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PESTICIDES RULES & REGULATIONS  
OF BHUTAN, 2019

PESTICIDE GUIDELINES



# PESTICIDE GUIDELINES

National Plant Protection Centre  
Department of Agriculture  
Ministry of Agriculture and Forests

2019



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# **Guideline 1: Standard Operating Procedures for Pesticides Board**

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The Pesticide Board is the ultimate Authority to decide on matters related to pesticides and provisions of the Pesticides Rules and Regulation 2019. The Board members are drawn from the technical Departments and other relevant agencies. The Pesticide Board is chaired by the Secretary of Agriculture and Forests. The purpose of this guideline is to regulate the procedures of the board meeting as follows:

1. The Pesticide Board shall convene the meeting at least two times a year.
2. The Pesticide Board shall convene a meeting only if a minimum of two-third members is present.
3. The Pesticide Board's member secretary will develop meeting agenda after consultation with the Chairman and members of the Pesticide Board.
4. After receiving feedback on draft agenda from the members, the member secretary will obtain approval from the Chairman and circulate to all members together with relevant reading materials at least 3 days before the scheduled meeting.
5. Pesticide Board meeting shall commence with the review of the previous meeting.
6. The Member Secretary shall keep the minutes of the meeting, finalize the minutes and arrange circulation among members.



## **Guideline 2: Guidelines and Standards on Manufacturing and Registration of Biopesticides**

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These guidelines provide information on the minimum infrastructure, equipment, instrument and data requirements during manufacturing and the registration of biopesticide (microbial and botanicals plant extract). In the preparation of this guideline references were made to some international guidelines such as those published by FAO. Applicants for the manufacture of biopesticide who require further clarification on these guidelines or other matters related to registration may contact the Secretary of the Pesticides Board at the following address:

***Department of Agriculture, National Plant Protection Centre (NPPC), Semtokha***

### **2.1 Guidelines for Developing Proposal for Manufacturing of Biopesticides**

Before obtaining a License to operate a bio-pesticide manufacturing unit, applicants must get their business proposal endorsed by the NPPC and the Department of Agriculture. Proposal on manufacture of bio-pesticides should include, but not limited to, the following:

- The name and address of the manufacturing plant at which the biopesticide will be produced.
- Flowchart of the process of manufacturing process of the biopesticide shall be submitted with the application for registration.
- All raw materials used shall be stated.
- A description of the procedures used to assure consistency of the composition of substance produced, e.g., calibration of equipment, sampling regimens, analytical methods or other quality control methods should be stated clearly.
- Provide information on substances used in the manufacturing process (example: identity of any extraction solvent, enzymes, stabilizers such as antioxidants), and any special precautions such as control of light, humidity and temperature.
- Occupational health and safety measures.

## 2.2 Data Requirements for Microbial Registration

The manufacture can apply for registration of product with the following data.

### 2.2.1 Biological and Chemical Characteristics

- Systematic name consisting of genus and species of microbial shall be given. (Example: *Bacillus thuringiensis*, *Trichoderma harzianum*).
- The strain or isolate of microbial shall be stated clearly. (Example: *Bacillus thuringiensis* subsp. *kurstaki*, strain ABTS-351; *Trichoderma harzianum* UPM 29)
- The common name of microbial shall be provided if available.
- The source or origin of microbial shall be mentioned. The host range of microbial has to be tested on honey bee or selected flora and fauna. For microbial where technical information is well known to be safe to human, plant, animal and the environment, it is not required to submit host range data. The mode of action of microbial should be mentioned clearly (example: non-toxic mechanisms, infection of target, competitive or antagonistic behavior, etc.).
- The specification of the product includes appearance, physical state, colour, pH, persistent foaming, solubility or suspendability, particle size, viscosity (liquids) and density. Type and test method used to specify the product shall be mentioned clearly.
- Composition of active and inert matters in % w/w in formulation shall be clarified. Microbial active ingredient needs to be specified in relevant unit of activity. The example unit of activity for each microbial are as follows: Entomotoxic bacteria in endotoxin content (IU/mg or ml), Baculoviruses (Nuclear Polyhedrosis Virus (NPV) and Granulosis virus (GV)) in viral unit (Polyhedral Occlusion Body (POB)/capsule count/ml or mg), Entomopathogenic fungi and antagonistic bacteria (Colony Forming Unit (cfu)/g or ml) product.
- Test procedure and criteria for identification for each microbial shall be stated clearly. The following bioassays are recommended:
  - Entomotoxic bacteria; immunology assays: Elisa/Dot Blot assay test or potency of product by bioassay method (LC50) on target larvae of *Trichoplusiani/Helocoverpaarmigera* and potency

against a reference using artificial diet or leaf disc method or in the water for mosquito larvae.

- Baculoviruses; biological assay for determining the LC50/LD50 of the formulation. Bioassay for Nuclear Polyhedrosis Virus (NPV) by the diet surface contamination method and Granulosis virus (GV) using bioassay against *Chiloinfuscatellus*, *Plutellaxylostella* or *Acheaejanata*.
- Entomopathogenic fungi; pathogenicity test on insect and bioassay procedure for *Plutellaxylostella*.
- Test procedure other than above may also be used for consideration.
- The formulation product should be free from biological contaminant especially human and mammals pathogenic contaminants such as *Salmonella*, *Shigella*, *Escherichia coli* and *Vibrio cholera* bacteria. Other microbial contaminants should not exceed 1 x 10<sup>4</sup> count/ml or g of formulation. The microbial contaminants should be determined throughout the process of production. The method used shall be mentioned and the result attached in product specification sheet.
- Shelf life claim of biopesticide product should not be less than six months. A minimum of two months storage stability data for six months claim or three months data for one year shelf life claim at ambient temperature (specify temperature and storage conditions in the study report) shall be submitted.

### **2.2.2 Bio-efficacy**

The recommended product must be tested against target pests and crops e.g., *Phytophthora capsici* of chili. Details on efficacy test protocol for microbial is attached in Annex 1.

### **2.2.3 Packaging and Labelling**

**Packing:** The type of packing material used shall be stated. The packaging should comply with Bhutanese Standard or international standard.

**Labels and leaflets:** Label requirements shall be prepared by the NPPC.

## **2.2.4 Infectivity and Pathogenicity or Toxicity to Non-target Organisms**

Infectivity and pathogenicity or toxicity to non-target organism's data should include:

- Report on infectivity and pathogenicity or toxicity to non-target microorganism for the technical material of the microbial shall be submitted.
- Acute oral and dermal study for formulated product shall be submitted.

## **2.2.5 Human Health Exposure, and Environmental Fate and Effects**

Data on human health exposure/ environmental fate are required if any results from Section 2.2.4 suggests risk. Extrapolation to human health can be done from mammalian testing if the microbial pest control agent is in any category of concern. Reports from publication journals about negative effects on human health and environmental fate are accepted.

## **2.2.6 Residue**

Residue data shall be submitted if microbes are suspected to produce any residue or metabolites of concern on food or feed items. Substances used for formulation must not produce residues of concern on food or feed items. Reports from any reliable and reputable publication journal is accepted.

## **2.3 Data Requirement for Botanical/Plant Extracts**

### **2.3.1 Biological and Chemical Characteristics**

- The systematic name or Latin name consist of genus and species name of the plant shall be given e.g., *Pongamiaglabra*, *Annonasquamosa*, *Chrysanthemum cinerariaefolium*.
- The common name of plant shall be provided if available.
- The origin of the plant shall be stated included locality and growing condition.
- Composition of active and inert in % w/w and purpose in formulation shall be clarified. The following information is required: chemical name according to IUPAC and CAS, CAS number, structural formula

and ISO name.

- Test procedures/methods and criteria for identification of active ingredient shall be provided. Botanical or plant extract products include unpurified or partially purified extracts derived from plants including oils or other extracts. For example, natural ‘pyrethrum’ may consist of a chemical mixture of a number of related pyrethrins. ‘Neem oil’ may consist of a mixture of chemical components, some characterized and other not characterized. If the substances are identified, validated method for analyzing the identified active substance shall be provided. Only identified or characterized active ingredients shall be declared on the label.
- Product should be free from any impurities such as toxic metabolites apart from actives, inactive metabolites and microbial. Show in detail the process of impurities (method of removal) during manufacturing process.

### **2.3.2 Efficacy of Botanicals**

Efficacy data requirements for botanical/plant extract are similar to those for conventional agriculture products. Field study and laboratory study are accepted depending on purpose of use. Detailed on efficacy test protocol is attached in Annex 1.

### **2.3.3 Packaging and Labelling**

The type of packing material used shall be stated. The packaging should comply with Bhutan Standard or international standard.

### **2.3.4 Toxicological Evaluation**

The aim of the assessment is to ensure that botanical/plant extract product do not have any harmful effects on humans or mammals. Information from studies or publications is accepted for evaluation. Toxicological data on acute oral and acute dermal are required for formulated product.

### **2.3.5 Environmental and Ecotoxicology Safety Testing**

Information from studies or publication on ecotoxicity is accepted for evaluation. Based on the evaluation on the available information, further

ecotoxicological data may be required.

### **2.3.6 Residue**

Residue studies are usually not required for botanical/plant extract. Botanical/plant extracts usually do not generate residues because they are rapidly degraded in the environment. They cannot be radio-labelled for tracing purpose like synthetic pesticide. Botanical/plant extracts are also exempted from the need for maximum residue limit (MRL). The residue data will be requested on case-by-case basis if evaluation found any significant issue on toxicology, environment or non-target species.

