PPE for the application of pesticides	X
• Operator risk and exposure is assessed at the time of registration in order to determine the PPE performance requirements	X
• Application of international standards (e.g. ISO 27065) or national standards for the classification of PPE by performance requirements (level of chemical resistance or some other measure to differentiate the level of protection provided by PPE)	X
• Only PPE which has met national standards may be marketed	X
• The label is required to list the elements of PPE (e.g. gloves, protective footwear, face protection, apron) and their performance requirements	X
• Responsibilities of pesticide operators (farmers and farm workers) are identified in national regulations, e.g. to follow safety and hygiene norms, to follow recommendations relating to PPE use, to take reasonable precautions, to report risks	X
Storage	
The legislation makes provision for safe storage of pesticides:	✓
• it differentiates between private, end-user or home storage and bulk or commercial storage	X
• it imposes record-keeping requirements on those storing pesticides	✓
• it prohibits the reuse of a pesticide container for any non-pesticide storage reason	✓
• it indicates the type of containers required	X

Section / aspect	Present in legislation
• the legislation specifies how and where pesticide products may be stored:	X
o the plant protection products are stored in their original containers and packs	X
o the plant protection products are stored according to label storage requirements	X
o the plant protection products that are liquid formulations are stored on shelving that is never above those products that are powder or granular formulations	X
o the plant protection product storage facilities are built in a manner that is structurally sound and robust	✓
o the plant protection product storage facilities have sufficient and constant ventilation of fresh air to avoid a build-up of harmful vapours	✓
o the plant protection product storage facilities have or are located in areas with sufficient illumination by natural or artificial lighting to ensure that all product labels can be easily read while on the shelves	X
o the plant protection product storage facilities are equipped with shelving that is not absorbent in case of spillage	X
o the plant protection product storage facilities have retaining tanks or products are bundled according to 110% of the volume of the largest container of stored liquid, to ensure that there cannot be any leakage, seepage or contamination to the exterior of the facility	X
o the plant protection product storage facilities and all designated fixed filling/mixing areas are equipped with a container of absorbent inert material, such as sand, floor brush and dustpan and plastic bags that must be in a fixed location to be used exclusively in the case of spillage of plant protection products	X
o there is a visual display of the accident procedure, including emergency contact telephone numbers and the basic steps of primary accident care; the display is accessible by all persons within 10 metres of the plant protection product/chemical storage facilities and designated mixing areas	X
o all plant protection product/chemical storage facilities and all filling/mixing areas have eye-washing amenities, a source of clean water at a distance no farther than 10 metres, and a first aid kit containing the relevant aid material	X
Disposal of unused pesticides	
A policy is in place to prevent the accumulation of obsolete pesticides and used containers	✓
A policy is in place to inventorize obsolete or unusable stocks of pesticides and used containers, and to establish and implement an action plan for their disposal	X
The legislation contains provisions to ensure that disposal of hazardous pesticide waste is carried out in an environmentally sound manner	✓
The legislation bans certain types of activities in relation to pesticide waste (e.g. pouring it down drains or into water sources, burying it in unapproved sites and burning it in unapproved incinerators)	✓
The legislation places affirmative duties on industry to assist in proper disposal	X
The legislation requires any person or entity seeking to dispose of pesticides or pesticide waste to seek authorization from the competent authority	X
The legislation contains provisions for the implementation of a toxic waste collection scheme	X
The legislation contains provisions for the establishment of facilities for the management of bulk quantities of toxic waste	X
Disposal of empty pesticide containers	
The legislation addresses the disposal of pesticide containers:	✓
• the regulations governing the disposal of empty pesticide containers is the same across the country	✓

