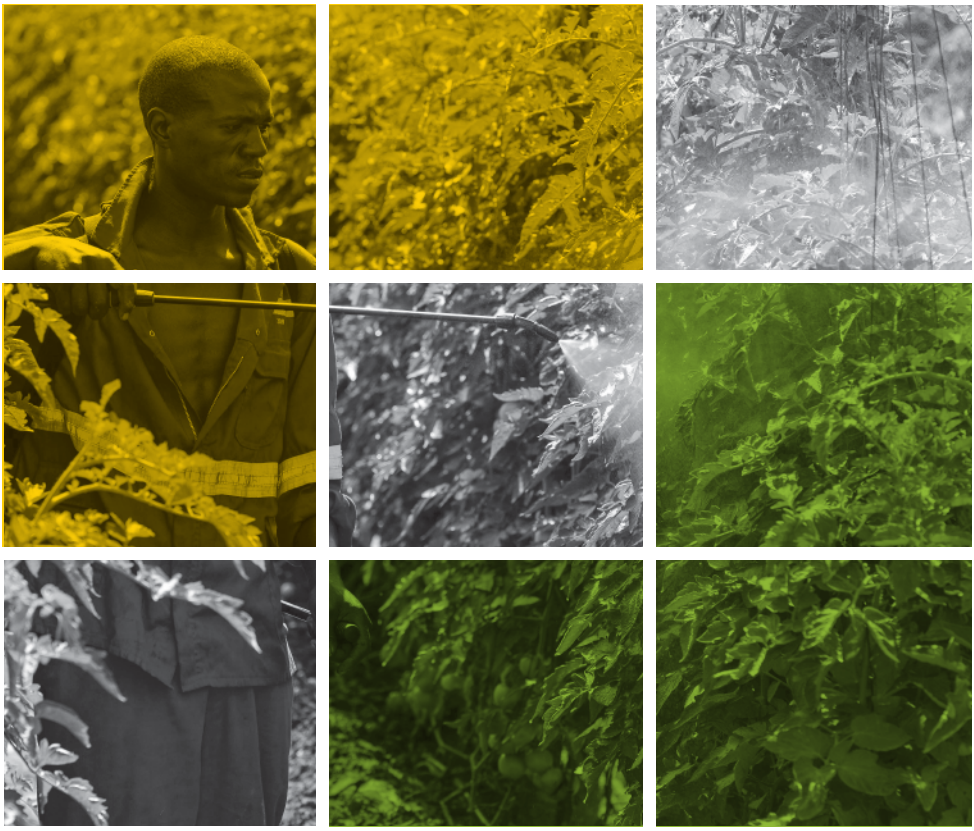

AGROCHEMICALS IN NAMIBIA

A TOOLKIT

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Acronyms

DAPEES	Directorate of Agricultural Extension and Engineering Services
DEFRA	UK Department of Environment, Food and Rural Affairs
EPA	Environmental Protection Agency (US)
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
GHS	Global Harmonised System
HHP	Highly Hazardous Pesticides
IFOAM	International Federation of Organic Agriculture Movement
IPM	Integrated Pest Management
JNCC	Joint Nature Conservation Committee
MAWLR	Ministry of Agriculture, Water and Land Reform
MRL	Maximum Residue Limit
NNF	Namibia Nature Foundation
PGR	Plant Growth Regulator
WHO	World Health Organisation
US	United States

> *"Agrochemical pollution poses a serious threat to humans, domestic animals, wildlife and the environment"*

Glossary

Acaricide: kills mites and ticks.
Algaecide: kills algae in lakes, canals, swimming pools, water tanks and other water sites.
Arboricide: an herbicide intended to kill trees or shrubs.
Fungicide: kills fungi (including blights, mildews, molds and rusts).
Herbicide: kills weeds and other plants that grow where they are not wanted.
Insecticide: kills insects.
Molluscicide: kills slugs and snails.
Nematicides: kills nematodes (microscopic, worm-like organisms that feed on plant roots).
Obsolete pesticides: pesticides that are unfit for further use or for re-conditioning due to either having degraded due to long/incorrect storage, or because they have been de-registered locally or banned internationally.
Parasiticides: substances used for livestock/animals to kill internal (endo-) and external (ecto-) parasites.
Pesticide: any substance that is used to control pests (plants and animals).
Rodenticide: controls/kills mice and other rodents.
Termiticide: kills termites.
Veterinary pharmaceuticals: livestock remedies and animal medicines (antibiotics, anti-inflammatories, euthanasia drugs, endo- and ecto-parasiticides).

John Mendelsohn

INTRODUCTION

Rationale

Agrochemicals are used widely in agriculture to:

1. Enhance crop productivity and crop marketability.
2. Support human and animal health by controlling disease vectors.

Over the years, the use of agrochemicals has increased to support agricultural productivity and growth. While agrochemicals may enhance crop productivity in the short-term, thereby benefitting the farmer, their use has far-reaching effects across space and time. Not only do agrochemicals pose health risks to humans and animals in the short- and long-term but the accumulation of pesticide residues in soil and groundwater may also ultimately lead to a reduction in the productivity of arable land. Agrochemical pollution poses a serious threat to humans, domestic animals, wildlife and the environment, yet these chemicals continue to be used and advertised, often with a limited understanding of their potential harmful effects. Furthermore, current international restrictions and strict guidelines on maximum residues of certain agrochemicals in food products in Europe or the USA may limit the export of agricultural products from countries that do not adhere to these regulations.

This brochure aims to inform farmers and the public about the safe use of agrochemicals, the corresponding risks, and provides information on alternative solutions.

Definitions and Scope

Agrochemicals are chemical products used in agriculture. They are usually referred to as pesticides, fertilisers, arboricides, growth hormones and pharmaceuticals (for livestock protection). Agrochemicals typically consist of 'active' and 'inactive' ingredients. The active ingredient includes any chemical, plant extract, pheromone or micro-organism that affects the pest or organism needing to be controlled. The 'inactive' or inert ingredient is the chemical that allows the active ingredient to 'stick' to the plant or animal (e.g., solvents, emulsifiers, detergents), in many cases not only the active, but also the inactive ingredient, is toxic and can have negative effects on the environment and human health.

This information booklet focuses on

i) agrochemicals that are currently available and being used in Namibia;

ii) the risks associated with the use of agrochemicals;

iii) a practical guide on how to reduce these risks;

iv) and pest control measures that should always be considered before using agrochemicals.

Legislation

In Namibia, the use of agrochemicals is primarily regulated by the Fertilisers, Farm Feeds and Agricultural Remedies Act 36 (1947). The Registrar, appointed by the Minister of Agriculture, Water and Land Reform (MAWLR), is responsible for the registration of all agricultural 'remedies' imported and used in Namibia, with the exception of any substance controlled under the Medicines and Related Substances Control Act, 1965 (Act No. 101 of 1965) or the Hazardous Substances Act, 1973 (Act No. 15 of 1973). The Registrar of the Namibian Medicines Regulatory Council, appointed by the Minister of Health, is responsible for the registration of veterinary pharmaceutical products used in agriculture.

In Namibia, **it is against the law** to:

- Import agrochemicals that are not registered.
- Possess agrochemicals that are not labelled.
- Use agrochemicals for purposes other than what they are registered for.
- Use agrochemicals to poison domestic animals, wildlife or humans.
- Sell products that do not show a Namibian registration number.

At the international level, the European Union (EU) and the United States (US) are important export markets for several Namibian products. Products destined for export to the EU or US are regularly tested for chemical residues. If residues are above a certain threshold (Maximum Residue Limit (MRL)) products may not be imported. Producers should be aware that products destined for export may accidentally be contaminated with agrochemicals that have been spilled or used in proximity.

Types of Agrochemicals

Pesticides – Plant and Animal Protection

Pesticides are a broad group of poisons or substances used to protect crops and horticultural plants from being eaten, killed or outcompeted. These include insecticides, fungicides, herbicides, arboricides, acaricides, termiticides, algaecides, molluscicides, nematicides and rodenticides, which are either classified as systemic (with residual or long-term activity) or contact (no residual activity). The active ingredients in pesticides can be broadly classified into the following categories: organophosphates, carbamates, neonicotinoids and pyrethroids. These ingredients are all toxic, affecting the target organism but also having adverse effects on human health (e.g., cancers and neurological defects) and the environment (e.g., killing beneficial insects or birds, and contaminating ground- and surface waters).

