

GUIDELINES FOR PESTICIDES

Introduction

There is a widespread use and misuse of pesticides in the country driven by economic motives. These pesticides are handled by persons who are underserved; i.e. not adequately organised, supervised, informed and guided in correct procedures. Consequently the pesticides have entered the environment in undesirable levels and caused un-quantified deleterious effects especially on the health of workers. There is inadequate trained technical human resources to support awareness campaigns in the public and private sectors; and Institutional weakness for supervising the trade and application of pesticides.

This situation calls for urgent additional service delivery measures for their management. This guideline document is an effort to supply the necessary guidance to the stakeholders in horticulture.

Background

Throughout economic activity whether it is mining, industry, agriculture, health etc. the major culprits of concern are chemicals (metals, dyes, acids, pesticides, drugs, solvents etc). Their effects arising from their physical, chemical and biological properties are now feared. The whole range of these insidious effects such as explosions, fires, massive acute poisoning, chronic diseases from chemicals have been spectacularly demonstrated by the chemicals themselves. The issue at stake therefore is the safety of man and his interest from them. The invariable subject of concern is "chemical safety".

Pesticides are widely used in horticulture. Currently permethrin is most widely used against foliage pests while dithane (a dithiocarbamate) is used against fungal damage. Organochlorines still do feature for horticulture among peasants but are no longer dominant as the case was thirty years ago. There is now a tendency to use Ambush CY (permethrin) or the organophosphates (Dursban, and Sumithion) against any leaf-eating insect on any crop.

The focus area of horticulture is the lucrative production of cut flowers (mainly roses) for export to Holland in Europe. Much of this is carried out in controlled environment in large green houses, which are intensively sprayed with a variety of pesticides. An inventory exercise by the Department of Occupational Safety and Health (1996, 2002) revealed that there are at least 23 such flower growing enterprises and thirty different formulations of pesticides used in each enterprise. The pesticides include all the chemical types of pesticides (bipyridyls, carbamates, organochlorines, organophosphates, metals, pyrethroids, sulphur based, etc).

Complaints have been registered in the Department of Labour, Employment and Industrial Relations about the adverse effects of these chemicals on workers in this sector. Cases include occupational blindness and miscarriage. Owing to the nature of flower growing, all the enterprises are located near water bodies as water sources and so discharges of wastes to these water bodies are a concern. NEMA has correspondingly received complaints about the discharges and pollution of the water bodies by the flower growers. These aspects require to be addressed.

Definition: Chemical Safety

The prevention and management of adverse health effects, both short term and long term, to humans and environment derived from the production, storage, transport, trade and disposal of their wastes and the minimization of economic losses arising from their hazards.

The strategy for chemical safety

As a result of the lessons learnt from incidents in the country and elsewhere in the world, the primary strategy is the prevention of adverse effects from chemicals.

The principal tools of this prevention can be summarized as follows:

- taking a critical attitude towards unnecessary use and over-use of any kind of chemicals
- to focus on the use of the least toxic alternatives of chemicals during the production, trade and use of chemicals.
- to ensure that pre-marketing testing of chemicals has been done and authentic results of their health and environmental effects are public available before the chemical is put to market.
- adequately considered siting and planning of land use for chemical industries, storage, transport routes and sites for big consumers or polluters such as energy production plants.
- licensing the production, the dealers and if appropriate the user.
- to ensure careful design of factories that have chemical processes, ensure effective process control and maintenance of the factory.
- to adequately manage transport systems where chemicals are passed including maintenance of good conditions of routes and vehicles.

- to control emissions from sources and ensure correct disposal, incineration and handling of wastes.
- to limit exposure to chemicals in the various settings: ambient and working environment, in water, soil, food and consumer products.
- to ensure that hazardous materials are labelled so that adequate danger symbols on them are visible, clear, and appropriate.
- to ensure that all people involved in production, transport, storage, trade or use of chemicals are adequately trained and made aware of the dangers involved and how to mitigate them.

All these are reasonably covered in the laws named above.