### **2.3.7 Storage Stability of Botanicals**

Storage stability test shall be conducted in accordance with the:

- FAO Accelerated Storage Test Procedures is performed usually at  $54 \pm 2$  °C for 14 days or at  $45 \pm 2$  °C for 6 weeks or at  $40 \pm 2$  °C for 8 weeks or at  $35 \pm 2$  °C for 12 weeks or at  $30 \pm 2$  °C for 18 weeks when applicable.
- Two- Year Storage Stability (Ambient testing) to demonstrate the storage stability of a formulation under true storage conditions usually over a period of 2 years. The test shall be conducted at ambient temperature or, 20 °C, 25 °C or 30 °C dependent on the final area of use.
- The packaging used in the study shall be based upon that in which the product is sold.

## **2.4 Guidelines for the Minimum Infrastructure to be created by the Manufacturers of Biopesticides and Their Formulations**

These are the general requirements. For individual biopesticides, specific requirements are to be installed and additional equipment are to be supplemented to suit the reactions involved in the manufacturing process.

### **2.4.1 Minimum manpower**

The following is the requirement for the minimum manpower to operate manufacturing infrastructure for biopesticides shall be as under:

| <b>Manpower</b>                                   | <b>For technical plant</b> | <b>For formulation plant</b> |
|---|----------------------------|------------------------------|
| Production Manager                                | R                          | R                            |
| Supervisor  | R                          | R                            |
| Instrument and process control personnel          | R                          | R/NR                         |
| Maintenance Personnel (Plant and utilities)       | R                          | R                            |
| Store Keeper (Raw material and finished products) | R                          | R                            |
| Quality Control Chemist                           | R                          | R                            |
| Security personnel                                | R                          | R                            |

*R = Required; NR = Not required*

## 2.4.2 Minimum Infrastructure, Machinery & Equipment

| <b>For technical plant</b>  | <b>Equipment for quality control laboratory</b>  |
|---|--|
| <ul style="list-style-type: none"> <li>• Control console,</li> <li>• Feed tank for raw material,</li> <li>• Reactors,</li> <li>• Distillation towers,</li> <li>• Evaporators,</li> <li>• Condenser/ heat exchanger/ boiler/ extinguisher plant/ chilling system,</li> <li>• Steam plant,</li> <li>• crystallizer,</li> <li>• Centrifuge,</li> <li>• Drier,</li> <li>• Phase separator,</li> <li>• Extractor,</li> <li>• Storage tank,</li> <li>• Process water tank.</li> </ul> | <ul style="list-style-type: none"> <li>• Analytical weighing balance;</li> <li>• Hot air oven;</li> <li>• Refrigerator;</li> <li>• pH meter,</li> <li>• Spectro-photometer / colourimeter,</li> <li>• GLC / HPLC depending on the products analytical process as in the specification;</li> <li>• Standard glassware;</li> <li>• Chemical &amp; general requirements for laboratory;</li> <li>• Pesticide Repository;</li> <li>• Specification / BIS standard of the product to be manufactured / formulated,</li> <li>• Sieve shaker;</li> <li>• Fume Hood;</li> <li>• Distilled water unit or equivalents;</li> <li>• Flash point apparatus;</li> <li>• Melting point apparatus</li> </ul> |

|                               |                                      |
|-------------------------------|--------------------------------------|
| <b>For formulation plant:</b> | <b>Packaging plant and equipment</b> |
|-------------------------------|--------------------------------------|

| <b>Equipment</b>       | <b>Solid<br/>(DP, WG, SP)</b> | <b>WG,<br/>G</b> | <b>Liquid<br/>(EC, EW, SL)</b> | <ul style="list-style-type: none"> <li>• Packaging machinery,</li> <li>• Filling machine (automatic / semi-automatic),</li> <li>• Weighing machine,</li> <li>• Bagging machine,</li> <li>• Sealing machine,</li> <li>• Labeling equipment.</li> </ul> |
|------------------------|-------------------------------|------------------|--------------------------------|---|
| Feeding channel chute  | R                             | R                | R                              |   |
| Jaw Crusher            | R                             | R                | NR                             |   |
| Raw Material feed tank | R                             | R                | R                              |   |
| Pulverizer             | R                             | R                | NR                             |   |
| Blender                | R                             | R                | R                              |   |
| Siever                 | R                             | R                | R                              |   |
| Bag Filter             | R                             | NR               | NR                             |   |
| Homogenizer            | R                             | R                | R                              |   |
| Ball Mill              | R                             | NR               | NR                             |   |
| Weighing Machine       | R                             | R                | R                              |   |
| Vessel with Stirrer    | R                             | R                | R                              |   |
| Drier                  | R                             | R                | NR                             |   |
| Cooling machine        | NR                            | R                | R                              |   |
| Sprayer                | NR                            | R                | NR                             |   |
| Water Tank for liquid  | NR                            | NR               | R                              |   |
| Filter                 | NR                            | NR               | R                              |   |

DP: dustable powder; WG: wettable granule; SP: soluble powder; SL: soluble liquid; EC: emulsifiable concentrate; EW: oil in water emulsion

## **2.5 Guidelines for Minimum Infrastructure Facilities to be created by the Manufacturers of Microbial Biopesticides (Antagonistic fungi, Entomopathogenic fungi, Antagonistic bacteria, Entomotoxic bacteria)**

### **2.5.1 Manpower Requirement**

At least a quality control biologist, and sufficient personnel to supervise production, maintenance are the minimum requirement.



## 2.5.2 Equipment Requirement

These are the general requirements of minimum infrastructure to be created by the manufacturers. However, for specific microbial biopesticides formulation(s) and their quantum of production, requirement of manpower, space, equipment/ instrument may be needed.

| General requirement  | Plant equipment   | Laboratory equipment & instruments   |
|--|---|--|
| <ul style="list-style-type: none"> <li>• Production, Mixing &amp; Drying Room</li> <li>• Formulation Unit for Antagonistic fungi/ Entomopathogenic fungi/ Entomotoxic bacteria,</li> <li>• Sterilization room,</li> <li>• Packaging and storage room,</li> <li>• Quality control laboratory,</li> <li>• Protective clothing and respiratory devices,</li> <li>• First Aid Kit,</li> <li>• Waste disposal arrangement in compliance with pollution control norms</li> </ul> | <ul style="list-style-type: none"> <li>• Plant fermenter with all accessories,</li> <li>• Bioreactor,</li> <li>• Shaker,</li> <li>• Steam boiler,</li> <li>• Chilling plant,</li> <li>• Air compressor,</li> <li>• Distillation unit,</li> <li>• Micro centrifuge,</li> <li>• Magnetic stirrer,</li> <li>• Sieves,</li> <li>• Electronic weighing machine,</li> <li>• Blender,</li> <li>• Homogenizer,</li> <li>• Vortex,</li> <li>• Vibro-screen,</li> <li>• Autoclaves</li> <li>• Sealing machine,</li> <li>• Racks and cabinets</li> </ul> | <ul style="list-style-type: none"> <li>• Autoclave,</li> <li>• Water bath,</li> <li>• Shaking incubator,</li> <li>• Refrigerator &amp; Deep freezer,</li> <li>• Thermo hygrometer,</li> <li>• U. V. light,</li> <li>• BOD Incubator,</li> <li>• Hot Air oven,</li> <li>• Laminar Flow,</li> <li>• pH meter,</li> <li>• Balance (2-3 decimal places), Vacuum pump,</li> <li>• Hot plate,</li> <li>• Microscope and accessories,</li> <li>• Glassware viz. Conical Flasks, Test tubes, Beaker etc., Petri dishes,</li> <li>• Titanium inoculating needles,</li> <li>• Pipettes (0.1 ml to 20 ml) &amp; tips,</li> <li>• Haemocytometer,</li> <li>• Colony counter,</li> <li>• Bunsen burner / equivalents</li> </ul> |

## 2.6 Guidelines for Minimum Infrastructure Facilities to be created by the Manufacturers of Baculoviruses (NPV, GV)

### 2.6.1 Manpower Requirement

At least a quality control biologist and sufficient staff to supervise production, maintenance, and stores are required.

### 2.6.2 General Requirement and Equipment

These are the general requirements of minimum infrastructure to be created by the manufacturers. However, for specific Baculoviruses formulation(s) and their quantum of production, requirement of manpower, space, equipment/ instrument may be needed.

| General requirement   | Equipment and Instrument requirement   |
|---|--|
| <ul style="list-style-type: none"><li>• Post culture production room with temperature and humidity control,</li><li>• Moth ovi-position room with temperature &amp; humidity control</li><li>• Production room with temperature &amp; humidity control,</li><li>• Diet preparation room and machine,</li><li>• Virus processing laboratory,</li><li>• Cold storage,</li><li>• Washing and sterilization facility,</li><li>• Stores room,</li><li>• Protective clothing &amp; Respiratory devices,</li><li>• First Aid Kit,</li><li>• Waste Disposal arrangement</li></ul> | <ul style="list-style-type: none"><li>• Diet preparation machine (mixer),</li><li>• Diet dispenser,</li><li>• Multi-channel pipette,</li><li>• Vacuum pump with aspirator blenders,</li><li>• Multipurpose centrifuges,</li><li>• B.O.D. incubator or an incubator room or an environmental chamber,</li><li>• Digital and scale balance,</li><li>• Haemocytometer with shallow depth counting chamber,</li><li>• Hot air oven,</li><li>• Compound research microscope,</li><li>• Vortex mixers,</li><li>• Tally counters,</li><li>• Electric stove,</li><li>• Autoclave,</li><li>• Shaker,</li><li>• Water distillation unit,</li><li>• Oviposition iron cage,</li><li>• Racks and cabinet,</li><li>• Refrigerators</li></ul> |

## 2.7 Guidelines for Minimum Infrastructure Facilities to be created by the Manufacturers of Botanical Biopesticides (Pyrethrum, Azadirachtin, Cymbopogon etc.)