Bush encroachment by indigenous bushes (e.g., sickle bush, blackthorn/swarthak, driedoring) is a considerable threat to agricultural productivity in Namibia. The expansion of bush, often caused by years of livestock mismanagement, suppression of natural fires, declining browser populations amongst others, made agricultural land unproductive and has negative impacts on wildlife and tourism. Bush is controlled using three methods (i) manual to mechanised, (ii) chemical and (iii) biological, often in combination with each other. Chemical control involves the application of **arboricides** to the soil, foliage, or stump to kill the bush. While arboricides may be very effective, their use can have significant residual effects on the environment.

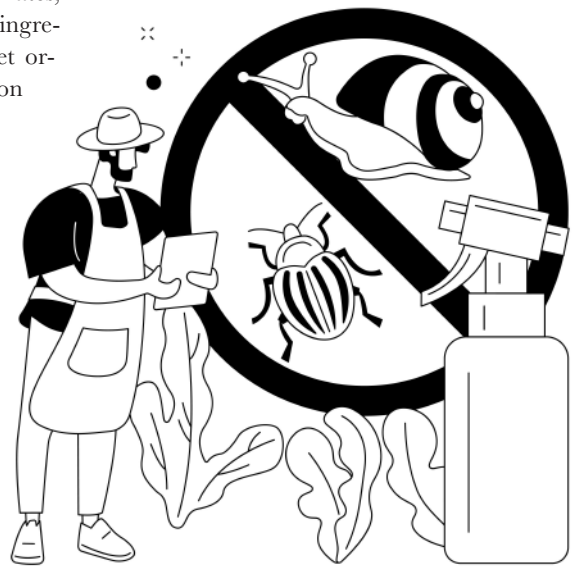


Table 1. Summary of pesticides commonly used in Namibia (for a more detailed list see Annex)

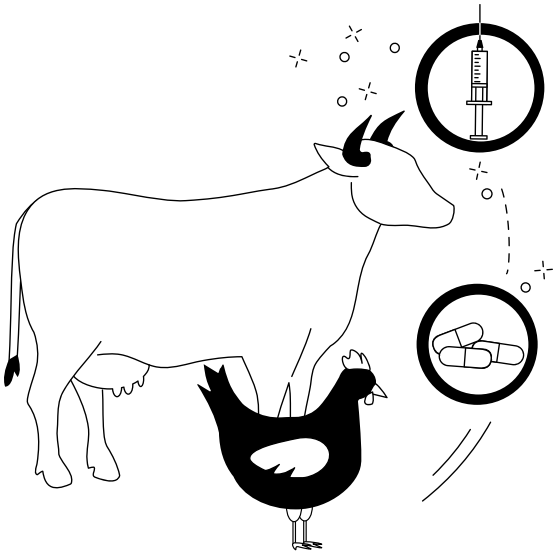
Main Types of Pesticides	General Use & Function	Examples of Active Ingredients	Potential Adverse Effects
Organophosphates	Insecticides & Fungicides	Dichlorvos, Acephate, Chlorpyrifos, Dimethoate, Temephos, Omethoate	Accumulation in the environment; threats to aquatic life
Carbamates	Insecticides & Fungicides	Mancozeb, Aldicarb, Benfuracarb, Carbosulfan, Pirimicarb, Methiocarb	Threat to human and animal health (affecting reproductive, neurological, immune functions)
Neonicotinoids	Insecticides	Imidacloprid	Threat to aquatic ecosystems, especially invertebrate communities; major threat to bee populations
Anticoagulant	Rodenticides	Brodifacoum, Difenacoum, Coumatetraluyl, Flocoumafan, Difethialone	Serious threat to human and animal health
Triazines	Herbicides, Algaecides, Fungicides	Amitrole, Difenoconazole, Folpet, Hexazinone	Threat to human and animal health (especially as endocrine disruptors and carcinogens)
Phenoxyacetic acids	Herbicides	MCPA, 2,4-D, Paraquat	Threat to human and animal health (carcinogenic); accumulation in water systems
Organophosphorus compound	Herbicides	Glyphosate	Serious threat to human and animal health (carcinogenic, kidney & liver damage, etc)
Pyrethroids	Insecticides & Herbicides	Permethrin, Picloram, Prallethrin, Tetramethrin, Triclopyr	May pose a threat to humans and animals through neurotoxic effects at repeated/high exposure.
Other: Obsolete Pesticides*			
Organochlorines	Pesticide (vector/disease control)	DDT, Endosulfan	Serious threat to human and animal health (affecting reproductive, neurological, immune functions)
Organophosphate	Pesticide	Monocrotophos	Serious threat to human and animal health (especially birds and aquatic organisms)

* Organochlorines and some organophosphates (Monocrotophos) are not commonly used in Namibia as a pesticide in agriculture. DDT is being used exclusively by the Ministry of Health and Social Services as a malaria vector control. These substances are included here to highlight their toxicity and potential availability.

There are records of old trees dying decades after intensive aerial application of arboricides in upstream areas. In addition, arboricides contain toxic ingredients (e.g. bromacil, tebuthioron) that pose health risks to humans and animals similar to other pesticides.

Pesticides such as strychnine and carbamates (e.g., aldicarb and carbofuran) were historically used for controlling livestock predators. Due to their extremely high toxicity to humans, animals, and the environment, these substances have been banned in Namibia and in most countries around the world.

Obsolete pesticides are pesticide products that have (1) deteriorated due to improper or prolonged storage and can no longer be used, or (2) have been prohibited or severely restricted for environmental or health by applicable provisions of the Conventions. For more information on obsolete pesticides, see the FAO website (https://www.fao.org/agriculture/crops/obsolete-pesticides/whatdealing/obs-pes/en/).



Veterinary Pharmaceutical Products

Animal medicines include a range of veterinary products such as:

i) antibiotics,
ii) anti-inflammatories,
iii) ecto- and endo-parasiticides (anthelmintics) and,
iv) euthanasia drugs.

The majority of these medicines are only administered or available on prescription by a veterinarian, and should always be used with caution and under guidance of a registered veterinarian. Veterinary medicines can contaminate soils, ground- and surface waters as these substances pass through the treated animal and are excreted.

The over- and incorrect use of antibiotics can lead to antibiotic/antimicrobial resistance which has been identified as one of the greatest threats to global health by the World Health Organisation (WHO). Resistance occurs when bacterial populations evolve in the presence of antibiotic medicines, leading to antibiotic treatments becoming less efficient or ineffective. Antibiotic use in livestock farming has been linked to antibiotic resistance in humans as residues of these medicines drive resistance in humans through the consumption of meat that is contaminated by antibiotics and antibiotic resistant bacteria particularly if antibiotic withdrawal periods have not been adhered to. Globally, it is estimated that up to 90% of antibiotics used in animals are excreted, thereby releasing them into the natural environment.

Table 2. Veterinary pharmaceutical products commonly used in Namibia.