Why the concern

There is a widespread use and misuse of pesticides in the country driven by health and economic motives. The pesticides are handled by persons inadequately informed and guided in correct procedures. Consequently the pesticides have entered the environment in undesirable levels and caused qualitatively observable but largely unquantified deleterious effects. These include:

- III Health on man:** Quite apart from the threat of “major accident/hazards”, pesticides cause ill health to man.

Examples include acute and chronic poisoning, allergic diseases, tumours, genetical diseases, attack on the immune system, and cause deformities among the offspring of the species.

Acute effects alone have been responsible for over 170,000 cases of poisoning in Uganda annually. 1% of these cases are fatal. 50% of the modern pesticides are mutagens, i.e cause heritable changes in the genetic material, DNA. This is of concern since it poses a threat to the gene pool of Uganda's biodiversity, which is ecologically critical, extensive and economically valuable. For example, with regard to terrestrial biodiversity, mention must be made of pesticide damage to pollinating insects (often non target as for bees) caused by pesticide application particularly aerial spraying, which has adverse effect on fruit production.

- Degradation of plant species:** Many tropical plants depend on insects for pollination. A widespread and injudicious use of pesticides therefore reduces insect's ability to effect pollination and therefore impairs

reproduction among plants. This situation is antagonistic to the national drive towards reforestation and fruit production.

- iii. **Degradation of aquatic biodiversity:** Pesticides adversely affect populations of organisms, which serve as food for economic species (e.g. fish). As pesticides are applied on plants and livestock on the land they are washed down into water bodies.

The presence of pesticides in water systems affects populations of aquatic insects, crustaceans and other invertebrates that form an important source of food for fish and birds (both aquatic and terrestrial). Long time suppressive effects of pesticides on total biomass must therefore be prevented in order to prevent reduction of fish and bird populations.

- iv. **Degradation of ecological system:** Many of the pesticides that have been used intensively over long periods in Uganda are organochlorines of POPs category. These are well known for their persistence and accumulation in the environment apart from their inherent toxicological behaviours. But no serious monitoring of their levels (residues) in food and drink has been done since 1976, neither have residue levels been monitored in soil and water bodies that form the country's great economic asset.

- v. **Soil degradation:** Pesticides also affect the quality of soils. There are variety of ways by which they get into the soil: During crop spraying, 70 - 90 percent of pesticides fall on soil; drift of droplet clouds, vapours from aerial spraying, irrigation waters, treated seeds, rainfall, run-off from cattle dips etc. At low doses of pesticides the soil takes the role of universal adsorber, purifier and neutralizer for all kinds of pollutants and mineraliser of organic matter.

However at high doses pesticides interact negatively with the soil biota, primarily with micro organisms (bacteria, fungi, actinomycetes, soil algae etc) and with the diverse soil fauna. These organisms are destroyed and the soil microstructure is altered adversely. The result is:

- Lower soil fertility
- Deterioration of the quality of crops (quite separate from deterioration as a result of pests)
- Loss of the soil function as a universal purifier of natural and xenobiotic compounds
- Loss of the genetic stock of the soil.

These effects should be assigned due importance because Uganda, is an agricultural country, with a rapidly growing population, which depends on the quality of her soil for socio-economic development.

The Overall Goal

The overall policy goal is sustainable social and economic development, which maintains and enhances safety, health and environmental quality and at the same time maintains resource productivity on a long-term basis.

The purpose of the Guidelines

To provide guidance and information to the workers, the employers and the relevant communities on the safe use of pesticides

Key Objectives

Specifically, the guidelines seek to meet the following objectives:

- Enhance the safety, health and environment and so ensure good quality of life of all people in Uganda and promote long-term, sustainable socio-economic development through sound environmental and natural resource management and use;
- Integrate safety, health and environmental concerns in the development efforts in the horticulture sector at enterprise level in Uganda with full participation of the stakeholders;
- Optimise resource use and achieve a sustainable level of resource consumption;
- Raise public awareness to understand and appreciate linkages between environment and development; and
- Ensure individual worker, employer and community participation in safety, health and environmental improvement activities.

Facts, Terms and Concepts on pesticides

Pesticides

Pesticides are a group of toxic chemicals that are very important to Uganda's national economy because of their use in agriculture and public health. They are the most abundant, most accessible and also the most misused toxic chemicals available in our market. They pose serious concern.