### 2.7.1 Manpower Requirement

At least a quality control biologist and sufficient staff to supervise production, maintenance, and stores are required.

### 2.7.2 General, and Plant and Laboratory Equipment Requirement

These are the general requirements of minimum infrastructure to be created by the manufacturers. However, for specific botanical biopesticides formulation(s) and their quantum of production, requirement of manpower, space, equipment /instrument may be needed.

| General requirement   | Plant equipment & instrument requirement   | Laboratory equipment & instrument requirement   |
|---|--|---|
| <ul style="list-style-type: none"> <li>• Extraction room,</li> <li>• Production room,</li> <li>• formulation unit,</li> <li>• Packing and storage room,</li> <li>• Quality control laboratory,</li> <li>• Protective clothing &amp; Respiratory devices,</li> <li>• First aid measures,</li> <li>• Waste disposal arrangement in compliance with Pollution Control norms</li> </ul> | <ul style="list-style-type: none"> <li>• Phase separation vessels,</li> <li>• Decanter,</li> <li>• Mixing vessels with stirrer,</li> <li>• Centrifuge,&amp; vortex</li> <li>• Electric oven with thermometer,</li> <li>• Chemical measuring cylinders,</li> <li>• Chemical transfer pumps,</li> <li>• Filter pressure pump,</li> <li>• Measuring cans,</li> <li>• Electric weighing machine,</li> <li>• Counter scales,</li> <li>• Filtration assembly,</li> <li>• Water distillation unit,</li> <li>• Wrist action shaker,</li> <li>• Blender,</li> <li>• Large air tight containers,</li> <li>• Material filling,</li> <li>• Trays,</li> <li>• Soxhlet apparatus,</li> <li>• Storage tank,</li> <li>• Filling machine,</li> <li>• Sealing machine,</li> <li>• Packing accessories</li> </ul> | <ul style="list-style-type: none"> <li>• HPLC System,</li> <li>• pH meter,</li> <li>• Spectrophotometer,</li> <li>• Refrigerator,</li> <li>• Thermometers,</li> <li>• Microscope,</li> <li>• Autoclave,</li> <li>• UV Lamp of appropriate wavelength,</li> <li>• Abel flash point Apparatus,</li> <li>• Incubator,</li> <li>• Glassware viz. Conical Flasks, Test tubes, Beaker, Separating funnel, Glass tubes,</li> <li>• Pipette fillers,</li> <li>• Pipettes &amp; tips,</li> <li>• Burette,</li> <li>• TLC apparatus &amp; accessories,</li> <li>• Micro-syringes</li> </ul> |

## **Guideline 3: Implementation Framework and Guideline for Supply of Bio-pesticides**

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### **3.1 Rationale**

Bio-pesticides include those products which are substances or organisms from natural sources, which are used for plant protection purposes. These are locally prepared or manufactured, packaged and certified as organic under strict standards and procedures. There is an urgent need for supply of bio-pesticides in the country to cater to the growing needs of farmers who are adopting organic farming and those who choose to use more environmentally friendly farm inputs. This framework and guideline has been developed to meet the needs for the organic production and also to clearly set a system of procurement and supply. In pursuant to the decision of the 70<sup>th</sup> RNR-GNH Committee meeting, the Ministry of Agriculture and Forests (MoAF) has already decided that for the initial phase the Department of Agriculture (DoA) will facilitate the procurement and distribution of bio-products through its agencies.

### **3.2 Implementation guideline**

1. Bio-pesticide products need to be identified by the National Plant Protection Centre (NPPC) and registered with the Bhutan Agriculture and Food Regulatory Authority (BAFRA). Only ISO certified and Organic Materials Review Institute (OMRI) listed organic certified products accredited by Indian Fertilizer Authority, Indian Plant Protection Registry will be allowed to be imported. The import can also be made from other regional/ international agencies accredited by internationally recognized body.
2. The currently submitted bio-pesticide list should be updated in the future as and when required.
3. To begin with, the procurement through imports will be done by directly ordering and purchasing from the manufacturer/ authorized dealer for few years.
4. Bio-pesticides offered by interested companies for promotional purposes will be tested and promoted in the country for initial

years provided promoting companies are willing to bear all the costs. A prior approval from the DoA will be required and these bio-pesticides also need to be registered with the BAFRA.

5. The supply of bio-pesticides either imported or sourced within the country needs to be cleared/endorsed by the NPPC with approval from the DoA. These bio-pesticides need to be submitted for registration with the BAFRA prior to its import.
6. The NPPC will solely facilitate the procurement and distribution of bio-pesticides in the country unless the change in directives from the MoAF.
7. No private companies/individuals will be allowed to procure and distribute the bio-pesticides in the country. They need to indent and buy from the NPPC for personal usage.
8. Existing indent and distribution systems will be applied and followed for bio-pesticides.
9. The National Plant Protection Centre with collaboration with the National Organic Programme should carry out the required awareness program on bio-pesticides.
10. The National Organic Programme will facilitate any changes required to the implementation framework and guideline in consultation with the technical authorities.
11. In order to start the process, the dzongkhags and relevant stakeholders should indent their requirements with the NPPC.

### **3.3 Management of Bio-pesticides**

Separate store for bio-pesticides should be maintained in the NPPC, Semtokha.

### **3.4 List of Bio-pesticides Permitted for Import or locally produced/ Supplied in the Country**

Following is a list of some bio-pesticides (on priority ranking basis) that can be considered for import and use.

### 3.4.1 Priority 1: Fruit Fly Pheromones and Lures

#### 3.4.1.1 Para-pheromones

| Common name |                | Acronym | Chemical   | Field Longevity*(weeks)              |
|-------------|----------------|---------|--|--------------------------------------|
| 1           | Trimedlure     | TML     | <i>tert</i> -butyl 4 (and 5)- chloro-2-methylcyclohexane-1-carboxylate | Polymeric plug – 6<br>Liquid- 2 to 4 |
| 2           | Methyl Eugenol | ME      | Benzene,1,2-dimethoxy-4-(2-propenyl)                                   | Polymeric plug – 6<br>Liquid- 2 to 4 |
| 3           | Cuelure        | CUE     | 4-(p-hydroxyphenyl)-2-butanone acetate                                 | Polymeric plug- 6<br>Liquid 2-4      |

#### 3.4.1.2 Food Based Lures

| Common name |   | Acronym  | Chemical  | Field Longevity*(weeks)                           |
|-------------|---|----------|---|---|
| 1           | Protein baits:<br>Torula yeast/borax<br>Protein derivatives | TY<br>HP | Torula yeast/<br>borax<br>Hydrolized<br>protein | Pellet (1-2)<br>Liquid (1-2)                      |
| 2           | Synthetic food lures:<br>Ammonium acetate                   | AA       | Ammonia +<br>acetic acid                        | Membrane-based (4-6)<br>Liquid (1)<br>Polymer (4) |
| 3           | Ammonium (bi)<br>carbonate                                  | AC       | Ammonia   | Membrane-based (6)<br>Liquid (1)<br>Polymer (4)   |
| 4           | Ammonium salts  | A        | Ammonia Salt                                    |   |
| 5           | Putrescine  | Pt       | 1,4<br>diaminobutane                            | Membrane-based (4-6)                              |
| 6           | Trimethylamine  | TMA      |   | Membrane-based (4-6)                              |

### 3.4.1.3 Priority 2: Bio-pesticides

| Sl.no | Bio-agents  | Utilization  | Other specifications  |
|-------|---|--|---|
| 1     | Tenet WP (2% <i>Trichoderma asperellum</i> and 2% <i>Trichoderma gamsii</i> ) | These beneficial fungi have different modes of action and are active over different temperature and environmental conditions. They are effective for diseases caused by <i>Phytophthora capsici</i> , <i>Rhizoctonia</i> , <i>Pythium</i> and <i>Verticillium</i> . General label.                                     | General label. OMRI-listed. EPA Reg. No. 80289-9. Isagro USA; distributed by SipcamAdvan. |
| 2     | Trilogy. 70% clarified hydrophobic extract of neem oil.                       | Labeled generally for several insects and diseases, including Alternaria, anthracnose, downy mildew, leaf spot, and powdery mildew in cucurbits.   | OMRI-listed. EPA Reg. No. 70051-2. Certis USA, LLC.                                       |
| 3     | Serenade Soil. 1.34% <i>Bacillus subtilis</i> train QST 713.                  | This bacterium colonizes roots and produces compounds that affect pathogens directly and trigger metabolic pathways to activate the plant's natural defenses and modulate growth. Labeled for diseases caused by <i>Rhizoctonia</i> , <i>Pythium</i> , <i>Fusarium</i> , <i>Verticillium</i> and <i>Phytophthora</i> . | OMRI-listed. EPA Reg. No. 69592-12. AgraQuest, Inc.                                       |
| 4     | Cease. 1.34% <i>Bacillus subtilis</i> strain QST 713.                         | Broadly labeled for use on greenhouse vegetables. Labeled for angular leaf spot, anthracnose, bacterial fruit blotch, downy mildew, gummy stem blight, and Powdery mildew in cucurbits.  | OMRI-listed. EPA Reg. No. 69592-19-68539. BioWorks, Inc.                                  |