Main Types of Pharmaceuticals	General Use & Function	Active Ingredients	Potential Adverse Effects
Antibiotics	To treat bacterial infection; subtherapeutic in animal feed	Amoxycillin	Emergence of antibiotic resistant bacteria; Transmission of these bacteria to humans (accidental contamination); Antibiotic toxicity effects on humans, soil micro-organisms (from manure).
		Doxycycline	
		Oxyteracycline	
		Procaine Benzylpenicillin	
		Trimethoprim	
		Cephalexin monohydrate	
		Chloramphenicol	Prohibited Group I substance!
Anti-inflammatories	To relieve pain and inflammation	Ketoprofen	Residues in carcasses have been linked to deaths of domestic animals and wildlife where carcasses have not been disposed of properly * Meloxicam is the only non-steroidal anti-inflammatory that is safe for scavenging wildlife
		Flunixin meglumine	
		Carprofen	
		Firocoxib	
		Meloxicam*	
Barbiturates	Euthanasia	Sodium pentobarbitone	Residues in carcasses have been linked to deaths of domestic animals and wildlife where carcasses have not been disposed of properly.
Parasiticides	Endoparasitic: Anti-thelminic	Fenbendazole	Drug resistance; Threat to soil biota and other beneficial organisms feeding off manure
		Praziquantel	
		Ivermectin/abamectin	
		Mebendazole	
		Nitroxynil	
	Ectoparasitic	Cypermethrin	Very toxic to aquatic organisms: very persistent in soils, sediments and water; high risk of bioaccumulating
		Lufenuron	
		Fipronil	
		Amitraz	
		Flumethrin	

Chemical Fertilisers - Nutrient Enhancement

Fertilizers typically contain a synthetic mixture of nitrogen, potassium, and phosphorus (and occasionally calcium, magnesium, sulphur, and other elements). The Green Revolution was a time period post World War II which was associated with an increased use of fertilizers and pesticides that contributed to the widespread reduction in global poverty by producing enough food for a growing global population. However, while the use of fertilizers only improves yields in the short-term, their long-term application to crop fields are known to decrease productivity. Excessive doses of synthetic fertilizers contaminate groundwater and surface water, cause eutrophication and increase the acidity of soil. This collectively leads to the loss of soil micro-organisms which in turn affects plant health. Changes in microbial activity and the nutrient cycle can affect the stability and soil structure leading to an ever-increasing demand for chemical fertilizers to produce the same yield.

Hormones - Growth Enhancement and Weed Control

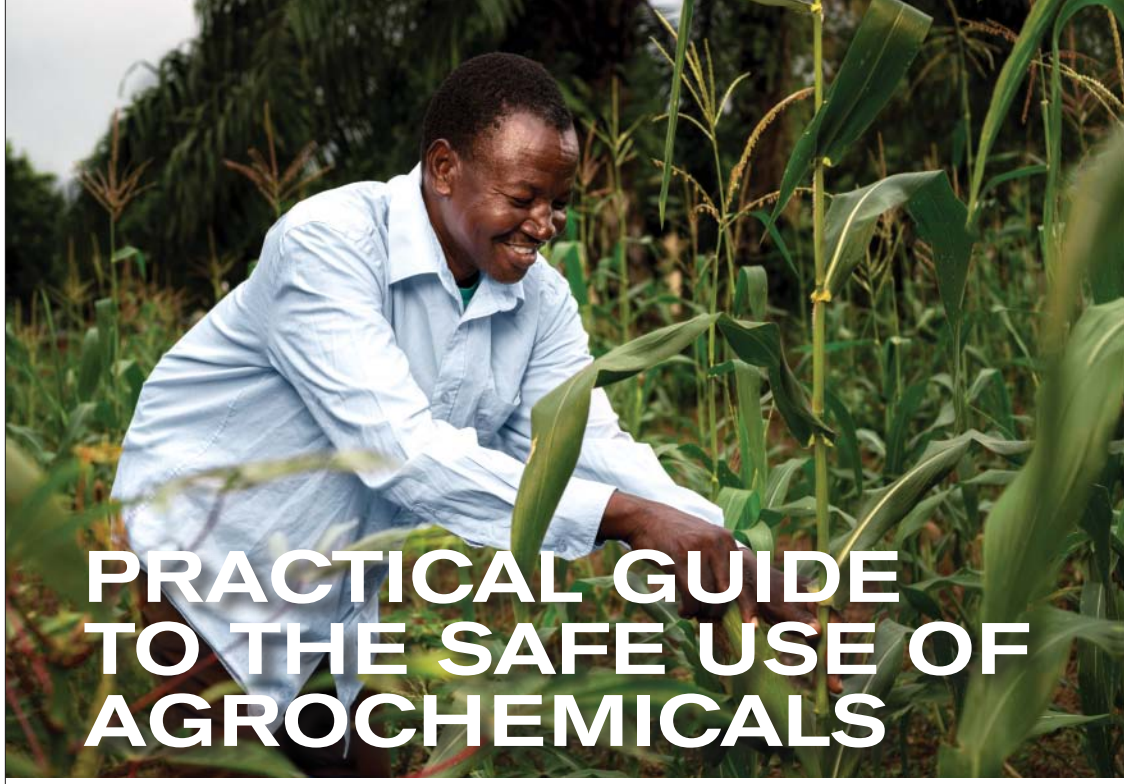
Growth hormones are used in both crop and livestock production to increase the speed at which an organism grows with the aim of increasing productivity.

Plant Growth Hormones (or plant-growth-regulators (PGRs)) are used to:

- Promote root growth and root development on plant cuttings;
- Enhance flower production and stimulate fruit ripening;
- Control or kill unwanted plants (as a herbicide).

There are five main groups of PGRs: auxins, gibberellins, cytokinins, ethylene, and abscisic acid. Residues of PGRs in agricultural products can affect human health and are suspected to affect the function of human and animal reproductive systems. In Namibia, synthetic auxins (e.g., 2,4-D, fluroxypyr, dicamba, picloram) are used as herbicides.

Animal Growth Hormones: Growth promoting substances with a hormonal or thyrostatic action and beta-agonist substances may not be administered to farm animals in Namibia. Antibiotic growth promoters (Virginiamycin) are permitted for use in the poultry industry.



PRACTICAL GUIDE TO THE SAFE USE OF AGROCHEMICALS

Before buying Agrochemicals

Step 1 IDENTIFY THE PROBLEM

To ensure the safe and correct use of any agrochemical, it is important to correctly identify the problem. Best practice is to:

- Collect samples/photographs of pest and to send experts or to take them to the local agricultural extension officer.
- Collect samples/photographs of the damaged crop (leaves/stem/root).
- If expert advice is not available, search online for a pest identification tool.
- Identify if the damage expected from the identified pest has an economic impact on crop production and therefore needs control.

Step 2 EVALUATE OPTIONS AND CONSIDER ALTERNATIVES

Before purchasing agrochemicals, non-toxic pest control measures within the context of Integrated Pest Management (IPM) should be considered and used. Non-toxic pest control measures include physical and biological control which

can save costs and reduce health risks. Only if physical and biological control is not effective in controlling the pest, agrochemicals should be used. While agrochemicals may provide a 'quick fix', their long-term usage can have adverse effects on yields and health. **Alternative options to potentially hazardous chemicals should always be considered and evaluated first.** If agrochemicals are used, their application should be compliant within an IPM framework (e.g., chemical control should go hand-in-hand with physical and biological control). There are many non-toxic alternatives for IPM and organic agriculture (see *Alternatives to Agrochemicals* for more information).

Step 3 UNDERSTAND RISKS

Health RISKS: Agrochemicals consist of active chemical ingredients mixed with 'inert' substances. Both the active and inert ingredients can have adverse effects on human health and biodiversity. While the active ingredient is listed on all agrochemicals, the inert ingredients are not always disclosed. Chemicals can enter the human body via four main avenues:

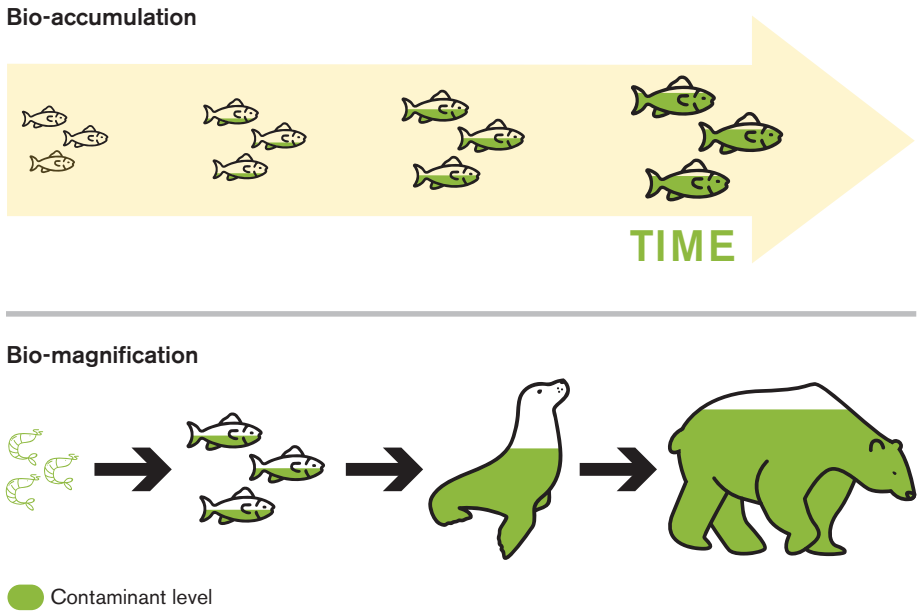
i) Inhalation,
ii) skin absorption,
iii) ingestion, and
iv) contact with eyes.