Definition

A pesticide is a chemical substance used for destruction of an organism that is detrimental to man or his interest.

The following is the definition of pesticide in the International Code of Conduct on the Distribution and Use of Pesticides:

Pesticide means any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or which may be administered to animals for the control of insects, arachnids, or other pests in or on their bodies.

The term 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 and transport.

In an ordinary way, pesticides are classified according to target species they are meant to kill. Their general names then denote the type of pesticides.

Examples:

INSECTICIDES kill insects.

LARVICIDES kill larvae of insects and other species.

FUNGICIDES kill fungi (moulds).

RODENTICIDES kill rats, mice, and other rodents.

MITICIDES kill mites.

MOLLUSCIDES kill snails (molluscs).

HERBICIDES or weedicides kill weeds.

AVICIDES kill birds.

NEMATOCIDES kill some types of parasitic worms (nematodes).

More technically pesticides are classified according to their chemical make up (composition):

Table 1: Commonly Used Pesticides

Group	Named Example
ORGANOPHOSPHATES	Malathion, DDVP, Diazinon, Methyl, Parathion, Dursban, Phosdrin, Fenitrothion, Dimethoate (Rogor), Bromophos
ORGANOCHLORINES	DDT, Aldrin, Dieldrin, Lindane, BHC, Thiodan, Toxaphene
CARBAMATES	Dithane M45, Dithane M22, Furadan
PYRETHRINS	Ambush CY (permethrin), Ripcord (cypermethrin)
BIPYRIDYL	Grammoxone (Paraquat), Weedol, Diquat
PHENOXY ACETIC ACID	2,4,-D; 2,4,5, - T; MCPA
INORGANIC METAL	Shell Copper (copper oxide), Lead Arsenate Phenylmercuric Acetate, Arsenic trioxide.

2,4, - D = Dichlorophenoxy acetic Acid

2,4,5 - T = Trichlorophenoxy acetic acid

MCPA = Monochlorophenoxy acetic acid.

DDVP = Dichloro Dimethyl Vinyl Phosphate (vapona)

Modes of entry to the body

Pesticides may act gain entry into the body or on target species in several ways,

Examples:

- A pesticide which kills the pest by first passing into it through the skin, cuticle, or exoskeleton, is a CONTACT POISON;
- A pesticide which kills the pest by first passing into the stomach is a STOMACH POISON;
- A pesticide which is distributed in the air is a FUMIGANT. It may act as a contact poison or be inhaled, according to target species.

Fumigants strictly apply to pesticides in the form of a gas or a vapour, but sometimes when droplets of an aerosol impinge on flying pests and act as a contact poison, the pesticide has been described as having a fumigant action.

Systemic pesticides

Systemic pesticides can be absorbed by the food source of a pest, and kill the pest without affecting the source. They are usually insecticides, larvicides or fungicides applied to the leaves of plants or to the soil around the plant so that they pass into it through the roots.

Other systemic pesticides may be designed to kill the plant itself if it is a weed. When the herbicide is applied to the leaves or to the soil, it is absorbed by the plant and kills the root also.

Confusion sometimes arises over the use of the word 'systemic'. When it is used to describe a pesticide, it usually has the meaning given above. However, in toxicology it may refer to any poison which is absorbed by an organism and interferes with its metabolism.

Technical Products, Active Ingredients, Formulations

The technical product is the pesticidal chemical plus impurities, which are associated with it in its manufacture. The pesticide chemical is also known as the active ingredient. The active ingredient is usually mixed with other chemicals to facilitate its use. It is then known as a formulation. Formulations usually need further dilution.

Formulation are complex chemical mixtures.

Only a selection of those in use are shown below. Examples:

Solids:

- Wettable or soluble powders (WP, WS or SP) or granules (SG) to be added to water;
- Granules (GR), Dusts or Dustable powders (DP), often applied as such;
- Pellets or Paste (PA) used for baits (RB);
- Tablets (TB) for smoke, gas or vapour generation;

Pesticides can also be incorporated into other materials such as plastics and mosquito coils and nets.