### 3.4.1.4 Priority 3: Other bio-pesticides

| Bio-agents/products |   | Utilization   |
|---------------------|---|---|
| 1                   | <i>Trichogramma spp.</i> (egg parasite)                       | Used for control of shoot borer, bollworms, stem borer    |
| 2                   | <i>NP Virus of Helocoverpaarmigera &amp; Spodopteralitura</i> | Used against bollworms and pod borers                     |
| 3                   | Neem Oil and Cake (Neem ban 50000 PPM)                        | Wide range of insect pests                                |
| 4                   | Bt ( <i>Bacillus thuringiensis</i> preparation)               | DBM and other Lepidopteron pests including army worm      |
| 5                   | Entomopathogenic Fungi (EPF) preparations                     | To control some insect pests by using some fungal strains |
| 6                   | Entomopathogenic Nematodes (EPN)                              | To control some insect pests using some Nematodes         |

### 3.4.2 List of Business Houses Considered for import of Bio-pesticides in the Country

| Name of Business house |  | Contact address   |
|------------------------|--|---|
| 1                      | Multiplex                                      | Multiplex Bio-Tech Pvt.Ltd.<br>#180, 1 <sup>st</sup> Main Road, Mahalakshmi Layout, Bangalore<br>-560086.India. Tel: 080-23497464, 23494406, 23497360,<br>Fax:080-23490647,<br>E-mail: <a href="mailto:multiples@multiplexgroup.com">multiples@multiplexgroup.com</a><br>Website:www.multiplexgroup.com |
| 2                      | T.STANES & COMPANY LIMITED                     | 8/23-24,Race Course Road, Coimbatore – 641 018, India.<br><a href="tel:+91-422-2221514">Tel:+91-422-2221514</a> , 222 3515-3518 Fax: +91-422-222 0432, 222 0857   |
| 3                      | Nimbion Organics                               | Nimbion Organics, 55, III Street, Balaaji Nagar, Ambattur, Chennai – 600 053. Tel: 044-26584641 Fax:044-26584642 Mobile: (o) 9433033229 Email: <a href="mailto:nimbionorganics@yahoo.com">nimbionorganics@yahoo.com</a>   |
| 4                      | Peak Chemical Industries Limited, Peak Biotech | Peak Biotech, Regd.Office: Sevoke Road, 2 <sup>nd</sup> Mile, Siliguri – 734001 (W.B), India, Telefax: + 91-3532541769/Cell: + 91 9434058763, Email: <a href="mailto:peakchem@peakgroupindia.com">peakchem@peakgroupindia.com</a> Website:www.peakgroupindia.com  |



## **Guideline 4: Commercial Pest Control Operation**

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The guidelines aim to assist the commercial pest control operation in complying with the legislation under which they are regulated, mainly the Pesticide Act 2000 and the Pesticides Rules and Regulation of Bhutan 2019. The Act requires individual pest control operators to be licensed. Licensing of the pest control operation is designed to protect pest control operators, consumers, members of the public and the environment from the harmful effects of pesticides.

License for pest control operation business shall be obtained from MoEA upon fulfillment of the conditions prescribed under Rules 24-29 of the Pesticides Rules and Regulations 2019. This guideline helps to outline the procedures in fulfilling those conditions.

### **4.1 Technical Certificate to Use Pesticides**

Commercial pest control operators must obtain Technical Certificate from the NPPC. Commercial pest control operators (hereafter referred to as an applicant) is defined in the Pesticide Rules & Regulations 2019 and refers to any individual who handles pesticides and operates pesticide application for commercial purpose. A Technical Certificate, without which an individual cannot operate pesticide application for commercial purpose, shall be issued to the individual who satisfies the following criteria. The License from MoEA does not substitute the requirement of a Technical Certificate. Such Certificates must be carried with the operators and must be produced upon demand by any authorized individual during inspection.

- is at least 21 years of age
- has completed a course listed in the section of *Training Curriculum*
- is employed as pest control operator
- has paid the relevant license fee.

The Technical Certificate to use pesticides is valid for a period of three years from the date of issue.

## **4.2 Certificate Authorizations**

### **4.2.1 Authorization types**

The Technical Certificate to use pesticides will authorize a pest control operator to use pesticides that are in the approved list of the NPPC.

### **4.2.2 Applying for a Certificate**

In order to obtain a Technical Certificate, an applicant must, in addition to the requirements in the above section, submit the following documents:

- Completed application form (which will be developed by the NPPC).
- A recent (taken within 6 months) photograph: full front view of head and shoulders not more than six months old, not smaller than 35 x 45mm and not larger than 40 x 50mm, good quality, sharply focused, not blurred or unclear, correctly endorsed on the back by the identifier who: has known the applicant for the past 12 months; is 21 years of age or over; must endorse the back of the photograph by writing 'This is a true photograph of [applicant's full name]' and sign underneath along with his/her CID number;
- Attach relevant qualification certificates and documents (e.g., copies of CID) certified by an authorized witness (who must sight the original documents to certify the copies).
- Pay the appropriate fee.
- Upon approval, the applicant will receive a photo identification Technical Certificate.
- The following information is detailed on the Certificate: Name, CID number; Photo; Certificate Number, Issue/Renewal date, Expiry date, Authorization/s, Seal & Signature of the certifying authority (NPPC/ Department of Agriculture).
- Pest control operators should carry the Technical Certificate with them at all times.
- Customers and/or authorized person may ask to see a pest control operator's Certificate to confirm that the pest control operator is qualified to perform a specific pest control activity.

### **4.2.3 Issue of Replacement Certificate**

A replacement Technical Certificate to use pesticides will be issued as per the existing system of the Royal Government of Bhutan.

### **4.3 General Conditions**

All holders of a Technician Certificate to use pesticides are required to comply with the Pesticides Act 2000 and the Pesticides Rules and Regulation of Bhutan 2019. Non-compliance constitute a breach of a condition of license in addition to an offence under the Act or regulations.

### **4.4 Training**

The pest control operators must be trained before they are certificate to operate as the pest control operators. Certificate(s) of trainings must be produced and attached with the form for the application of pest control operation license.

The training curriculum shall include following topics:

- Pest identification
- Pest habits and locations
- Pesticides selection
- Pesticides label interpretation
- Selection of personal protective equipment
- Selection and maintenance of equipment
- Pesticides application methods
- Calibration of sprayers and chemicals
- Safe handling of equipment and pesticides, including pesticides storage, disposal of unused or left-over pesticides
- Procedures for handling chemical spills
- Industry best practice
- Interpretation of material safety data sheets
- Side effects of pesticides

## **4.5 Vehicles for Pest Control Operation**

Vehicles used for the purpose of pest control, including the storage, transport and preparation of pesticides, should meet the following requirements:

- The vehicle should be labelled with the name of the pest control business
- The driver's cabin should be separate from chemicals and contaminated clothing or equipment.
- The chemical storage area should have appropriate ventilation
- Emergency telephone numbers should be clearly displayed in a prominent location (such as secured to the windscreen or dashboard) so that anyone can find them in case of a spill or other emergency.
- List of all chemicals carried on the vehicle should be kept in an easily accessible location
- A well-maintained fire extinguisher (dry powder or CO<sub>2</sub> type), within the expiration date, should be kept in an easily accessible location
- Suitable clean-up material for chemical spillages should be carried at all times. This includes a spare pair of gloves and materials to contain liquids and prevent spills such as commercial absorbent materials: (hydrated lime or dry sand). Pest control operators should ensure that their spill kit is clearly labelled, stored in an easily accessible location and that they are familiar with the contents and their use.

## **4.6 Pesticide Application Equipment for Pest Control Operation**

Pesticide application equipment should meet the following requirements:

- Be clean and free from pesticide residue
- Be secured to the vehicle, not free to move around the load area during transport or use
- Be well maintained and free from any damage or leaks.
- Pest control operators should check their equipment regularly and replace items subject to wear and tear (such as hoses) at least every 12 months
- All containers should be properly labelled for contents, including pesticide tanks, contaminated article containers and clean water tanks.

#### **4.7 Personal Protective Equipment and Other Safety Items**

When working with pesticides, pest control operators should always read the label and follow the directions. This includes any safety precautions and specified personal protective equipment. This is particularly important for pest control operators as they work with chemicals every day and are at greater risk of exposure. For personal protective equipment to be effective it must be selected, used and maintained correctly. The following personal protective equipment and other safety items should be available when chemicals are being handled:

- A respirator of an appropriate type, well maintained and properly stored
- Suitable spare respirator cartridges, within the manufacturer's expiration date
- Long-sleeved overalls. After use, these should be removed and transported in a contaminated articles container. They should be washed separately before being used again.
- A washable hat
- Eye and face protection
- Soap, towel and at least ten liters of clean water, stored away from any chemicals
- First aid kit
- Spare change of clothing for use in an emergency
- Sturdy, sealable receptacle for contaminated items
- Material safety data sheets for each of the chemicals handled.
- Impervious boots and gloves. Leather boots must be treated regularly with a waterproofing agent to ensure they remain impervious.

#### **4.8 Pesticide storage**

Whether pesticides are stored on a business vehicle or in a storeroom at the business premises, storage areas should meet the following requirements in addition to the guidelines prescribed in Sections 6.5 & 6.6 of Guideline 6.

- Suitably located away from any hazards
- Secure and should remain locked when not in use. Where possible, public access should be minimized.
- Pesticides stored on a vehicle should be secured to the vehicle, not free to move around the load area during transport or use
- Fire resistant, ventilated and well lit
- The floor and shelving should be impervious (unable to absorb spills)
- Incompatible chemicals separated
- Material safety data sheets for each of the chemicals stored should be readily available for use in an emergency.
- Warning placards should also be available to indicate pesticide application or other hazards.
- Suitable fire extinguisher (dry powder or CO<sub>2</sub> type) should be easily accessible preferably outside by the entrance, well maintained and within its expiration date
- Suitable clean-up material for chemical spillages should be kept in an easily accessible location. This includes a spare pair of gloves and materials to contain liquids and prevent spills such as commercial absorbent materials (hydrated lime or dry sand). Pest control operators should ensure that their spill kit is clearly labelled and that they are familiar with the contents and their use.