Exposure to agrochemicals is classified into two categories: Acute (short-term and once-off) and chronic (long-term), which result in different health issues. Acute exposure may lead to skin rashes, blisters, blindness, nausea, dizziness, diarrhea and death (see Section on Basic First Aid). Chronic exposure to agrochemicals has been linked to cancers, birth defects, neurological and developmental toxicity, and effects on the endocrine system. It is noted that 'natural' pesticides may also be toxic to humans, for example, Neem oil may be detrimental to children, and pregnant women, and can cause kidney failure, encephalopathy, and severe brain ischemia in children.

Environmental RISKS: Agrochemicals are typically not target-specific, and kill non-target organisms including beneficial predatory insects that keep pest populations under control (e.g. ladybirds which feed on aphids), and micro-organisms in the soil which play a vital role in soil nutrient cycling and maintaining healthy soils. In addition, agrochemicals can contaminate ground water and surface water, which directly affects the health of humans and animals, especially aquatic organisms. The concentration of agrochemicals may increase over time in the soil, in organisms, in biological communities and in the food web through bio-accumulation and bio-magnification. Bio-accumulation refers to the process of toxins (e.g., pesticides) entering the food web and gradually accumulating over time in individual organisms and the soil. Bio-magnification refers to the ever-increasing concentrations of a chemical or toxin at each level of the food chain (see graphic on page 14).

Secondary poisoning occurs when a predator or scavenger eats a poisoned animal and becomes poisoned itself. Carcasses from animals that were treated with certain veterinary pharmaceuticals (all NSAIDs except Meloxicam), killed using rodenticides or treated with pesticides (organophospates or carbamates) has caused a major decline in scavenging wildlife populations (especially vultures) across the world through secondary poisoning. A further example of secondary poisoning is in bee populations where entire colonies have died due to being exposed to certain pesticides (e.g., neonicotinoids such as imidacloprid). Wildlife such as vultures and bees form a key part of a healthy ecosystem, which humans are entirely dependent on.

Economic RISKS: The use of certain agrochemicals may limit export opportunities due to strict regulations in global markets. Import/export products are regularly tested for pesticide/chemical residues in the EU and US, which are important export markets for Namibian producers. In rain-fed crop production systems, the use of expensive agrochemicals is a significant financial investment that can be a serious financial burden in the event of crop failure as a result of lack of rain.



Buying and Transporting Agrochemicals

Due to the potential health risks to humans and to other animals in the food chain, it is best practice to first consider and alternative, environmentally friendly control measures before applying potentially harmful or toxic agrochemicals to homes, crops, gardens or livestock. Once the farmer has identified the pest/problem, trialed IPM practices, completed a cost-benefit analysis and understands the risks, he/she may decide to purchase a chemical. It is then important to:

- Select the right agrochemical treatment under the guidance of a licensed/certified supplier of agrochemicals or a veterinarian. The supplier should provide training and information to the farmer on how to safely handle the chemical.
- Agrochemicals should be purchased from licensed suppliers only.

There are a few basic principles that agrochemical users must adhere to:

1. Reading Labels (incl. Abbreviations)

Before purchasing any product, farmers must make themselves familiar with the labels and abbreviations on the product. Labels are based on international guidelines. Each product should be accompanied by a Material Safety Data Sheet (MSDS), which includes information on the health impacts; hazard evaluation for the product's handling, storage, and application; and emergency procedures. Farmers must be aware that some approved and unapproved active ingredients have very similar names: For example, in the EU, pirimiphos-methyl is an approved ingredient, while pirimiphos-ethyl is not approved.

All registered products have labels that clearly state (see sample with numbers below):

1 Trade name
2 Registration number
3 Mode of Action Group
4 List of active ingredients
5 Hazard classification label (green, blue, yellow, red)
6 Warning/advice pictograms
7 Toxicity level: LD50 in mg/kg
8 Date of Manufacture and Expiry
9 First Aid and medical advice in the event of poisoning/spillage

NEVER BUY CHEMICALS THAT ARE NOT LABELLED OR WHERE THE CONTAINER IS DAMAGED OR SEALS ARE BROKEN.

> *The development of resistance to a specific pesticide is a major concern in crop agriculture*

2. Mode of Action Group

All pesticides (insecticides, fungicides, herbicides) are classified by their Mode of Action (MoA). The development of resistance to a specific pesticide is a major concern in crop agriculture. Resistance to pesticides develops if the same Mode of Action of the active ingredient is applied regularly without another overlapping MoA and/or non-chemical control measures.

For example, within a population of 'weeds' there may be a few individuals that are resistant to the specific active ingredient. This means, they survive, thrive, and reproduce despite herbicide application, leading to the next generation of weeds that are resistant to the herbicide used on the first generation. If, however, herbicides with a different MoA are applied, those individuals in the population with genetic resistance to Herbicide 1 may be controlled by Herbicide 2.

The insecticide, fungicide, and herbicide Resistance Action Committees (RACs) have developed group codes and are responsible for advancing resistance management practices. These group codes (commonly seen as IRAC, FRAC or HRAC codes on labels) provide critical information for farmers to allow for resistance management. To avoid resistance development, farmers should use pesticides with different MoAs (designated by different group codes), as well as combining the use of chemical control with physical and biological control measures.

3. Hazard Classification

The most important part of a pesticide label is the colour (red, yellow, blue, green), which signifies the toxicity of the active ingredients of the product: Red indicates the most hazardous chemicals, and green the least harmful (see graphic on page 18). The toxicity classification of pesticides is based on experiments with laboratory rats to determine how many milligrams will kill half (50%) of the experimental population. This value (lethal dose, LD) is often shown on product labels as LD50. The lower the value, the higher the toxicity of the substance. In addition, pesticides are classified as harmful/hazardous based on their impact, both long- and short-term, on humans, animals and the environment (especially bees, fish and other aquatic organisms), which is typically depicted on product labels as pictograms.

Table 3. Hazard Colours and LD50 values

Label	Poison Group	Toxicity level	LD (Lethal Dose) (mg/lg)	Warning statement	Listed chemicals
	Ia	Very toxic	< 5	Most toxic pesticide groups. Protected equipment and clothing MUST be used.	Monocrotophos, zinc phosphide, ethyl mercury acetate and others.
	Ib	Toxic	5 – 50	Most toxic pesticide groups. Protected equipment and clothing MUST be used.	Monocrotophos, zinc phosphide, ethyl mercury acetate and others.
	II	Harmful	51 – 500	Second most toxic pesticide group. Use all precautions on label.	Endosulfan, carbaryl, quinalphos and others.
	III	Moderately toxic	501 – 5000	Use carefully and use protection.	Malathion, thiram, glyphosate and others.
	IIII	Slightly toxic	>5000	Relatively safe.	Mancozeb, oxyfluorfen, mosquito repellant oils and liquids, most household insecticides.