Section / aspect	Present in legislation
• appropriate PPE is required when handling empty pesticide containers	X
• cleaning the container before final disposal is the responsibility of the person disposing of the container	X
• when a metal, plastic or glass pesticide container is empty, it must be immediately triple-rinsed (or pressure washed), with the resulting residue from the pesticide container being added to the spray tank for application	X
• after rinsing, the container should be rendered unusable by puncturing, crushing or breaking	✓
• The legislation contains specifications for the storage conditions for the storage of empty pesticide containers (e.g. bagged, stored in a secure, ventilated location)	✓
• The legislation bans the reuse of empty pesticide containers	✓
• Burying empty pesticide container is prohibited; or, if burying is allowed, specifications are provided for how the empty containers should be buried	✓
• Burning empty pesticide containers is prohibited; or, if burning is allowed, specifications are provided for how the empty containers should be burned (e.g. to stay out of smoke, information on what should be done with the ash)	✓
• Empty containers are classified as hazardous waste regardless of whether or not they have been decontaminated	X
• Empty containers must be transported in specially licensed vehicles	X
• Empty containers may not be transported with food, beverages, medicines, feed, animals and people	X
• Users must return containers to the manufacturer or to the place of purchase or to the place indicated on the invoice issued at the time of purchase	X
• Final disposal of empty pesticide containers must be carried out by authorized companies / containers must be destroyed at a specialized facility	X
• The procedure for disposal is described in legislation (recycling (if available), in a sanitary landfill, by incineration…)	✓
• Pesticide waste generators (= pesticide users) are required to establish waste management plans for harm reduction	X
The legislation contains dispositions to establish a container management system	X
Post-registration monitoring	
A policy is in place to collect reliable data and maintain statistics on the health effects of pesticides and pesticide poisoning incidents / on environmental contamination and adverse effects, including the monitoring of pesticide residues in feed, drinking water and/or the environment:	X
• it assigns responsibility for mandatory monitoring and data collection with respect to pesticides	X
• it sets out the powers and responsibilities of the responsible body and the inspection corps with regard to information-gathering	X
• it imposes reporting requirements on manufacturers, importers, distributors and sellers of pesticides	X
• it requires reporting of pesticide-related incidents to the competent authority	X
Residue monitoring in food and MRLs	
The legislation contains provisions to regulate and/or monitor pesticide residues in food:	X
• it defines which authority is in charge of the monitoring	✓
• it defines which authority is in charge of setting the MRLs	X

Section / aspect	Present in legislation
• it applies to domestic production for national consumption as well as to imports / exports	X
• it applies only to a limited number of export crops	X
• it prescribes following the MRLs set by the *Codex Alimentarius*	X
Other relevant human health and environmental protection regulations	
A policy is in place to raise awareness among users about the importance of, and ways of, protecting health and the environment	X
A policy is in place to carry out health surveillance programmes in respect of those who are occupationally exposed to pesticides	X
A policy is in place to provide guidance and instructions to health workers on the diagnosis and treatment of suspected pesticide poisonings	X
A policy is in place to establish national or regional poisoning information centres	X
Compliance and enforcement	
The legislation contains provisions to prohibit the import, packaging, re-packaging, transportation, distribution or sale of a pesticide unless it is packaged in accordance with criteria provided in the law	X
The legislation contains provisions to detect and control counterfeiting and illegal trade in pesticides	X
The legislation contains provisions to facilitate the exchange of information (e.g. actions taken to ban or severely restrict a pesticide; scientific, technical, economic, regulatory and legal information; the availability of resources and expertise; cases of counterfeit and illegal pesticides being traded; poisoning and environmental contamination incidents data) between regulatory and implementing authorities	X
The legislation designates the national authority responsible for inspection:	✓
• Ii defines the powers of the inspectors	✓
The legislation provides procedures and criteria for inspections:	X
• it provides procedures and requirements for sample-taking	✓
• It contains provisions for the designation of official laboratories for analysis of samples	✓
• It provides clear and effective procedures for intervention if irregularities are found during inspections	X
• It defines the actions that will be considered as offences, including special offences for public officials	X
• It determines which offences will be criminal and which administrative	X
• It determines proportional and deterrent fines and includes mechanisms to adapt the fines if their value declines	X
• It defines other consequences of the infringement, such as the revocation of a licence or forfeiture of materials used in connection with the commission of the offence	✓