## 4.9 Records

The following details must be recorded by the pest control operator carrying out the pest control activity for every pesticide application. Records should be accurate, up to date, coherent, consistent and in English. They must be kept at the business address for a minimum of three years.

- Trade name of the pesticide
- Batch number of the pesticide
- Specific precautions to be observed, including the re-entry period
- Date of pesticide application
- Start and finish times of the pesticide application
- Location of the pesticide application including the name and address

of the person for whom the work was carried out.

- Description of treated areas, amount of the pesticide applied including the pest(s) treated and the methods used e.g., spray or bait.
- If applied outdoors, the ambient temperature, wind direction and speed at the time of application.
- The name and license number of the person applying the pesticide and, if applicable, the name and license number of the person supervising the application,
- The trading name, address and phone number of the business employing, engaging or owned by the person applying the pesticide.
- The signature of the person completing the record.

*Note: All aspects of the weather (for example, temperature, humidity and wind direction) should be assessed when deciding whether it is safe to spray pesticides.*

#### **4.10 Spill Prevention**

Pest control operators should prevent hazards due to spillage by:

- securing containers on vehicles;
- storing containers in an organized and orderly manner;
- having an emergency response plan;
- using the lowest toxicity pesticide possible;
- using funnels and accurate measuring jugs with a pouring lip;
- mixing products on a level surface and holding containers steady;
- not mixing or storing pesticides near drains or storm water outlets;
- keeping lids on containers when not in use;
- carrying absorbent materials and keeping them accessible in case of an accident;
- using warning signs when mixing and applying pesticides;
- keeping people, animals and vehicles away from pesticide containers and treatment areas;

#### **4.11 Disposal of Unwanted or Left-Over Chemicals**

Disposal should be as per the Pesticide Rules and Regulation 2019 and related conditions laid out in Guidelines 7 & 8.

#### **4.12 Advice to Clients Especially During Household Pest Control Operation**

Pest control operators build a wealth of knowledge about pests and the pesticides used to control them. Clients do not have this experience and knowledge and may feel uneasy about the treatment. They, therefore, look to the pest control operator to provide them with information and advice. Important information includes:

- The name of the pesticide to be used;
- Its toxicity rating;
- Potential health risks associated with its use;
- How it will be applied and to what areas;
- The withholding period;
- Pre- and post-treatment measures that the client can take to minimize exposure:
  - ensuring food, clothes, toys, toothbrushes, bedding, towels, vegetable gardens, pet bowls, fish ponds, cooking utensils are covered or removed from the area to be treated;
  - vacating the premises along with pets, especially for indoor treatments, while the pesticide is mixed and applied and until the pesticide is dry (generally four to six hours);
  - ensuring that all doors and windows are closed if the pesticide is to be applied outdoors;
  - ventilating the house by opening all doors and windows upon return if a chemical smell can be detected;
  - ensuring that bench tops and kitchen utensils are thoroughly cleaned prior to food preparation if a pesticide has been applied indoors.



### **4.13 Inspections and Investigations**

Under rule 45 and 46 of the Pesticides Inspector in the Pesticides Rules and Regulation of Bhutan 2019, a Pesticides Inspector may enter, at any reasonable hour in the daytime, any premises used for the business of a pest control operator for the purposes of monitoring compliance or investigating a contravention of the Act or regulations or a risk to health. Pesticides Inspector may conduct inspections or investigations in response to complaints or as follow-up to non-compliance issues arising as a result of an inspection.

The Pesticides Inspector may arrange a mutually suitable time and location for the inspection with the pest control operator. The pest control operator will be advised of the areas to be inspected prior to the appointed time and shall receive a post-inspection report highlighting areas requiring improvement. The Pesticides Inspector also investigates reports of pest control operators in breach of the Act, regulations and conditions on their license.

## **Guideline 5: Appointment of Pesticides Analyst**

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1. The Ministry of Agriculture and Forest in consultation with the Pesticide Board, shall recommend appointment of pesticides Analyst to the Royal Civil Service Commission.
2. Although the number of pesticides Analyst shall depend on the scope and the nature of the work, it is desirable at least to have two analysts: one for organochlorine and organophosphate groups, and another for pyrethroids and dithiocarbamate groups.
3. Pesticide Analyst must not have any conflict of interest in the manufacture, import, export, distribution or sale of any pesticide.
4. A person shall be eligible for appointment as Pesticides Analyst under the Act only if he/she possesses adequate training in analyzing pesticides
5. Pesticide Analyst shall possess a minimum Bachelor's degree in chemistry or Agricultural Chemistry or Analytical Chemistry from RCSC recognized University.

## **Guideline 6: Transportation and Storage of Pesticides**

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Most accidental pesticide poisonings occur when pesticides are mishandled. Pesticide accidents can be prevented by careful planning, using a secure storage location, adopting safe handling methods during transport and following proper disposal guidelines for both product and containers.

### **6.1 Transporting Pesticides**

Certain precautions should be taken when transporting pesticides. Improperly loaded pesticide containers can fall off vehicle or become punctured or torn. Because pesticides are transported on public roads, the potential damage from such accidents is great. Transportation of pesticides with food, seed, livestock feed or minerals should never be allowed. Hazardous materials spill kit must be kept in the vehicle during transportation. A spill kit commonly contains chemical resistant gloves, coverall and goggles; sorbent pads and absorbent material (such as kitty litter); and a plastic temporary storage container.

In case of a pesticide spill follow the three “Cs”: control, contain, and cleanup. Control the spill immediately to prevent further spillage. Contain the spill. Dike the spill with absorbent material or sorbent pads to keep it out of water and prevent environmental contamination. Clean up the spill. Use absorbent material to soak up the spill, then shovel contaminated material into a plastic storage container for disposal.

### **6.2 What Vehicle to Use**

Pesticides must be transported exclusively in the back of a truck or pickup. If the truck has a wooden bed, insert an impervious liner such as plastic or a truck bed liner before loading pesticides. Nonporous beds are preferred because they can be easily decontaminated in case of an accidental spill.

### **6.3 Loading Pesticides**

The following steps should be followed during loading of pesticides:

- Wear work clothing and chemical-resistant gloves even when handling unopened pesticide containers, in case the container should leak.
- Also, carry protective clothing and equipment in the passenger compartment of the vehicle. You will need protective equipment if a spill or other pesticide-related accident should occur.
- Thoroughly inspect all containers at the time of purchase before loading. Accept them only if the labels are legible and firmly attached.
- Check all caps, plugs, or bungs and tighten them if necessary. If leakage has occurred, do not accept the container. Request another container.
- When loading containers, handle them carefully; do not toss or drop them. Avoid sliding containers over rough surfaces that could rip bags or puncture rigid containers.
- Know safe handling procedures when using fork lifts.
- Secure all containers to the truck to prevent load shifts and potential container damage.
- Protect containers made of paper, cardboard, or similar materials from rain or moisture.

### **6.4 Unloading Pesticides**

- Never leave pesticides unattended.
- The driver is responsible if anyone is accidentally poisoned from pesticides left unattended in your vehicle.
- Move the pesticides into your storage facility as soon as possible.
- Inspect the vehicle thoroughly after unloading to determine if any containers were damaged or any pesticide leaked or spilled.

### **6.5 Storing Pesticides**

As soon as pesticides arrive at their destination, they should be properly stored and the area immediately secured. This not only helps discourage theft, but also prevents access to the materials by pets, children, and other persons not trained to use pesticides.

- The pesticide storage location should be a cool, dry well-ventilated area away from sources of heat or flame. See the pesticide label for specific storage recommendations. Some pesticides can be reduced in effectiveness if they are frozen or overheated. Expansion of pesticides caused by freezing or heating can cause containers to crack or break, resulting in potentially dangerous leaks or spills. Heat expansion of a liquid pesticide also may result in contents that are under pressure. When the container is opened, the pressure may cause an overflow and/or contamination of the user or storage site. Excessively high temperatures can also change the effectiveness of a pesticide and may produce dangerous fumes, making the storage area unsafe.
- Always keep personal protective equipment (PPE) and a hazardous material spill kit. This includes chemical-resistant gloves, coverall and goggles; sorbent pads and absorbent material such as kitty litter; a plastic temporary storage container, and a rated fire extinguisher readily available in or near the pesticide storage area.
- When storing pesticides on shelving, place liquid formulations on lower shelves and dry formulations above them.
- If a liquid formulation container leaks, the dry formulations will not be contaminated. Keeping the liquid containers on lower shelving also helps reduce the risk of accidental spills if the container is knocked off the shelf.
- To prevent contamination or accidental use of the wrong chemical, store herbicides, insecticides and fungicides in separate areas within the storage unit.
- Dry formulations of insecticides or fungicides can become contaminated if stored with certain volatile herbicides and may cause plant injury when used.
- Treated baits (for rodents, insects, and birds) should not be stored near other chemicals because they can absorb odors and become repellent to the pest.
- Always store pesticides in the original container with the label intact. Once a container is opened, the shelf life is considerably reduced.
- Never store pesticides, for even a short time, in any container other than the original. Doing so is a violation of the law. Pesticides in soft

drink bottles, fruit jars, milk cartons, margarine tubs or glasses are a common cause of accidental poisonings.

- Store pesticides away from food, pet food, feed, seed, fertilizers, veterinary supplies and plants.
- Check all stored pesticide containers. Transfer the contents of any leaking container into a container with exactly the same original formulation and label. When this is not possible, put the leaking container with the pesticide into a liquid-proof container and dispose of it as per the disposal guideline.