"Pesticides are classified as harmfull/ hazardous based on their impact, both long- and short-term, on humans, animals and the environment"

Warning and advice pictograms commonly used on pesticide labels

Storage

Keep locked away and out of reach of children

Activity/Application

When handling liquid concentrate

When handling dry concentrate

When applying pesticide

Health and Safety (Personal Health)

Wear mask

Wear respirator

Wear eye protection

Wear gloves

Wear boots

Wash after use

Wear overalls

Wear apron

Animals and Environment

Dangerous/harmful to fish – do not contaminate lakes, rivers, ponds or streams

Dangerous/harmful to animals

Harmful to the environment

4. Transporting Agrochemicals

Agrochemicals should be transported by licensed entities only. However, many farmers need to transport agrochemicals from the point of sale to their farm. In this case, the following precautions should be adhered to:

- Transport agrochemicals in sealed containers, separately packed from any food items or flammables.
- Do not place agrochemicals next to the driver or any passengers.
- Ensure that containers are safely packed on vehicles in a way that no sharp edges can damage the container during transport.

5. Storing Agrochemicals

Agrochemicals must always be stored in a lockable closed cupboard, away from food items and out of direct sunlight. Keep agrochemicals in a separate house/hut that is accessible only to the person responsible for the use of the agrochemical and inaccessible to children and animals.

Applying Agrochemicals

In many countries across the world, the application of agrochemicals is done exclusively by trained personnel (or a veterinarian in the case of livestock pharmaceuticals). This is due to the health risks of applying chemicals and the risk of environmental contamination. In Namibia, there is currently no law that regulates the process of applying pesticides and fertilisers. Users must always practice caution and adhere to the instructions for each product.

The following precautions should be taken:

- Read the product label, and adhere to the instructions on the label. Seek advice from the supplier, your local agriculture officer, or from community members who have experience in applying any chemical to crops or livestock or for bush control.
- Always wear protective clothing, including closed shoes, long shirt and trousers, face/dust mask or respirator, and chemical-resistant gloves. Gloves should be discarded or washed thoroughly and dried away from homes and food items after application.
- Make sure no food items are contaminated during the application of chemicals.
- Inform others in the area when, where and which agrochemical is being sprayed/applied.
- Do not spray agrochemicals during strong winds or just before predicted rain.

Mixing Agrochemicals

Products are sold as concentrate (either in liquid or powder form) with instructions on how to correctly mix the chemical prior to application. It is important to always read the label carefully prior to mixing, strictly follow the instructions, and always wear Personal Protective Equipment (PPE). Carefully plan the amount of mixed pesticide solution that is needed before purchase to avoid needing to dispose of surplus agrochemical waste.

> *It is important to always read the label carefully prior to application, strictly follow the instructions, and always wear protective gear.*

Post-application of Agrochemicals

Re-Entry and Preharvest Intervals

The **re-entry period** or interval is the time that needs to lapse between pesticide/agrochemical application and re-entering the treated area. In Namibia, this applies to both humans and livestock. For example, humans should not enter crop fields, and livestock should not graze in areas treated with arboricides for bush control. Ideally, sprayed fields should be fitted with signs indicating the length of time no-one or animal, is permitted to enter the area. The **Pre-harvest interval** (PHI) is the time that needs to lapse between the last application of pesticides to crops and harvesting in order to reduce the risk of consuming fruit or vegetables that are contaminated by a given chemical. This time period is indicated on the label of the pesticide.

Withdrawal and Discard Periods in livestock

For veterinary pharmaceutical products, there is a 'withdrawal period' from the time of administering the remedy during which animals may not be slaughtered for human consumption, and a 'discard period' after which products from livestock need to be discarded. It is important to make yourself familiar with these time periods. Ideally, livestock remedies should only be administered under the guidance of a veterinarian.

Carcass Disposal

Carcasses of animals that have been treated with veterinary pharmaceutical products, parasiticides or killed using rodenticides need to be disposed of safely to avoid scavengers consuming meat that contains residues of these chemicals. For example, rodenticides are typically extremely toxic, and poisoned rodents must be properly disposed of (ideally buried) to avoid secondary poisoning to owls or other wildlife.

Carcasses that have been treated with painkillers or non-steroidal anti-inflammatories within one week prior to death; OR carcasses of animals that have died while being anesthetized or euthanized (barbiturates) should be completely burnt to avoid poisoning of wildlife, especially scavenger birds such as vultures. If burning is not possible, the carcass must be buried at a depth of at least 1 meter. The application of lime to the carcass is advisable during burial to reduce the spread of pathogens.

Disposal of Agrochemicals

Agrochemicals need to be disposed of safely. Agrochemicals should be disposed of when:

- it is no longer needed,
- it has expired, or
- the container is damaged (potentially leading to spillage).
- the label is no longer readable,
- it is obsolete.

Agrochemicals and their containers, even empty ones, should never be dumped in landfills or any other site with a potential risk of contamination. Avoid surplus of chemicals that need to be disposed of by planning exactly how much chemical is needed for treatment/spraying, especially when mixing chemical solutions.

Steps for safe disposal:

1) Dispose agrochemical waste via the supplier, or via a company or a person licensed to handle waste disposal. Always seek advice from your supplier, local authority or community leader.
2) If no safe disposal of surplus chemicals is possible, the chemical should be stored in a safe place until there is an opportunity to dispose of it safely. Do not spray or dump left over chemicals.
3) Do not use empty agrochemical containers for anything else, except in the case of refilling the container with the same agrochemical.
4) Paper and cardboard containers can be burnt.
5) Puncture metal and plastic containers to prevent further use.

In Namibia, there are currently two hazardous waste disposal sites (Kupferberg dumpsite, Windhoek and Walvis Bay).

Burial of Waste

If the supplier or licensed waste disposal authority cannot dispose of the containers safely, containers should be buried underground at a depth of at least 1 meter. Select a site that is far away from human settlements and/or human activity, animals and water sources. The site must be fenced to prevent access by people and animals.

DISPOSE OF PESTICIDES AND PESTICIDE CONTAINERS PROPERLY!

BASIC FIRST AID

If you suspect poisoning, first **READ THE LABELS** on the container of the suspected substance. Provide First Aid if you are able to do so. Always seek medical advice at your nearest clinic/medical center, especially if the patient has weak breathing, convulsions and/or unconsciousness.

First Aid to be taken when experiencing the following symptoms:

ALWAYS keep the patient warm and dry.

ALWAYS take the label/trade name/active ingredient to the medical center or doctor

BREATHING IS WEAK/ HAS STOPPED
Give artificial respiration if trained/qualified to do so, else seek medical help.

CONVULSIONS | Restrain the patient gently to prevent self-injury.

UNCONSCIOUSNESS | Make sure the patient can breathe. Check tongue position to prevent the throat from being blocked.

In the case of knowing how and what the patient was in contact with, follow these steps which are relevant to your patient while also seeking medical help:

INHALATION | Drag the victim to fresh air immediately. Open windows and doors if accident/spillage happened indoors and make sure no one else is exposed to the fumes.

INGESTION | If the chemical has been swallowed, read the label first: Induce vomiting **ONLY** if the label or physician recommends this should be done. Some poisons can cause more damage if vomiting is induced. Otherwise give small amounts of water to the patient if conscious to dilute the poison in stomach. Poisons are quickly taken up by the intestinal tract and can cause illness and, in severe cases, death.

EYES | If poison/pesticide has splashed into the eyes, hold the eyelid open and gently wash with clean running water for 15 minutes. The membranes in the eyes absorb substances more rapidly than the skin and permanent damage can occur within a few minutes.

SKIN | If pesticide/chemical has splashed onto the skin, drench and wash thoroughly with plenty of soap and water. Contaminated clothing should be removed and washed. Do not put any lotion onto the affected area.

IITA/Kathy Lopez

ALTERNATIVE SOLUTIONS TO AGROCHEMICALS

Holistic Farming Practices

Integrated Pest Management

An alternative to immediate agrochemical use is **Integrated Pest Management** (IPM). It is an environmentally sensitive approach to managing pests (insects and weeds) considering the life cycle of pests and their interactions with the environment. IPM allows the use of synthetic chemicals. These should be used in conjunction with other pest control methods to minimize costs, health hazards and environmental damage. IPM also takes into consideration cultural practices and local knowledge to develop site-specific solutions.