Annex III. HHP AI registered for use in Zambia

HHP AI	Chemical class	Use type	HHP1 Acute toxicity	HHP2 Carcinogenicity	HHP3 Mutagenicity	HHP4 Reproductive toxin	HHP5 POP	HHP6 PIC	HHP7 ODS	PAN HHP	EU approved	GIZ classification	Number of products registered
Abamectin	Macrocyclic lactone - avermectin	Insecticide	1			2	N	N	N	Y	Approved	B	11
Alachlor	Amide	Herbicide	2	2			N	Y	N	Y	Not approved	A	3
Aldicarb	Carbamate	Insecticide, nematicide	1A				N	Y	N	Y	Not approved	A	3
Aluminium phosphide	Fumigant	Insecticide, rodenticide	1				N	N	N	Y	Approved	B	2
Benomyl	Benzimidazole	Fungicide	U	2	1A / 1B	1A / 1B	N	N	N	Y	Not approved	A	4
Beta-cyfluthrin	Pyrethroid	Insecticide	1B			2	N	N	N	Y	Approved	A	1
Bioresmethrin	Pyrethroid	Insecticide	U		2	1A / 1B	N	N	N	Y	Not approved	B	3
Borax	Biochemical biopesticides - inorganic compounds / minerals	Herbicide; insecticide	3			1A / 1B	N	N	N	Y	Not listed	A	3
Brodifacoum	Coumarin	Rodenticide	1A				N	N	N	Y	Not approved	A	2
Bromadiolone	Coumarin	Rodenticide	1A				N	N	N	Y	Approved	A	1
Captan	Phthalimide	Fungicide	U	1B			N	N	N	N	Approved	B	3
Carbaryl	Carbamate	Insecticide	2	1B			N	N	N	Y	Not approved	B	3
Carbendazim	Benzimidazole	Fungicide	U	2	1A / 1B	1A / 1B	N	N	N	Y	Not approved	A	7
Carbofuran	Carbamate	Insecticide, nematicide	1B		2		N	Y	N	Y	Not approved	A	3
Chlorothalonil	Aromatic fungicide	Fungicide, oomycide	U	1B			N	N	N	Y	Approved	B	5
Copper sulfate	Inorganic - copper	Fungicide, oomycide, bactericide	2	1A / 1B			N	N	N	N	Approved	C	1
Cyfluthrin	Pyrethroid	Insecticide	1B			2	N	N	N	Y	Not approved	A	2