## **6.6 Pesticide Storage Site Selection**

Several points must be considered when selecting the site for pesticide storage. Pesticide storage sites must have an appropriate isolation distance from water sources. Locating storage facilities away from dwellings and livestock facilities will minimize possible contamination. The site also should be in an area where flooding is unlikely. It should be where runoff can be diverted and drainage from the site cannot contaminate surface or ground water. The drainage system for a pesticide storage facility must not be connected to the wastewater sewer or septic tank.

### **6.6.1 Storage Area**

Depending on inventory size, a separate building, room or enclosure may be best for pesticide storage. If the inventory is not large enough to warrant a separate facility, enclose the storage area on the first floor of an existing building. In either case, store pesticides or pesticide containers in a fire-resistant structure having good ventilation and a sealed, concrete floor that drains into secondary containment. Weatherproof signs, stating “Danger - Pesticides -Keep Out - No Smoking” or a similar warning, should be posted on each door and in any windows of the facility. The name, address and phone number of an emergency contact person also should be posted at the primary entrance of the storage area. Regardless of whether it is a cabinet, room or an entire building, the pesticide storage area should be lockable to prevent unauthorized entry and should only be used for pesticides and pesticide equipment.

An electrically shielded exhaust fan is required in a confined storage area to reduce the temperature and concentrations of toxic fumes. The fan should be installed so that fumes can be vented outdoors without endangering people, animals or plants in the area. Wooden pallets or metal shelves must be provided for storing granular and dry formulations packaged in sacks, fiber drums, boxes or other water-permeable containers. If metal pesticide containers are stored for a prolonged period, they should be placed on pallets, rather than directly on the floor, to help reduce potential corrosion and leakage.

## **Guideline 7: Prevention of Overstocking of Pesticides and Disposal of Obsolete Pesticides**

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This guideline is prepared with the overall objective of promoting principles and practices for environmentally sound management of pesticides.

It offers guidance on what to do with obsolete pesticides and disposal methods that may cause severe environmental and health problems. The guidelines offer information on procedures on collection of unused and obsolete pesticides for disposal; how to conduct and evaluate pesticide inventories; site clean-up or stabilization. These guidelines should be regarded as a further instrument to enhance implementation of the Pesticides Rules and Regulation number 63 and 64 under “Disposal of Unused and Obsolete Pesticides in the Pesticides Rules and regulation 2019 of the Ministry of Agriculture and Forests, Royal Government of Bhutan.

### **7.1 When is Pesticides Obsolete?**

Obsolete pesticides are stocked pesticides that can no longer be used for their intended purpose or any other purpose and therefore require disposal. Common causes of this situation include the following:

- Use of the product has been prohibited or severely restricted for health or environmental reasons (e.g. through banning; withdrawal of registration; or policy decision by the Ministry of Agriculture & Forests or other authorized ministries);
- The product has deteriorated as a result of improper or prolonged storage and can no longer be used according to its label specifications and instructions for use, nor can it easily be reformulated to become usable again;
- The product has undergone chemical and/or physical changes that result in phytotoxic effects on the target crop, or an unacceptable hazard to human health or the environment;
  - The product has undergone an unacceptable loss of biological efficacy because of degradation of its active ingredient and/or other chemical or physical changes;



- The product physical properties have changed to such an extent that it can no longer be applied with standard or stipulated application equipment.
- Products have aged or passed the expiry date of the manufacturer.

## **7.2 Hazard of Obsolete Pesticides**

Leaking containers and torn bags / box can seriously increase the occupational risks and affect the health of staff working at storage sites and of others who happen to come in contact with the pesticides. In addition, they often pose a broader general danger to public health and the environment. Factors determining the level of hazard include: quantity of pesticides; condition of containers and packaging; and the degree of leakage; toxicity of the products; behavior of the product in the environment (persistence, mobility in soil, solubility in water, volatility); storage location (inside or outside a store); and the floor material (degree of permeability); the proximity of the storage site to densely populated areas (some are located in or near urban areas or villages); proximity of the storage site to water bodies (some stores are located on irrigation schemes, near rivers).

Obsolete pesticide stocks, particularly those in leaking and deteriorating containers, require immediate containment and disposal. Unfortunately, there are no easy disposal methods that are safe, cheap and generally applicable under circumstances prevailing in developing countries. On the other hand, there are several methods that definitely should not be used, such as open burning or burying, because they are likely to cause severe damage to public health and the environment.

## **7.3 Procedures on Collection of Unused and Obsolete Pesticides for Disposal**

- i. The NPPC will coordinate collection of unused and obsolete pesticides from around the country every five years.
- ii. The NPPC will designate a focal technical staff either from the NPPC-Semtokha or the Agriculture Research and Development Centres (ARDCs) for collection of unused and obsolete pesticides from different locations. The technical person should be of a senior officer

with knowledge on pesticides and who knows occupational safety and first aid.

- iii. Before collection, the dzongkhags and concerned agencies should provide a list of unused pesticide stocks in their respective locations.
- iv. Based on the information received, a technical person from NPPC will prepare a preliminary inventory and plan to visit the locations.
- v. The NPPC shall provide trainings to technical staff on basic information about handling hazardous materials and disposal operations; use of protective gear; work and safety procedures for the various tasks; what to do if anything goes wrong; basics of first aid operations.
- vi. In order to facilitate the physical handling of pesticides, the NPPC will provide protective clothing, first aid kits, appropriate containers and transportation required. List of Protective gear is given in Box 1.
- vii. The NPPC technical person, with assistance from the field staff, shall perform the following tasks:
  - a) Conduct an inventory using the Inventory Form (Annex 2) to identify and record the pesticides from each location. Products for which information are not complete or missing must be labelled as ‘unidentified obsolete pesticide’ on the container and segregated from others. Information in the inventory forms are very important as these will be used to determine disposal options and prepare disposal plans. Materials and equipment required to conduct an inventory is given in Box 2.
  - b) Evaluate and decide which products are obsolete.
  - c) Decide if products can still be used and advise farmers on re-usage.
  - d) Reusable items will be retained at the location, but information must be collected as per the inventory form.
  - e) Re-pack products whose containers are damaged and not fit for transport (refer Section 7.6.2 on containment).
  - f) Clean sites using appropriate measures in case of spillage or leakage of pesticides (refer Section 7.6.3 on cleaning up spills).
  - g) Coordinate transportation of collected pesticides to the ARDCs where pesticides collected from all locations will be stored till

lifted by the NPPC. Transportation must be done as per Guideline 6 on transportation.

- h) Hand over the collected stocks along with the inventory to the NPPC. Copies of inventory should also be provided to the ARDCs.
  - i) The ARDC Stores must comply with the conditions given in Section 7.7 on specification of store) and be equipped as per the Section 7.6.2 containment of obsolete.
- viii. During the lifting of pesticides from the ARDC Stores, the plant protection staff with additional support from the NPPC will perform the following:
- a) Repack products if containers are leaking or deteriorating (refer Section 7.6.2 on containment)
  - b) Clean-up spillage according to the Section 7.6.3 cleaning up spills
  - c) Pack contaminated materials and send for disposal together with the obsolete pesticide.
- ix. The NPPC should lift the stock from the ARDC Store within 6 months.
- x. The NPPC shall perform the following as part of disposal procedures if necessary:
- a) Samples from the ‘unidentified obsolete pesticides’ and other products may need to be sent for analysis (within NPPC or to pesticide laboratories outside Bhutan) to determine proper disposal or usage according to the guidelines under the Section 7.4 on ‘Sampling of unidentified obsolete pesticides or products that require chemical and physical analysis’.
  - b) Conduct evaluation of the inventory data submitted from the gewog as per the guidelines in Section 7.5.
  - c) Prepare a summary of product using the given in Annex 3.
  - d) Re-pack according to international regulations if disposal is to be done outside the country for disposal.
  - e) Perform clean-up as per Section 7.6.3.

**BOX 1: Personal protective gear needed when handling obsolete pesticides**

Adequate respiratory protection (e.g. half-face or full-face mask for protection against toxic vapors and/or dust; or an appropriate dust mask for protection against toxic dust); eye protection goggles or face shield; impermeable gloves (nitrile or neoprene); impermeable boots; overalls (preferably liquid-resistant disposables).

**BOX 2: Materials and equipment required to conduct an inventory**

- Appropriate inventory forms (Annex2)
- Storage records, if available • flashlight • sampling equipment and sampling instructions.
- Personal protection equipment (see Box 1) • basic first aid and safety equipment

**7.4 Sampling of Unidentified Obsolete Pesticides or Products that Require Chemical and Physical Analysis**

Samples need to be taken from unidentified products and from products that require chemical and physical analysis to determine whether they are still usable. It may be convenient to take samples during the inventory. The following procedure is recommended for collection of samples (Pesticide formulation sampling sheet is given in Annex 4). However, before taking samples, the laboratory that is to carry out the analysis should always be contacted in order to confirm their requirements (sample size and number of samples). Analysis of samples is expensive. Therefore, the number of samples analyzed should be the minimum that is required to get a good idea about the state of the products concerned.

**7.4.1 Sample Size**

In principle, one sample should be taken from each batch of product that needs to be examined. However, for large batches of a single product, more samples may be required to get an accurate idea of its condition. If the quantity of a batch exceeds 10 tons, it is suggested that one sample is taken for each 10 tons of the product. For batches larger than 30 tons, the laboratory could then analyse two or three samples initially. If there

appears to be a large variation between these samples, more samples should be analyzed. If the variation appears minimal, the rest of the samples would not need to be analyzed.