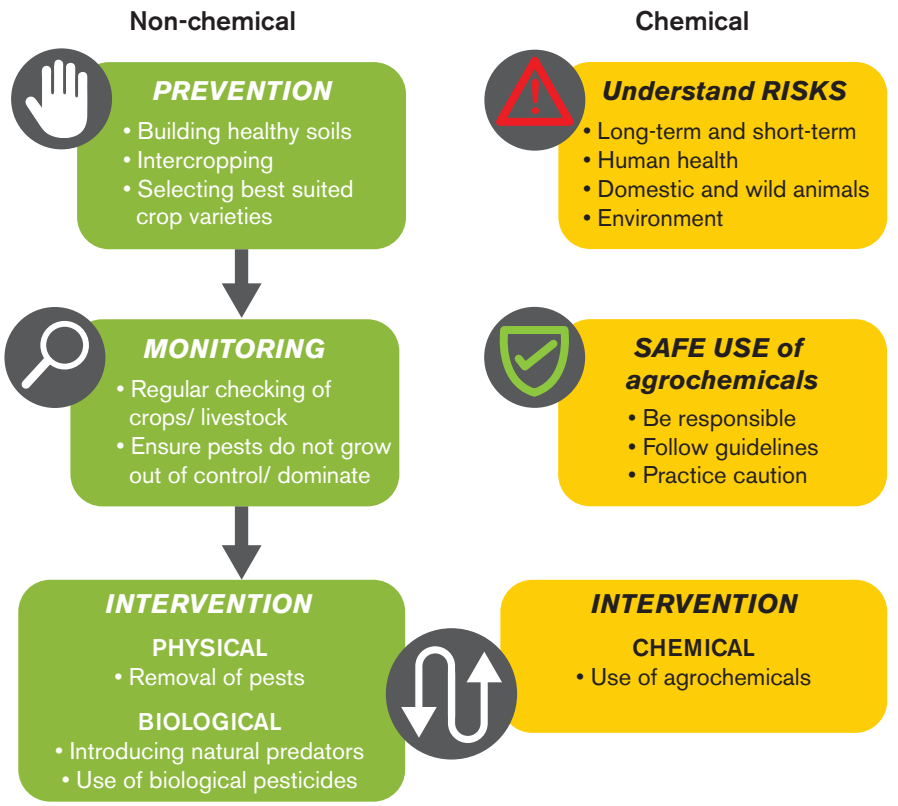
IPM is implemented in three main stages: prevention, monitoring and intervention.

Stage 1

PREVENTION

The first stage of IPM focuses on a set of practical strategies that support growing healthy crops and thereby reducing the risk of pest development. This includes:

- Selecting crop varieties best suited to the specific location.
- Selecting the best site for the crop based on microclimate, soil and topography.
- Planting crops strategically in 'communities' alongside pest repelling plants instead of monocultures.
- Implementing crop rotation.
- Actively managing soil fertility and health, for example by using micro-organisms to improve the health of plants. Similarly, in livestock agriculture, animals should not be kept in overcrowded feedlots and should be fed a healthy diet (more pasture, less grain).



Stage 2

MONITORING

The second stage of IPM involves active monitoring of crops and regularly checking plants/animals for pests. The main objective of monitoring is to ensure that pests do not become dominant, and interventions can be planned before the pest grows out of control.

Stage 3

INTERVENTION

The last stage of IPM is only necessary when damage from pests significantly threatens the economic value of the crop. The

intervention method is selected based on a three-tiered process:

1) Implementing **physical control** measures that are crop- and site-specific.
2) If these prove to be ineffective, **biological control** measures are assessed and implemented.
3) The last resort is **chemical pest control**.

These control measures are often implemented in combination and are selected based on a careful assessment of the costs, labour and equipment requirements. Social, economic and environmental impacts are also taken into consideration.

Organic Agriculture

There is a growing movement of **organic agriculture** around the world which rests on the four principles of health, ecology, fairness and health (International Federation of Organic Agriculture Movement).

Under these principles, there is a focus on:

- Nutrient cycling
- Crop diversity and rotation
- Natural pest control
- Using no harmful agrochemicals (e.g. synthetic pesticides and fertilisers)

These contribute to improved soil fertility and enhance biological pest control. Research has shown that healthy soils produce healthy crops that are less susceptible to pests and diseases.

Natural Pest Control and Soil Improvers

Natural Pest Control

Natural pest control remedies or organic pesticides are an environmentally-friendly alternative to toxic pesticide chemicals. Many of these substances repel the pest, and others also kill the target plant or animal. While organic pesticides are **less harmful** to humans, animals and the environment than synthetic agrochemicals, they are **not considered non-toxic**. There are a variety of home-made pest-control remedies using plant ingredients such as garlic, chili, khakibos, onion, lemon verbena, pepper tree leaves and basil (for example, see Margaret Roberts' book on Companion Planting).

Soil Improvers – compost, green manure, organic fertilisers, biofertilisers

The health of soil plays a key role in producing healthy crops that are able to withstand pests and diseases. Research has shown that healthy plants are attacked much less frequently than weak plants or plants with unbalanced nutrient supply. There are a number of simple, practical ways to improve the soil to make it richer and more viable.

These include making and using compost, applying organic fertilisers (e.g. bone meal, blood-bone-fish meal, chicken manure, ground limestone, seaweed derivatives), and incorporating green manure crops into the fields and soil. Biofertilisers are substances containing micro-organisms such as mycorrhizal fungi, blue-green algae and bacteria. Micro-organisms in the soil play a key role in making nutrients available for uptake by plants, thereby promoting plant growth.

The use of synthetic fertilisers typically leads to diminished soil life and, in the long term, nutrient-deficient soils, which means there is a never-ending cycle of needing to use increasingly more fertilisers to achieve the same yields. Biofertilisers, on the other hand, promote the establishment of a healthy community of soil micro-biota and the associated nutrient-cycling, resulting in increased soil fertility that is maintained over time, thereby decreasing fertiliser needs. Plants growing in this healthy environment and living soil will have much less challenges with pests than plants in unbalanced soils.

Table 3. List of further reading/ information

Topic	Organisation/Name	Link/ Supplier
Holistic Farming Practices	International Federation of Organic Agriculture Movement (IFOAM)	www.ifoam.bio
	Namibian Organic Association (NOA)	www.noa.org.na
Natural Pest Control	Margaret Roberts – Companion Planting	Book
Pest Identification Tools	Insect Science Pest Identification	https://shop.insectscience.co.za/pest-identification/
	Corteva FarmFundi App	https://www.corteva.co.za/media-center/Corteva-Agriscience-and-Plantix-Introduce-Free-Pest-Disease-and-Weed-Identification-pp.html
Pesticides	Pesticide Environmental Stewardship (PES)	www.pesticidestewardship.org
	US Environmental Protection Agency (EPA)	www.epa.gov
	EU Pesticides Database	ec.europa.eu/food/plants/pesticides/eu-pesticides-database.en
	Pesticide Resistance Action Committees (RACs)	https://irac-online.org/ https://www.hracglobal.com/ https://www.frac.info/
	Unpoison ZA	https://unpoison.org/
	Poisons & Pesticides Brochure NARREC	Brochure available from NARREC/ MAWLR
	Vulture Management Guidelines 2019	NARREC Online: http://vultures-namibia.com/VultureGuidelines2019.pdf
Alternative products to agrochemicals in Namibia	Soy-gro Inoculants	AGRA
	Biodyne	SWACHEM
	Kirchhoff's Margaret Roberts Pesticides	Pupkewitz AgriGro
	SuperGrow microbes	Aqualand CC

ANNEX

Table A1. List of commonly used pesticide substances in Namibia, their hazard classification based on the WHO and GHS Classification Systems, and whether each substance is approved for use in the EU. This list is not the full list of substances registered in Namibia.