HHP AI	Chemical class	Use type	HHP1 Acute toxicity	HHP2 Carcinogenicity	HHP3 Mutagenicity	HHP4 Reproductive toxin	HHP5 POP	HHP6 PIC	HHP7 ODS	PAN HHP	EU approved	GIZ classifi-cation	Number of products registered
DDT	Organochlorine	Insecticide, acaricide	2	2			Y	Y	N	Y	Not approved	A	1
Diazinon	Organophosphorus	Insecticide	2	2		1B	N	N	N	Y	Not approved	B	3
Dichlorvos (ddvp)	Organophosphorus	Insecticide, acaricide	1B	2			N	N	N	Y	Not approved	A	5
Difethialone	Coumarin	Rodenticide	1A			1A / 1B	N	N	N	Y	Not approved	A	1
Diuron	Urea	Herbicide	3	1B			N	N	N	Y	Approved	B	5
Endosulfan	Organochlorine	Insecticide, acaricide	2				Y	Y	N	Y	Not approved	A	3
Epoxiconazole	Triazole	Fungicide		1B		1A / 1B	N	N	N	Y	Approved	A	3
Ethoprop	Organophosphorus	Insecticide, nematicide	1A	1B			N	N	N	Y	Approved	A	1
Ethylene dibromide	Fumigant	Fumigant, insecticide		1B			N	N	N	Y	Not listed	A	2
Flusilazole	Triazole	Fungicide	2	2		1A / 1B	N	N	N	Y	Not approved	A	4
Furfural	Unclassified	Fungicide, nematicide		1B			N	N	N	N	Not approved	B	1
Hexachlorocyclohexane	Organochlorine	Insecticide, rodenticides	1B	2		2	N	Y	N	Y	Not approved	A	2
Iprodione	Dicarboximide	Fungicide	3	1B			N	N	N	Y	Approved	B	1
Iprovalicarb	Carbamate	Fungicide	U	1B	-		N	N	N	Y	Approved	B	2
Kresoxim-methyl	Strobilurin	Fungicide		1B			N	N	N	Y	Approved	B	1
Magnesium phosphide	Fumigant	Insecticide	1				N	N	N	Y	Approved	B	1
Mancozeb	Dithiocarbamate	Fungicide, oomycide	U	1B		2	N	N	N	Y	Approved	B	14
Maneb	Carbamate	Fungicide	U	1B		1B	N	N	N	Y	Not approved	B	1
Metam-sodium	Dithiocarbamate	Fungicide, herbicide, nematicide	2	1B			N	N	N	Y	Approved	B	1
Methamidophos	Organophosphorus	Insecticide	1B				N	Y	N	Y	Not approved	A	6

HHP AI	Chemical class	Use type	HHP1 Acute toxicity	HHP2 Carcinogenicity	HHP3 Mutagenicity	HHP4 Reproductive toxin	HHP5 POP	HHP6 PIC	HHP7 ODS	PAN HHP	EU approved	GIZ classifi-cation	Number of products registered
Methomyl	Carbamate	Insecticide	1B				N	N	N	Y	Approved	A	7
Methyl bromide	Fumigant	Fumigant, insecticide, herbicide, nematicide			2	2	N	N	Y	Y	Not approved	A	1
Metiram	Dithiocarbamate	Fungicide, oomycide	U	1B		2	N	N	N	Y	Approved	B	1
Monocrotophos	Organophosphorus	Insecticide	1B		2		N	Y	N	Y	Not approved	A	2
Oxamyl	Carbamate	Insecticide, nematicide	1B				N	N	N	Y	Approved	A	4
Permethrin	Pyrethroid	Insecticide	2	1B			N	N	N	Y	Not approved	B	4
Pirimicarb	Carbamate	Insecticide	2	1B			N	N	N	Y	Approved	B	2
Procymidone	Dicarboximide	Fungicide	U	1B			N	N	N	Y	Not approved	B	1
Propachlor	Chloroacetanilide	Herbicide	2	1B			N	N	N	Y	Not approved	B	1
Propineb	Dithiocarbamate	Fungicide, oomycide	U	1B		2	N	N	N	N	Approved	D	5
Terbufos	Organophosphorus	Insecticide, nematicide	1A			2	N	N	N	Y	Not approved	A	1
Triadimefon	Triazole	Fungicide		2		1B	N	N	N	N	Not approved	B	1
Zinc phosphide	Inorganic-zinc	Rodenticide	1B				N	N	N	Y	Approved	A	3

Annex IV. List of AI which are registered in Zambia which require exceptional authorization for procurement by GIAE