#### **7.4.2 Sample Collecting Procedures**

- First take all necessary safety precautions. Use of protective gear is essential.
- Ensure that the sample taken is representative (select an average looking container);
- Shake the container thoroughly before sampling. Large drums should be rolled back and forth several times before samples are taken;
- For the sampling of liquid formulations, lower a pipette vertically into the formulation. Place a finger over the top end of the pipette, withdraw and transfer the liquid into a sample bottle. Be sure to have tissue within reach to wipe away drips and to clean the outside of the pipette to avoid dripping.
- To avoid cross contamination, a new pipette should be used for each product. The use of plastic disposable pipettes is recommended;
- For the sampling of powder or granular formulations, use a long-handled spatula or spoon. Granular and powder products may undergo segregation into different particle sizes during storage. If segregation is suspected, samples should be taken from various depths and bulked to a laboratory sample. If a spoon is used, ensure that it will not be used as cutlery again.
- If skin or clothing becomes contaminated during sampling, the affected area should immediately be rinsed thoroughly under running water.
- Do not leave any contaminated materials (pipettes, gloves) lying around at the premises. Used pipettes should not be put into the drum sampled because this could cause problems later if its contents had to be pumped out.
- Wash hands after sampling.

### 7.4.3 Packaging and Labelling

- Laboratory samples must be sealed immediately after sampling.
- The lid of the sample bottle/container must be closed tightly and should then be sealed with parafilm (plastic wrapping film) or adhesive tape.
- Each sample container must immediately be marked with the product name and an identification number for 'unidentified products in the sampling sheet (Annex 4) which should be filled out immediately. Particular attention must be paid to the declared concentration of the active ingredient. Indicate whether this concentration is in weight in volume (w/v:g/l) or in weight in weight (w/w:g/kg). For salts of acids it must be noted whether the free acid or the salt of the acid is declared (e.g. 2,4-D acid or 2,4-D sodium salt). The same applies to esters of acids and to bases (e.g. paraquat base or paraquat dichloride). If the samples are to be sent abroad for analysis, the inner and outer packaging and labels should comply with relevant regulations for international transport of dangerous goods.

### 7.4.4 Sampling Equipment

The following equipment is required for the sampling of pesticides:

- Sample bottles (20 to 30 ml);
- Pipettes (40 cm length; preferably plastic disposal pipettes);
- Spatula or spoon;
- Funnel and mixing container for bulk samples;
- Parafilm, adhesive tape;
- Wiping-off tissue;
- Labels and a marker;
- Pesticide formulation sampling sheet
- protective gear (gloves, goggles, overalls, adequate respiratory protection)

### *Further notes*

If samples are to be airfreighted it is important to be aware that there are special provisions for airfreighting dangerous goods in limited quantities which are less stringent than those for larger quantities. The provisions for dangerous goods in limited quantities apply to pesticide samples, provided that certain conditions are met. The main conditions are that the pesticides fall under Class 6.1 and Packaging Group III under the Dangerous Goods Regulations of the International Air Transport Association (IATA), and that individual samples do not exceed 30 ml/mg and the total does not exceed 1 litre/kilogram.

## **7.5 Evaluation of Inventory Data**

The NPPC will review the inventory data from all locations and classify individual products in one of the four categories listed below.

### **1. Products that are definitely obsolete and require disposal**

- Products which has been banned for health or environmental reasons;
- Products visually deteriorated beyond usability (e.g. caked powder, caked emulsions, flakes and crystals in liquids);
- Aged products that are no longer usable;
- Products contaminated by other products.

### **2. Products requiring further testing**

- Unidentified products;
- Older products, past guaranteed shelf-life, that have not yet visibly deteriorated.
- Analysis of such products is complex and requires a well-equipped laboratory and qualified staff, together with appropriate test methods and specifications. In the absence of pesticide control laboratory at the NPPC, analysis may have to be carried out at a laboratory of the manufacturer or in any reputable and designated laboratory.

### **3. Products that are still usable**

- These are products that have not yet deteriorated and are still permitted to use.
- This forms a second round of screening in addition to the screening performed by the NPPC technical staff at the household level.

### **4. Products that can become usable again after reformulation**

- Products that are still in good condition but cannot be used because the formulation is not appropriate for the intended use, may possibly be reformulated to become usable.
- The NPPC may seek advice from the manufacturer or a pesticides expert to find out whether reformulation is feasible. The manufacturer can also advise on facilities needed to reformulate the product, the formulation method, safe handling and packaging. However, in the absence of a local testing laboratory and a pesticide formulation plant, it probably is not feasible to reformulate the product locally. Reformulation only makes sense if there is a permitted use for the reformulated product.

## **7.6 Containment of Obsolete Stocks and Site Clean-up Procedures**

It is recommended that workers be medically examined before involvement in large containment and/or disposal operations. A local physician experienced in diagnosing and treating exposure to pesticides should be notified of the planned work. For large operations, such a physician should be supplied with antidotes and medicine to treat poisoning cases, if these are not already available.

### **7.6.1 Materials and Equipment Required**

- First aid box (bandages, disinfectant, etc.);
- Eyewash bottle and emergency shower. There should be sufficient water and soap for personal cleaning and washing of contaminated clothes;
- Sufficient quantities of appropriate protective gear;
- Shovels and brooms;



- Detergent for site clean-up;
- Large quantities of absorbent materials such as purpose-made spill control products, sand, sawdust, or activated charcoal;
- Neutralizing agents such as hydrated lime or sodium hypochlorite;
- Wiping-off tissue;
- Heavy duty polyethylene floor sheeting for spill containment;
- Appropriate drums and bags to repack pesticides from deteriorated containers and to pack contaminated soil and materials.
- Pumping equipment to transfer larger quantities of liquids, and a large funnel for smaller quantities;
- Earthing cables to prevent build-up of static electricity during product transfer operations;
- Drum spanners (device to open drums);
- Fire extinguisher(s).

The following additional equipment may be desirable for large containment operations:

- Drum crusher, container shredder, drum cutting equipment drum lifting equipment;
- Industrial vacuum cleaner;
- Digger, excavator, pneumatic drill.
- Sufficient vehicles should be available for the transport of personnel, equipment and drums.
- At least one vehicle should always remain on site to be available to transport people to hospital in the event of accidents or emergencies.

### **7.6.2 Containment**

- All containers should be inspected for damage and leaks.
- Isolate damaged containers before repacking the product.
- Workers should wear full-face masks when handling leaking containers.
- A simple, temporary containment area to control spillage and protect against further contamination of the soil during repacking, can be

made from a polyethylene sheet with the sides raised (e.g. by sand bags) to contain any major spillage.

- Product in damaged or leaking containers should be handled as follows:
  - For torn paper or plastic bags containing solid formulations: place the damaged bag inside a clear, heavy polyethylene plastic bag so that the contents and label are visible; label new bags if clear bags are not available. Seal the plastic bag carefully and tightly.
  - For Leaking containers holding liquid formulations: options for repacking include: a) transfer to an undamaged container that previously held the same product and label them; b) transfer to a new, or thoroughly cleaned, empty container, and relabel; c) over pack in a larger drum or specially designed over pack and relabeled.

### **7.6.3 Cleaning up Spills and Contaminated Storage Sites**

Leaked product, spill and otherwise contaminated floors should be cleaned up as follows:

- First read the instruction on the product label or Material Safety Data Sheet.
- Unauthorised persons should be kept away from the contaminated area.
- The store should be ventilated immediately as much as possible.
- All persons involved in the clean-up should wear appropriate protective clothing.
- Eyewash, soap and plenty of water should be kept at hand.
- In the event of leakage, contain the leaking drum in an over drum, or pump its contents into another drum. As a very temporary “first aid” measure, it is often possible to stop leakage by rolling the drum into a position so that the leak is on top.
- Mop up the leaked product with absorbent material (special spill-control material, sawdust, earth or lime), sweep up and pack these materials. Lay a ring (small dike) of absorbent material around the contaminated area. Wet the area with a detergent solution (e.g., 10%

saturated sodium carbonate solution, or 5% caustic soda solution); scrub the floor; and then sweep the solution into the ring of the absorbent material. Remove the material after all liquid has been absorbed. Repeat if necessary. Clean equipment with detergent solution.

- Contaminated materials (e.g. soil, soft floor material, absorbent materials) are regarded as hazardous waste and should be carefully packed and properly labelled for disposal or temporary storage until disposal can be carried out.

*Notes: Heavily contaminated soil should be excavated or chemically treated, depending on the type of contamination. All solid toxic residues, contaminated materials and significantly contaminated soil should be packed in appropriate containers, labelled and disposed of in the same environmentally sound manner as the obsolete pesticides. Even after thorough cleaning, old storage facilities should never be used for the storage of food, fodder or animals.*

## **7.7 Conditions of Stores for Obsolete Pesticides**

Ideally, obsolete pesticides should be removed for disposal immediately after repackaging. However, temporary storage may be required while making collections from the dzongkhags and when disposal cannot be accomplished immediately.

Obsolete pesticides should be stored and managed in the same manner as current stocks. For details on safe storage of pesticides, refer to: Pesticide storage and stock control manual (FAO, 1996) and Provisional guidelines on prevention of accumulation of obsolete pesticide stocks (FAO, 1995a).