Function	Active Ingredient	Chemical Compound	WHO	GHS	GHS Health	GHS Environment	HHP List	Environmental impacts	EU Approved
Acaricide	Milbemectin		III	4	Acute Tox. 4 - H302, Acute Tox. 4 – H332, H373	H400, H410	1	highly toxic to bees	Yes
	Amitraz	Amidine/ Formadine	II	4	Acute Tox. 4 – H302, STOT RE 2 - H373, Skin Sens. 1 - H317	H400, H410			No
Fungicide	Dichlorophen		II	4	Acute Tox. 4 - H302, Eye Irrit. 2 - H319	H400, H410			No
	Omethoate	Organophos-phate	Ib	2	Acute Tox. 3 - H301, Acute Tox. 4 – H312	H400	3	highly toxic to bees	No
	Mancozeb	Dathiocarbamate	U	5	Aquatic Acute 1 - H400, Repr. 2 - H361d, Skin Sens. 1 - H31	H400	1		No
Herbicide	Alachlor	Chloroacetanilide	II	4	Acute Tox. 4 - H302, Carc. 2 - H351, Skin Sens. 1 - H317	H400, H410	2		No
	MCPA	Phenoxy	II	4	Acute Tox. 4 – H302, Eye Dam. 1 - H318, Skin Irrit. 2 - H315	H400, H410			Yes
	Tebuthiuron	Urea Compound	II	4	Acute Tox. 4 – H302	H400, H410			No
	Triclopyr	Pyridyloxy	II	4					Yes
	Acetochlor	Chloroacetanilide	III	5	Acute Tox. 4 – H332, Carc. 2 - H351, Repr. 2 - H361f, STOT RE 2 - H373, STOT SE 3 - H335, Skin Irrit. 2 - H315, Skin Sens. 1 - H317	H400, H410			No

Table A1 (cont.)

Function	Active Ingredient	Chemical Compound	WHO	GHS	GHS Health	GHS Environment	HHP List	Environmental impacts	EU Approved
Herbicide	Glyphosate	Isopropylamine salt	III	5	Eye Dam. 1 - H318	H411	1		Yes
	Amitrole	Aminotriazole	U	5	Repr. 2 - H361d, STOT RE 2 - H373	H411	1		No
	Bromacil	Urea compound	U	5					No
	Picloram	Pyridine Carbo-xylic Acid	U	5					Yes
	Clodinafop-propargyl	Aryloxyphenoxy-proprinate			Acute Tox. 4 - H302, STOT RE 2 - H373, Skin Sens. 1 - H317	H400, H410		very toxic to aquatic life with long lasting ef-fects; may be fatal if swallowed; may cause nervous system damage in cases of long/re-peated exposure	Yes
	Dicamba		II	4	Acute Tox. 4 – H302, Eye Dam. 1 - H318	H412			Yes
	2,4 -D	Phenoxy derivative	II	4		H412			Yes
Insecticide	Aluminium Phosphide	Fumigant/ Pyrethroid		1	Acute Tox. 1 - H330, Acute Tox. 2 - H300, Acute Tox. 3 - H311, Water-react. 1 - H260	H400	2	highly toxic to bees, see Note 1	Yes
	Beta-Cyfluthrin	Pyrethroid	Ib	2	Acute Tox. 2 - H300, Acute Tox. 2 - H330	H400, H410	2	highly toxic to bees	No
	Carbofuran	Carbamate	Ib	2	Acute Tox. 2 - H300, Acute Tox. 2 – H330	H400, H410	3	highly toxic to bees	No
	Dichlorvos	Organophos-phate	Ib	3	Acute Tox. 2 - H330, Acute Tox. 3 - H301, Acute Tox. 3 - H311, Skin Sens. 1 - H317	H400	2	highly toxic to bees	No

Function	Active Ingredient	Chemical Compound	WHO	GHS	GHS Health	GHS Environment	HHP List	Environmental impacts	EU Approved
Insecticide	Acephate	Organophosphate	II	4			1	highly toxic to bees	No
	Benfuracarb	Carbamate	II	3	Acute Tox. 3 - H331, Acute Tox. 4 – H302, Repr. 2 - H361f	H400, H410	1	highly toxic to bees	No
	Carbusulfan	Carbamate	II	3	Acute Tox. 2 - H330, Acute Tox. 3 - H301, Skin Sens. 1 - H317	H400, H410	3	highly toxic to bees	No
	Chlorpyrifos	Organophos-phate	II	3	Acute Tox. 3 - H301	H400, H410	2	highly toxic to bees	No
	Cypermethrin	Pyrethroid	II	2	Acute Tox. 4 - H302, Acute Tox. 4 – H332, Aquatic Acute 1 - H400, Aquatic Chronic 1 - H410, STOT SE 3 - H33	H400, H410	1	highly toxic to bees	Yes
	DDT		II	3	Acute Tox. 3 – H301, Carc. 2 - H351, STOT RE 1 - H372	H400, H410	3	Very toxic to aquatic organisms: very persistent in soils, sediments and water	No
	Dimethoate	Organophos-phate	II	3	Acute Tox. 4 - H302, Acute Tox. 4 - H312		1	highly toxic to bees	No
	Endosulfan	Organochlorine	II	3	Acute Tox. 2 - H300, Acute Tox. 2 - H330, Acute Tox. 4 – H312	H400, H410	2		No
	Esfenvalerate	Pyrethroid	II	3	Acute Tox. 3 - H301, Acute Tox. 3 – H331, Skin Sens. 1 - H317	H400, H410	1	highly toxic to bees	Yes
	Imidacloprid	Neonicotinoid	II	4	Acute Tox. 4 – H302	H400, H410	1	highly toxic to bees	No

Table A1 (cont.)

Function	Active Ingredient	Chemical Compound	WHO	GHS	GHS Health	GHS Environment	HHP List	Environmental impacts	EU Approved
Insecticide	Indoxacarb	Oxidiazine	II	3	Acute Tox. 3 - H301, Acute Tox. 4 - H332, STOT RE 1 - H372, Skin Sens. 1B - H317	H400, H410	1	highly toxic to bees	No
	Lambda-cyhalo-thrin	Pyrethroid	II	3	Acute Tox. 2 - H330, Acute Tox. 3 - H301, Acute Tox. 4 – H312	H400, H410	2	highly toxic to bees	Yes
	Permethrin	Pyrathroid	II	3	Acute Tox. 4 - H302, Acute Tox. 4 – H332, STOT SE 3 - H335	H400, H410	2	highly toxic to bees	No
	Prallethrin	Pyrethroid	II	4			1	highly toxic to bees	?
	Propoxur	Carbamate	II	3	Acute Tox. 3 – H301	H400, H410	2	highly toxic to bees	No
	Lufenuron	Benzamide	III	5	Skin Sens. 1 - H317	H400, H410	1	Very toxic to aquatic organisms: very persistent in soils, sediments and water; high risk of bioaccumulating	No
	Spinosad	Naturalyte	III	5		H400, H410	1	highly toxic to bees	Yes
	Temephos	Organophos-phate	III	5			1	highly toxic to bees	No
	Magnesium Phosphide	Fumigant			Acute Tox. 1 - H330, Acute Tox. 2 - H300, Acute Tox. 3 – H311, Water-react. 1 - H260	H400	1	See Note 2	Yes
	Tetramethrin	Pyrethroid	U	5	Acute Tox. 4 – H302, Aquatic Acute 1 - H400, Aquatic Chronic 1 - H410, Carc. 2 - H351, STOT SE 2 - H37	H400, H410	1	highly toxic to bees	No

Function	Active Ingredient	Chemical Compound	WHO	GHS	GHS Health	GHS Environment	HHP List	Environmental impacts	EU Approved
Insecticide	Pirimicarb	Carbamate	II	3	Acute Tox. 3 - H301, Acute Tox. 3 – H331, Aquatic Acute 1 - H400, Aquatic Chronic 1 - H410, Carc. 2 - H351, Skin Sens. 1 - H31	H400, H410	2	Very toxic to aquatic organisms: very persistent in soils, sediments and water	Yes
	Piperonyl Butoxide	Pyrethroid	U	5					Not assessed
Molluscicide	Metaldehyde		II	3					Yes
	Methiocarb	Carbamate	Ib	2	Acute Tox. 3 – H301	H400, H410	2	highly toxic to bees	No
Rodenticide	Brodifacoum	Anticoagulant	Ia	1	Acute Tox. 1 - H300, Acute Tox. 1 - H310, Acute Tox. 1 - H330, Repr. 1A - H360D, STOT RE 1 - H372	H400, H410	2		No
	Bromadiolone		Ia	1	Acute Tox. 1 - H300, Acute Tox. 1 - H310, Acute Tox. 1 – H330, Repr. 1B - H360D, STOT RE 1 - H372	H400, H410	2		No
	Difenacoum	Anticougulant	Ia	1	Acute Tox. 1 - H300, Acute Tox. 1 - H310, Acute Tox. 1 - H330, Repr. 1B - H360D, STOT RE 1 - H372	H400, H410	2	high risk of bio-accumulating	No
	Coumatetraluyl	Anticoagulant	Ib	2	Acute Tox. 2 - H300, Acute Tox. 2 - H330, Acute Tox. 3 - H311, Repr. 1B - H360D, STOT RE 1 - H372	H410	1		No

Table A1 (cont.)