Pesticide AI	Chemical class	Use type	Hazard summary	Proposed POPs	Rotterdam notifications	PAN HHP list	Approved for use in the EU	Number of products registered
Abamectin	Macrocyclic lactone - avermectin	Insecticide	HHP	N	N	Y	Approved	11
Acephate	Organophosphorus	Insecticide	Danger	N	Y	Y	Not approved	3
Acetochlor	Chloroacetamide	Herbicide	Warning	N	Y	Y	Not approved	5
Aluminium phosphide	Fumigant	Insecticide, rodenticide	HHP	N	N	Y	Approved	2
Ametryn	Triazine	Herbicide	Danger	N	N	N	Not approved	1
Amitraz	Formamidine	Insecticide	Danger	N	Y	N	Not approved	6
Ammonium sulphate	Inorganic	Herbicide	Warning	N	N	N	Not approved	2
Atrazine	Triazine	Herbicide	Warning	N	Y	Y	Not approved	8
Bioallethrin	Pyrethroid	Insecticide	Warning	N	N	N	Not approved	3
Bioresmethrin	Pyrethroid	Insecticide	HHP	N	N	Y	Not approved	3
Bromacil	Uracil	Herbicide	Warning	N	N	N	Not approved	1
Bromoxynil octanoate	Nitrile	Herbicide	Danger	N	Y	Y	Approved	2
Captan	Phthalimide	Fungicide	HHP	N	N	N	Approved	3
Carbaryl	Carbamate	Insecticide	HHP	N	Y	Y	Not approved	3
Cartap	Nereistoxin analogue	Insecticide	Warning	N	N	N	Not approved	1
Chlorfenapyr	Pyrrole	Insecticide, acaricide	Danger	N	Y	Y	Not approved	1
Chlorothalonil	Aromatic fungicide	Fungicide, oomycide	HHP	N	N	Y	Approved	5
Chlorpyrifos	Organophosphorus	Insecticide, acaricide	Danger	N	N	Y	Approved	7
Copper hydroxide	Inorganic - copper	Fungicide, oomycide, bactericide	Danger	N	N	Y	Approved	3
Cypermethrin	Pyrethroid	Insecticide, acaricide	Danger	N	N	Y	Approved	7
Deltamethrin	Pyrethroid	Insecticide	Danger	N	N	Y	Approved	7
Diammonium phosphate	Inorganic	Acaricide, fertiliser	Warning	N	N	N	Approved	1
Diazinon	Organophosphorus	Insecticide	HHP	N	Y	Y	Not approved	3
Dichlorophen	Hetrocyclic	Fungicide, herbicide, bactericide, algicide	Warning	N	Y	N	Not approved	1
Dicofol	Bridged diphenyl	Acaricide	Danger	N	Y	N	Not approved	2
Didecyl dimethyl ammonium chloride	Disinfectant	Fungicide, virucide	Danger	N	N	N	Not approved	1