Liquids:

- Emulsifiable concentrates (EC) to be added to water, water in oil emulsion (EO) or oil miscible liquids (OL)
- Liquids (UL) for use in ultra low volume (ULV) application equipments
- Aerosol generators (AE)
- Fogging concentrates (HN or KN)
- Pour-ons (PO) for direct application to skin of animals
- Shampoos for humans

The following points can be noted:

- i. Active ingredients exist in various physical forms: solids, liquids or gases. The physical form of the active ingredient is not always the same as that of the formulations in which they are used.

While a formulation is designed mainly to facilitate use and increase the effectiveness of the active ingredient, it may also be modified to increase the safety of handling the pesticide. For example, the hazard of distributing a solid formulation may be less if it is a granule rather than a dust.

- ii. The non-active ingredient components of a pesticide formulation e.g. solvents including xylene, methylene chloride and kerosene may add to the overall toxicity of the product.

Gases are released either from tablets by exposure to air (e.g. cyanide), or from cylinders (e.g. methyl bromide). They are not usually formulated, but irritating or smelly agents may be added to warn of their presence.

Concentrations of active ingredients in formulations vary greatly. Whenever any formulation is specified, the concentration should also be stated.

Toxicity

The toxicity of a chemical is its ability to cause a harmful effect in a living organism.

The following points may be noted:

- i. Toxicity may vary greatly between species. It is obvious that if a pesticide is to be effective, it must be highly toxic to the target species.
- ii. The toxicity of a formulation usually varies with the concentration of the active ingredient in the formulation, but it can vary:
 - With non-pesticidal constituents of a formulation, or
 - If impurities associated with the active ingredient exceed their average levels, e.g. after long storage.
- iii. Acute toxicity is quantified by the LD50 value. This is a statistical estimate of the number milligrams (mg) of a chemical per kilogram (kg) body weight required to kill 50 percent of test animals.
- iv. The letters LD refer to Lethal Dose administered to the group of animals, and a similar notation may be used for other percentage of kill, e.g. LD10 or LD100 , or for other ways of administering the chemical, e.g. LC50 (Lethal Concentration) in inhalational studies.

Guiding Principle

Everyone who handles pesticides has a duty to ensure that the pesticides affect no other person, and that adverse environmental effects are avoided as far as possible.

Besides the law, all said and done, it is not the rigorous enforcement based on utilisation of sanctions of the law to the full that counts. This only leads to conflict with the law and is counter-productive. Rather, it is the provision of information, skills and knowledge that lead to sense that really counts.

Consequently the strategy is to develop alertness and involvement of all people concerned with the subject through creation of attitude and practice changing awareness. In line with the purpose of these guidelines, the information that may be of help to the stakeholders is provided.

Labels

The first step in the use of pesticides is the reading of the label. Consequently no one who cannot read a label should handle a pesticide.

- The label gives the trade name and the approved name of the pesticide.
- The active ingredients, and the hazard it presents.

Transport by truck or boat

- Containers of pesticides should never be carried in the same truck or boat as food or animal feeds because if the containers leak, foodstuffs may absorb pesticides especially in the liquid form. Never carry pesticides in the same truck or boat as food or animal feed for the same reason that they may be absorbed if the container for some reason leaks.
- Note that the food may not show that it has been contaminated.
- Whenever the pesticides are carried, the deck of the truck or boat should always be examined after unloading for any evidence of leakage. If containers might have leaked, the deck must be decontaminated immediately.
- Decontamination is carried out by scrubbing the deck with water. Use saw dust, news papers or old cloth to absorb the water, and dispose of these in the same way as empty containers namely by burning or burying. Feet and hands must be protected during decontamination.

Storing and using pesticides

- Unused pesticides should be kept in a locked cupboard, but not in the same cupboard as drugs, or medicines.
- Do not use pesticides in any other way other than as described on the label.
- Pesticide containers in use should be kept out of the reach of children

- Pesticides should be kept in their original containers. Do not repack or put them in bottles or other containers except in the original properly labelled containers. If a child or adult mistakenly drinks or eats a pesticide, the medical person attending to him needs to have access to the original label to save him or her. These labels are important.