Function	Active Ingredient	Chemical Compound	WHO	GHS	GHS Health	GHS Environment	HHP List	Environmental impacts	EU Approved
Rodenticide	Flocoumafan	Anticougulant	Ia	1	Acute Tox. 1 - H300, Acute Tox. 1 - H310, Acute Tox. 1 - H330, Repr. 1B - H360D, STOT RE 1 - H372	H400, H410	2		No
	Zinc Phosphide		Ib	2			1		Yes
	Difethialone	Anticoagulant	Ia	1	Acute Tox. 1 - H300, Acute Tox. 1 - H310, Acute Tox. 1 - H330, Aquatic Acute 1 - H400, Aquatic Chronic 1 - H410, Repr. 1B - H360D, STOT RE 1 - H37	H400, H410	2		No

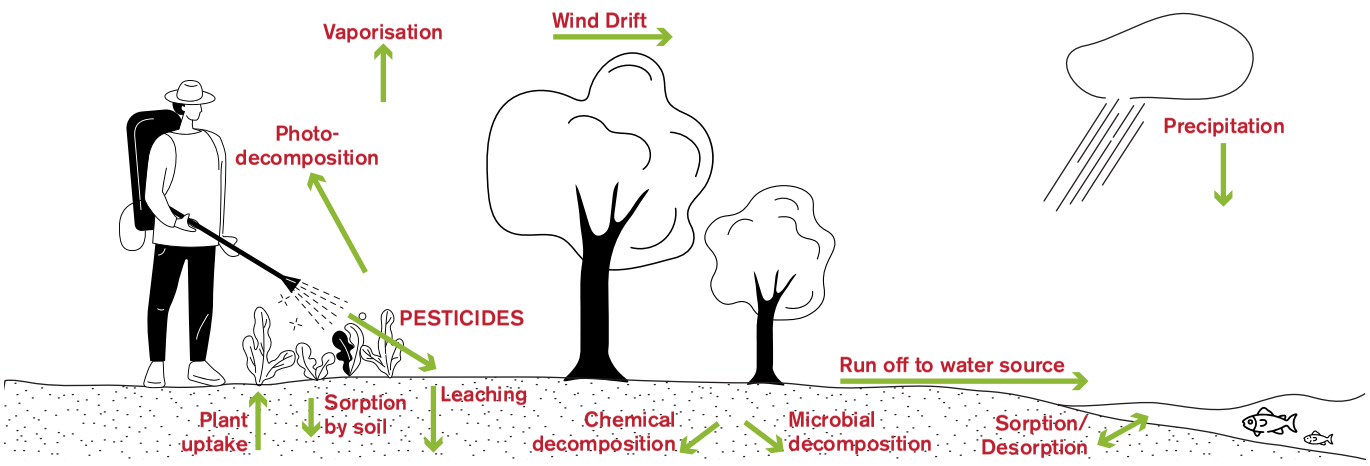
Note 1. Aluminium phosphide is used in the form of solid pellets, which release phosphine gas following exposure to moisture (including exposure to air or following ingestion). Phosphine has a separate entry in Table 8. Solid aluminium phosphide is classified as fatal if swallowed. A high case fatality has been reported in poisoning cases with aluminium phosphide
Note 2. Magnesium phosphide is used in the form of solid pellets, which release phosphine gas following exposure to moisture (including exposure to air or following ingestion). Phosphine has a separate entry in Table 8. Solid magnesium phosphide is classified as fatal if swallowed.
Note 3. Column 8 (HHP) depicts whether the substance has been included in the List of Highly Hazardous Pesticides (compiled by Pesticide Action Network International). The higher the number, the more impacts the substance has on environment, human health and animals.
Note 4. GHS Codes for Columns 6 & 7 are based on the Globally Harmonised System of Classification and Labelling of Chemicals (United Nations).
* DDT is not used in Namibia as a pesticide in agriculture. It is used exclusively by the Ministry of Health and Social Services as a malaria vector control. It is included here to highlight its toxicity and potential availability.
** Endosulfan is banned in Namibia, but included here to highlight its toxicity and potential availability.

Code	Description	Code	Description
H300	Fatal if swallowed	H330	Fatal if inhaled
H301	Toxic if swallowed	H331	Toxic if inhaled
H302	Harmful if swallowed	H332	Harmful if inhaled
H303	May be harmful if swallowed	H333	May be harmful if inhaled

Code	Description	Code	Description
H304	May be fatal if swallowed and enters airways	H420	Harms public health and the environment by destroying ozone in the upper atmosphere
H305	May be harmful if swallowed and enters airways		
H310	Fatal in contact with skin	H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled
H311	Toxic in contact with skin		
H312	Harmful in contact with skin	H335	May cause respiratory irritation
H313	May be harmful in contact with skin	H336	May cause drowsiness or dizziness
H314	Causes severe skin burns and eye damage	H340	May cause genetic defects
H315	Causes skin irritation	H341	Suspected of causing genetic defects
H316	Causes mild skin irritation	H350	May cause cancer
H317	May cause an allergic skin reaction	H351	Suspected of causing cancer
H318	Causes serious eye damage	H360	May damage fertility or the unborn child
H319	Causes serious eye irritation	H361	Suspected of damaging fertility or the unborn child
H320	Causes eye irritation	H362	May cause harm to breast-fed children
H400	Very toxic to aquatic life	H370	Causes damage to organs
H401	Toxic to aquatic life	H371	May cause damage to organs
H402	Harmful to aquatic life	H372	Causes damage to organs through prolonged or repeated exposure
H410	Very toxic to aquatic life with long lasting effects	H373	May cause damage to organs through prolonged or repeated exposure exposure
H411	Toxic to aquatic life with long lasting effects		
H412	Harmful to aquatic life with long lasting effects		
H413	May cause long lasting harmful effects to aquatic life		

Acknwledgements
We would like to thank The Registrars of DAPEES and Namibia's Ministry of Agriculture, Water and Land Reform) for providing the list of registered pesticides, as well as the State Veterinarian for providing a list of allowed veterinary remedies in Namibia.
The NARREC booklet Poison and Pesticides – A guide to Safe use (2008 and 2014) was an invaluable resource and is by no means replaced by this brochure on agro-chemical use in Namibia. The Vulture Management Guidelines Manual (2019) provided information on potentially dangerous veterinary pharmaceutical products for scavenging birds in Namibia.

HOW PESTICIDES SPREAD



IMPORTANT CONTACTS

Contact numbers for more information/emergencies regarding agrochemicals in Namibia

• **Ministry of Agriculture, Water and Land Reform**	061-208 7111
• **State Veterinarian – Medicine Control and Advisory Services, Directorate of Veterinary Services**	061-208 7324
• **Namibian Medicines Regulatory Council**	061-203 2400
• **Namibia Nature Foundation**	061-248 345
• **Ministry of Environment, Forestry and Tourism**	061-284 2541
• **Hazardous Waste Disposal**	061-290 2903

FOR POISONED ANIMALS/ POISON CASES

• **NARREC – Namibia Animal Rehabilitation Research and Education Centre**	061-264 409