Pesticide AI	Chemical class	Use type	Hazard summary	Proposed POPs	Rotterdam notifications	PAN HHP list	Approved for use in the EU	Number of products registered
Dimethenamid-p	Amide	Herbicide	Warning	N	N	N	Approved	1
Dimethoate	Organophosphorus	Insecticide	Danger	N	N	Y	Approved	2
Diuron	Urea	Herbicide	HHP	N	N	Y	Approved	5
Etofenprox	Pyrethroid	Insecticide	Danger	N	N	Y	Approved	2
Fenazaquin	Unclassified	Acaricide	Danger	N	N	Y	Approved	3
Fenitrothion	Organophosphorus	Insecticide	Danger	N	Y	Y	Not approved	3
Fenthion	Organophosphorus	Avicide, insecticide	Danger	N	Y	Y	Not approved	2
Fenvalerate	Pyrethroid	Insecticide	Danger	N	N	Y	Not approved	2
Fipronil	Pyrazole	Insecticide	Danger	N	Y	Y	Not approved	2
Fluazifop-p-butyl	Phenoxy	Herbicide	Warning	N	Y	N	Not listed	2
Fomesafen	Amide	Herbicide	Warning	N	N	N	Not approved	3
Formic acid	Biopesticide - other	Acaricide	Danger	N	N	N	Not approved	1
Furfural	Unclassified	Fungicide, nematicide	HHP	N	Y	N	Not approved	1
Glyphosate	Organophosphorus	Herbicide	Danger	N	N	Y	Approved	14
Hexazinone	Triazinone	Herbicide	Warning	N	N	N	Not approved	1
Imazapyr	Imidazolinone	Herbicide	Warning	N	Y	N	Not approved	2
Imazethapyr	Imidazolinone	Herbicide	Warning	N	N	N	Not approved	2
Imidacloprid	Neonicotinoid	Insecticide	Warning	N	N	Y	Approved	14
Imiprothrin	Pyrethroid	Insecticide	Warning	N	N	Y	Not listed	2
Indoxacarb	Oxadiazine	Insecticide	Danger	N	N	Y	Approved	3
Iprodione	Dicarboximide	Fungicide	HHP	N	N	Y	Approved	1
Iprovalicarb	Carbamate	Fungicide	HHP	N	N	Y	Approved	2
Kresoxim-methyl	Strobilurin	Fungicide	HHP	N	N	Y	Approved	1
Lambda-cyhalothrin	Pyrethroid	Insecticide	Danger	N	N	Y	Approved	12
Magnesium phosphide	Fumigant	Insecticide	HHP	N	N	Y	Approved	1
Malathion	Organophosphorus	Acaricide, insecticide	Danger	N	Y	Y	Approved	10
Mancozeb	Dithiocarbamate	Fungicide, oomycide	HHP	N	N	Y	Approved	14
Maneb	Carbamate	Fungicide	HHP	N	N	Y	Not approved	1
Metam-sodium	Dithiocarbamate	Fungicide, herbicide, nematicide	HHP	N	N	Y	Approved	1
Metiram	Dithiocarbamate	Fungicide, oomycide	HHP	N	N	Y	Approved	1
Metolachlor	Amide	Herbicide	Danger	N	N	N	Not approved	1
Metribuzin	Triazinone	Herbicide	Danger	N	N	Y	Approved	2

Pesticide AI	Chemical class	Use type	Hazard summary	Proposed POPs	Rotterdam notifications	PAN HHP list	Approved for use in the EU	Number of products registered
Msma	Arsenical	Herbicide	Danger	N	N	N	Not approved	3
Novaluron	Insect growth regulator	Insecticide	Warning	N	N	N	Not approved	1
Paraquat	Quaternary ammonium	Herbicide	Danger	N	Y	N	Not approved	2
Paraquat dichloride	Quaternary ammonium	Herbicide	Danger	N	Y	Y	Not listed	1
Permethrin	Pyrethroid	Insecticide	HHP	N	Y	Y	Not approved	4
Pirimicarb	Carbamate	Insecticide	HHP	N	N	Y	Approved	2
Pirimiphos-methyl	Fumigant, organophosphorous	Fumigant, insecticide, acaricide	Warning	N	N	Y	Approved	7
Prallethrin	Pyrethroid	Insecticide	Danger	N	N	Y	Not listed	1
Procymidone	Dicarboximide	Fungicide	HHP	N	Y	Y	Not approved	1
Propachlor	Chloroacetanilide	Herbicide	HHP	N	Y	Y	Not approved	1
Quinalphos	Organophosphorus	Insecticide, acaricide	Danger	N	Y	Y	Not approved	1
Spinosad	Biochemical biopesticides - microbial extracts / fermentation products / enzymes	Insecticide	Warning	N	N	Y	Approved	1
Tebuthiuron	Urea	Herbicide	Warning	N	N	N	Not approved	1
Temephos	Organophosphorus	Insecticide	Danger	N	N	Y	Not approved	1
Terbutryn	Triazine	Herbicide	Warning	N	N	Y	Not approved	1
Tetradifon	Bridged diphenyl acaricide	Insecticide	Warning	N	N	N	Not approved	6
Tetramethrin	Pyrethroid	Insecticide	Warning	N	N	Y	Not approved	2
Thiamethoxam	Neonicotinoid	Insecticide	Warning	N	N	Y	Approved	4
Triadimefon	Triazole	Fungicide	HHP	N	N	N	Not approved	1
Trifluralin	Dinitroaniline	Herbicide	Danger	N	Y	Y	Not approved	1