Exclusion from a sprayed area

- After application of pesticides in the agricultural area, no unprotected person should enter the sprayed area.
- The exclusion areas must be marked with flags or other marking that is understood by the local population at work or near the sprayed area. This marking should be removed as soon as the exclusion period has ended.
- For areas dusted or sprayed with liquid formulation of a slight hazard pesticide, this exclusion should last until the pesticide has dried up on the crop.
- For pesticides with higher hazard ranking, the label on the original container gives the exclusion period and this label should be consulted to.

Disposal of wash water

- In areas where the ground water is not high, wash water can be allowed to soak away slowly in a pit and the pit should be refilled with soil in a slow way so that the water does not overflow from the pit. Recall that most flower growing farms are located in low lying areas next to lakes or rivers. This implies that the ground water is near the surface and this method of disposal is null and void.
- Most pesticides will either be inactivated as they soak away through the soil or be absorbed on to soil particles so that they will not travel far from the point of spraying. However, the persistent organic pollutants do move beyond and this method will not work for them. These pesticides should not be used at all in Uganda.
- The pit should be at least one meter deep and more than 100 meters away from streams, lakes or any water body, or house. The base of the pit should be dry before use.

- No more than the recommended amount of pesticide should be used. Disposal of unwanted pesticides can be avoided by care in calculating the amount of pesticide needed.

Disposal of wash water as a diluent

- When the ground water level is high, a dry pit cannot be dug. In this case, an alternative has to be found.
- Wash water can be used to make up the dilution of the same pesticide on the next day that the pesticide will be used.
- The wash water should be collected in a clearly marked drum with a tight lid.
- If the drum is transported, it should be treated in all respects as a container of pesticides. However when the water is used for dilution, it should be measured as if it was water.

Disposal of containers by burning

- Large containers of pesticides retain pesticide residues in them after use. If the containers cannot be returned to the supplier for destruction, they should be buried if they are made of hard paper.
- A hole suitable for burying containers must be dry and when the container is buried its highest point is at least one meter below the top surface as well as being 100 meters away from a water body or an occupied house.
- All containers should be pierced or crushed before burying. This should not apply to pressurised containers.
- Addition of manure or other rotting organic matter to the hole before filling will assist microbiological breakdown of the pesticide.
- If an approved disposal site for chemical waste is available (such as Kitesi in Kampala) all empty containers should be taken there.

Disposal of containers by burning

- This method of disposal can be used for boxes, card drums, plastic liners, and other combustible materials. This method should only be used if a pit cannot be dug and there is no other way of disposing the containers in an approved site for chemical waste.
- The smoke may affect the residents of the area so this has to be avoided by choosing a burning site that is remote.
- The fire must be down the wind in direction.

Specific steps in disposal of containers by burning

- First empty the containers of any pesticide and rinse out plastic liners.
- Dispose the resulting wash water as wash water described above.
- Make a fire in the pit at least 100 meters away from any well, river, or house.
- One worker at least must stand by the fire (windward side of the fire, to avoid the smoke) until the containers have been reduced to ash.
- When all the containers are bunt, cover the ash with soil and refill the pit.

Disposal of large quantities of unwanted pesticides

This has to be done with the direct guidelines of the National Environment Management Authority (NEMA) guidelines. The following should be noted:

Never

- Dispose into any river, lake or water body
- Put into any landfill site unless it has been specifically approved by NEMA.
- Use for any other purpose other than that stated on the original label.
- Donate to any person or organisation unless. It is not legal.

Options

- Return it to the supplier.
- Incinerate at high temperature in an approved incinerator (There is one in Nakasongola Industries Limited).

Principles of personal care and pesticide hygiene

- As said above, pesticides should never be stored or kept in the same place where food is kept or in the same containers used for food.
- Workers should be supplied with plenty of soap and water to wash themselves with after work with pesticides.
- The employer should give maximum supervision by a knowledgeable person during mixing of chemicals.
- Handling of pesticides and smoking cigarettes at work simply do not mix together. Therefore workers should not smoke at work.
- Workers handling pesticides should not chew anything while at work because the pesticide on the hands will be ingested.
- Applicators should wear protective clothing during spraying and these should be regularly cleaned. The thrust of protection is the face including the nose. Mouth and neck; the hands; the body and legs.
- Spraying equipment should be regularly serviced and replaced when leaks develop.
- The equipment for pesticide application should be accessible only to persons who fully understand and appreciate the dangers of pesticides. On no account should equipment be close to children.

Simple tips to avoid pesticide contamination

- Cover as much skin as possible with cotton cloth material.
- Clothing soaked with pesticide should be changed immediately.
- When moderately and highly toxic pesticides are used, ensure that the head and the neck are protected.
- When spraying above waist level, a wide brimmed cotton hat should be worn.

- The lower legs and feet can be contaminated during spraying or walking through recently sprayed areas. Therefore: wear boots during spraying; do not wear open sandals; If possible, do not walk through recently sprayed fields.
- Use gloves when handling concentrated pesticides; when applying highly toxic formulations; when washing or maintaining pesticide application equipment.
- Protect the lungs by wearing appropriate respirator: A respirator must be fitted with the proper type of canister, and this must be regularly replaced in accordance with the instructions on the canister; it must closely fit around the mouth and nose curvature; must be washed daily after removal of the canister and dried; must be kept in a clean, dry plastic bag when not in use; must be regularly inspected; must be worn only by persons trained to use them.

Mixing Pesticides

This is a process when the concentrated pesticide is diluted with water or appropriate liquid to the approved concentration before spraying. This process requires extra caution

- Wear a plastic apron when pouring the mixture into the application equipment.
- Use a paddle or stirrer to stir the mixture – not bear hands.
- Make sure that water for washing hands is close at hand.

Washing

- Always wash hands, arms and face with soap and water: before eating, before drinking, before travelling back to base, before urinating. This way you minimise contamination of the body and intake through the skin.
- Washing (bathing) is always needed; at the end of the day, one should take a bath or shower before going home.
- Each time the pesticide pump is refilled, persons engaged in hand spraying should wash their hands and arms.
- Whenever the skin is contaminated, wash immediately with soap and plenty of water. It is the responsibility of the employer to provide these items.

- Wash your working clothes separately from your domestic clothes – pesticides can cling to your clothes and you should not take pesticides home to your children in your clothes.

Recognising pesticide poisoning

Pesticide poisoning is usually of “acute” nature ie it occurs in a short while and the effects are recognisable within a few days., It usually results from ingestion of the pesticide or the pesticide enters the body through the skin.

The many signs and symptoms include:

- **General:** Extreme weakness and fatigue.
- **Skin:** Irritation, burning, excessive sweating, staining.
- **Eyes:** Itching, burning, watering, difficulty in seeing or blurred vision, narrowing or widening of the pupils.
- **Digestive system:** Burning in the mouth, burning in the throat, extreme salivation, nausea, vomiting, abdominal pain, diarrhoea.
- **Nervous system:** Headache, dizziness, confusion, restlessness, muscle twitching, staggering gait or loss of balance, slurred speech, fits unconsciousness.
- **Respiratory system:** Cough, chest pain, and tightness, difficulty in breathing, wheezing.

Whenever these are noted in the working environment ask:

- The person concerned and workmates if any contamination has occurred or if any work with pesticides has taken place.
- What product has been handled and in what quantity?
- When and for how long handling took place?
- What protective clothing has been used?
- If alcohol or medicines had been taken?

Look for:

- Evidence of pesticide containers, labels, or spray equipment, and retain them carefully.

- Evidence of exposure, spillage on to ground or clothing.
- For defective or faulty equipment.
- The patient's condition.

Smell: Many pesticide formulations have a characteristic smell, which will normally be noticeable if contamination to any great extent has occurred.

If over exposure is suspected, give first aid as described and call refer to a doctor as soon as possible. It will be important for the doctor to know what pesticide the person has been exposed to so that he can do the necessary speedy diagnosis.

First aid measures

- Check first for respiration and pulse. If either is absent, start resuscitation.
- Ensure that the first aider will not be contaminated in the process of resuscitation.
- If the person is unconscious, make sure that the airway is clear by pulling the chin upwards and backwards.
- Put the person at rest on the side or front downwards, with the head turned one side.
- If the person is to be transported, use this posture in order to prevent vomitus from entering the lungs.
- Never give anything by mouth to unconscious patient.
- Immediately remove any contaminated clothing from the person and wash the skin with soap.