Annex V. List of the key pests of soybean and groundnut, with the HHP and non-HHP AI which are registered for their management

Pest common names	Pest scientific name	Crop	AI effective against target pest which are registered for use on the target crop and are not HHPs	HHPs which are used to manage the target pest[1]
Pod borer, bollworm, American bollworm, old world bollworm	*Helicoverpa armigera*	Soybean / groundnut	Acetamiprid (GIZ class: D) Alpha-cypermethrin (GIZ class: C) Azadirachtin (GIZ class: D) *Bacillus thuringiensis* (GIZ class: D) D-allethrin (GIZ class: not classifed) Diflubenzuron (GIZ class: D) Emamectin Benzoate (GIZ class: D) Piperonyl butoxide (GIZ class: D) Transfluthrin (GIZ class: D)	Abamectin Aldicarb Aluminium phosphide Beta-cyfluthrin Bioresmethrin Borax Carbaryl Carbofuran Cyfluthrin DDT Diazinon Dichlorvos (DDVP) Endosulfan Ethoprop Ethylene dibromide Hexachlorocyclohexane Magnesium phosphide Methamidophos Methomyl Methyl bromide Monocrotophos Oxamyl Permethrin Pirimicarb Terbufos

[1] The list of HHPs includes those that are registered for use against the pest and those which are being used by farmers or recommended by extension agents, even if they are not registered.

Pest common names	Pest scientific name	Crop	AI effective against target pest which are registered for use on the target crop and are not HHPs	HHPs which are used to manage the target pest[1]
Soybean rust	*Phakopsora pachyrhizi*	Soybean	Azoxystrobin (GIZ class: D) Copper Oxychloride (GIZ class: C) Cyproconazole (GIZ class: C) Flutriafol (GIZ class: C) Pyraclostrobin (GIZ class: D) Tebuconazole (GIZ class: C)	Benomyl Captan Carbendazim Chlorothalonil Copper sulfate Epoxiconazole Flusilazole Furfural Iprodione Iprovalicarb Kresoxim-methyl Mancozeb Maneb Metam-sodium Metiram Procymidone Propineb Triadimefon
Frogeye leaf spot	*Cercospora sojina*	Soybean	Flutriafol (GIZ class: C) Propiconazole (GIZ class: C)	Benomyl Captan Carbendazim Chlorothalonil Copper sulfate Epoxiconazole Flusilazole Furfural Iprodione Iprovalicarb Kresoxim-methyl Mancozeb Maneb Metam-sodium Metiram Procymidone Propineb Triadimefon

Pest common names	Pest scientific name	Crop	AI effective against target pest which are registered for use on the target crop and are not HHPs	HHPs which are used to manage the target pest[1]
Purple seed stain	*Cercospora kikuchii*	Soybean	Flutriafol (GIZ class: C)	Benomyl Captan Carbendazim Chlorothalonil Copper sulfate Epoxiconazole Flusilazole Furfural Iprodione Iprovalicarb Kresoxim-methyl Mancozeb Maneb Metam-sodium Metiram Procymidone Propineb Triadimefon
Rust	*Puccinia arachidis*	Groundnut	Azoxystrobin (GIZ class: D) Copper Oxychloride (GIZ class: C) Difenoconazole (GIZ class: C) Tebuconazole (GIZ class: C)	Benomyl Captan Carbendazim Chlorothalonil Copper sulfate Epoxiconazole Flusilazole Furfural Iprodione Iprovalicarb Kresoxim-methyl Mancozeb Maneb Metam-sodium Metiram Procymidone Propineb Triadimefon

Pest common names	Pest scientific name	Crop	AI effective against target pest which are registered for use on the target crop and are not HHPs	HHPs which are used to manage the target pest[1]
Early and late leaf spot	*Mycosphaerella arachidis, Mycosphaerella berkeleyi*	Groundnut	Azoxystrobin (GIZ class: D) Copper Oxychloride (GIZ class: C) Propiconazole (GIZ class: C) Pyraclostrobin (GIZ class: D) Tebuconazole (GIZ class: C)	Benomyl Captan Carbendazim Chlorothalonil Copper sulfate Epoxiconazole Flusilazole Furfural Iprodione Iprovalicarb Kresoxim-methyl Mancozeb Maneb Metam-sodium Metiram Procymidone Propineb Triadimefon

Pest common names	Pest scientific name	Crop	AI effective against target pest which are registered for use on the target crop and are not HHPs	HHPs which are used to manage the target pest[1]
Groundnut aphids	*Aphis craccivora*	Groundnut	Acetamiprid (GIZ class: D) Alpha-cypermethrin (GIZ class: C) Azadirachtin (GIZ class: D) D-allethrin (GIZ class: not classifed) Diflubenzuron (GIZ class: D) Emamectin Benzoate (GIZ class: D) Piperonyl butoxide (GIZ class: D) Tebufenpyrad (GIZ class: C) Transfluthrin (GIZ class: D)	Abamectin Aldicarb Aluminium phosphide Beta-cyfluthrin Bioresmethrin Borax Carbaryl Carbofuran Cyfluthrin DDT Diazinon Dichlorvos (DDVP) Endosulfan Ethoprop Ethylene dibromide Hexachlorocyclohexane Magnesium phosphide Methamidophos Methomyl Methyl bromide Monocrotophos Oxamyl Permethrin Pirimicarb Terbufos

Annex VI. List of registered pesticides

The list of registered pesticides available to the study team does not allow identification of AI by pest or crop as no target pests or crops are listed. A copy of part of the list is reproduced below.

		Pesticides Registered in Zambia	
	Trade Name	**Active Ingredients**	**Use/Type**
1	PREMISE 200SC	IMIDACLOPRID 200g/L	INSECTICIDE
2	FINALE RAT MOUSE BAIT	DIFETHIALONE	RONENTICIDE
3	DRASTIC DEADLINE	FLUMETHRIN	ACARICIDE
4	MILBITRAZ SPRAY DIP	AMITRAZ	ACARICIDE
5	SEED PLUS	IMIDACHLOPID METELAXYL CARBENDAZIM	FUNGICIDE + INSECTICIDE
6	FASTMITE	TETRADIFON	ACARICIDE
7	METALIN (VICTORY)	MANCOZEB & METALAXYL	FUNGICIDE
8	DORADO	PROPAMOCARB	FUNGICIDE
9	VYTEN	OXAMYL	INSECTICIDE
10	MOSQUIRON 100	NOVALURON	INSECTICIDE
11	ANEMON	PENDA METHALIN	HERBICIDE
12	TRIGER 5 EC	LAMBDA CYHALOTHRIN	INSECTICIDE
13	MATURE	CHLORIMURON ETHYL	HERBICIDE
14	FAST	FOSETY ALUMINIUM	FUNGICIDE
15	BROMOTRIL P 500	BROMOXYNIL ISO HYDROXY BENZONITRILE	HERBICIDE
16	MCPA	MCPA	HERBICIDE

Zambia pesticide list

PesticideRegistration List Zambia .pdf

Annex VII. References

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Annex VIII Workshop participants

Table 6 Chipata workshop participants 22–23 November 2017

Title	Organisation
Investigator – Chipata	CPCC
Assistant Inspector	ZABs
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Regional Coordinator	Chipata District Farmers' Association
Assistant Project Manager	COMACO
Food Security Coordinator	Peace Corps
Senior Health Inspector	Chipata City Council
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SEMO	Department of Agriculture
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Coordinator	Association of Grain and Commodities Traders
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