The basic conditions for a store:

- Stores should be well ventilated;
- Floors should be made of impermeable material;
- Entrances should have ramps to contain any major leakage within the store;
- Doors must be lockable and have danger signs;
- Windows should be barred;

- Floors should be arranged in separate blocks with aisles between them with sufficient space to move containers freely, enable inspection of containers and treat leakage;
- Drums should be stacked in such a way that each individual drum can be inspected from the aisles between the blocks;
- Drums and bags should be stored on pallets; stacking recommendations should not be exceeded; each store should have the necessary materials and equipment to deal with emergencies.
- Containers which have deteriorated should not be transported, until they have been repackaged first. Old containers that are still in good condition may possibly be transported within the country, provided that necessary safety precautions are taken.
- Drums should be placed on drip-trays sufficient to contain all leakage if a container should crack or start leaking.

## 7.8 Disposal

The NPPC is responsible for planning and arranging, in consultation with the Department of Agriculture, the disposal of obsolete pesticide. Appropriate disposal measures will be followed as per the existing international regulations affecting pesticide disposal operations (Annex 5).

### **Prevention of accumulation of obsolete pesticides:**

The first step in preventing the accumulation of obsolete pesticide stocks is to review whether pesticide use is actually required. Over the last few years, much progress has been made in the development and introduction of Integrated Pest Management (IPM) for various crops. IPM increasingly offers alternative strategies for effective long-term pest control while mitigating hazards to public health and the environment. Subsidy removal was another major step made to reduced pesticide usage. Reduced dependency on pesticides reduces the use of pesticides. The lower the annual volume, the smaller the chance of large obsolete stocks accumulating. The NPPC will review pesticides usage from time to time and adopt the most appropriate methods to reduce pesticide accumulation in the country.

For handling of pesticide containers, refer Guideline 8, Section 8.12.

## **Guideline 8: Safe Use of Pesticides**

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Pesticides are toxic to both pests and humans and suitable precautions must be taken. Most pesticides will cause adverse effects if intentionally or accidentally ingested or if they are in contact with the skin for a long time. Pesticide particles may be inhaled with the air while they are being sprayed. An additional risk is the contamination of drinking-water, food or soil. Special precautions must be taken during transport, storage and handling. Spray equipment should be regularly cleaned and maintained to prevent leaks. People who work with pesticides should receive proper training in their safe use.

### **8.1 Pesticides in Workplace**

This is applicable for those who deal with pesticides in the research Centre's, gewogs or dzongkhags. To get the most out of this guideline, do the following things first.

- Make a list of all the hazardous substances on the premises.
- Check protective clothing to be used for handling hazardous substances.
- Write down how and where the hazardous substances are stored. Is anything else stored with them?
- Write down current procedures for handling hazardous substances. Take into account training conducted, protective clothing, storage, decanting and mixing, disposal and transport
- Consider that there may be other less hazardous means of control.
- Use the following checklist to help identify pesticide use in your workplace
  - Is there an awareness that using chemicals involves hazards?
  - Is the least toxic substance that will do the job used?
  - Is the information on the label read and followed?
  - Are Material Safety Data Sheets obtained from the supplier?
  - Are hazardous substances stored correctly?
  - Is appropriate protective clothing worn?

- Is there a safe procedure for applying hazardous substances?
- Is there a safe procedure for cleaning up?
- Are hazardous substances transported safely?
- Is training and supervision provided for employees using hazardous substances?

## **8.2 Pesticide Label**

Read the pesticide label before use because the label:

- Identifies the hazardous substance's properties and toxicity.
- Provides a guide to safe handling, storage and use.
- Will help you choose which chemical is least toxic to humans.
- Provides first aid treatment advice.
- Additional information should be available in the form of a Material Data Safety Sheet, if not provided, demand one from the NPPC.

## **8.3 Storing Pesticides**

- Store in a well-ventilated and well-lit shed that is lockable and has an impervious floor and impervious shelving.
- Keep away from animal feeds, fertilizers and seeds.
- Store away from protective clothing and equipment.
- Make sure water tap is located close to clean up any spills.
- Store the hazardous substance in their original containers, with labels intact.
- Re-label containers if labels come off.
- Separate hazardous substances that may react with one another.
- Store pesticides in a place that can be locked and is not accessible to unauthorized people or children; they should never be kept in a place where they might be mistaken for food or drink.
- Keep them dry but away from fires and out of direct sunlight. Do not carry them in a vehicle that is also used to transport food.

## **8.4 Safe Application of Pesticides**

- Prepare only enough for immediate use.
- Keep a record of their use and results. Make sure equipment works well and doesn't leak.
- Spray with minimal drift and preferably in low wind conditions.
- Cover feed and water containers near mixing or spraying.
- Wash hands before going to the toilet, smoking or eating.
- Wear protective clothing.

## **8.5 Transport**

- Avoid transporting with food, water, animal feed or other reactive hazardous substances.
- Secure hazardous substances on the vehicle so they do not fall off.
- Keep a list of the hazardous substances you are carrying.
- For details, refer Guideline 6 on transportation

## **8.6 Care for the Environment**

- Stick to recommended quantities and rates.
- Observe the withholding periods stated on label.
- Observe any warnings on the label regarding toxicity to non-target animals.

## **8.7 First Aid Procedures**

- For skin contact, wash with soap and water, and rinse with clean water.
- For eye contact, hold eye open under running water for 15 minutes.
- If swallowed, contact and refer to local health centre, read the label for recommendation of antidote and safety measure, and seek advice from the NPPC.

## **8.8 Using Pesticides**

- To prepare for pesticide applications, remove the pesticide containers from storage and take them to an open area.

- Always measure and mix pesticides in a well-lit, well-ventilated location.
- Regardless of whether they are partially or completely emptied, never leave pesticide containers open or unattended while the pesticide is being applied.
- Return all containers to storage prior to application to prevent accidental spills, ingestion, or exposure to people, pets, livestock or wildlife.
- Mixing and applying pesticides requires detailed attention to label instructions, along with common sense and good judgment.
- Use protective clothing.

## **8.9 Protective Clothing**

Read the label and Material Safety Data Sheet for instructions on appropriate protective clothing to use during mixing and application. During spraying of pesticides, if proper protective clothing is not available, then workers should wear overalls or shirts with long sleeves and trousers, a broad-brimmed hat, a turban or other headgear and sturdy shoes or boots. Sandals are unsuitable. The mouth and nose should be covered with a simple device such as a disposable paper mask, a surgical-type disposable or washable mask, or any clean piece of cotton. The cotton should be changed if it becomes wet. The clothing should be of cotton for ease of washing and drying. It should cover the body without leaving any openings. In hot and humid climates, the wearing of additional protective clothing may be uncomfortable, and pesticides should therefore be applied during the cooler hours of the day.

## **8.10 Cleaning Up**

- Thoroughly clean all spraying and protective equipment where run-off will not contaminate the environment or create a hazard.
- Wash work clothing separately or dispose of as appropriate.
- Wash exposed skin areas with soap and water, and rinse with clean water.
- For spillage refer Section 7.6.3 under Guideline 7.



### **8.11 Handling of Pesticides Left Over in the Mix or Spray Tank:**

- Prepare only the required amount. Calculate the spray volume by spraying a given volume of plain water in a given area or tree to get an idea on the actual volume required.
- In case of pesticide mix left over, use/spray on the end rows or field borders where the pesticide has been used.
- Clean or rinse mix or spray tank and hose lines with clean plain water at least three times before storing the equipment. Refer the label whether some spray mix requires special rinsing agents/ method and follow accordingly.
- Do not pour any pesticide mix into water bodies or any places.
- For disposal of unused and obsolete pesticides, refer Guideline 7.

### **8.12 Handling of Empty Pesticides Containers**

Reuse of pesticide containers for domestic purpose is risky and not recommended. Containers made of materials such as polyethylene preferentially absorb pesticides and should not be reused. In many countries, the label provides recommendations for disposal. Therefore, it is important to read the label not only for recommendations on usage but also for disposal methods.

Some general guidelines for cleaning pesticide containers depending on formulation type are given below. Use protective clothing:

#### *Liquid formulation*

- In Bhutan, the largest pack size for liquid formulation pesticides do not exceed 1L. Pesticide containers must be rinsed at least three times before disposal:
- Fill the container with  $\frac{1}{4}$  to  $\frac{1}{2}$  full of water; replace the cap securely and shake for about 30 seconds; pour the rinsate into the mix or sprayer tank for use on target crop; repeat at least 3 times and drain well; remove caps and crush all metal and plastic containers after rinsing to prevent use.

*Solid formulation (powder & granules):*

- Most of these types of formulations come in plastic bags or pouches on its own or packed inside paper or cardboard boxes.
- Empty the containers properly. Fill the plastic bag  $\frac{1}{4}$  to  $\frac{1}{2}$  full with water while holding it over the mix or spray tank openings; hold by the grasping the opening of the bag opening and shake; pour the rinsate into the mix or spray tank; rinse three times; drain well by holding upside down over the mix or spray tank; punch holes in the plastic bags to prevent reuse.

*What to do after rinse?*

- Consider all pesticide containers as hazardous. Keep in safe and dry place for collection by the NPPC.
- Containers which are made of recyclable material can be sent for recycle after the thorough rinse procedures described above or washed according to the instruction on the labels.

*Other packaging materials*

- Packaging material such as paper, cardboard, plastic or other packaging material that has come in contact with a pesticide should be stored safely until disposal.
- Paper or cardboard packaging should be well shaken, punctured or shredded and plastic bags should be rinsed once to remove any pesticide residue prior to either storage or disposal.

# **ANNEX 1: EFFICACY TEST PROTOCOL FOR MICROBIAL AND BOTANICAL BIOPESTICIDES**

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## **1. EXPERIMENTAL CONDITIONS**

### **1.1. Selection of Crop and Cultivar, Test Organisms**

This test protocol is concerned with the efficacy evaluation of microbial pest control agents and Botanical for the control of (common name /scientific name of insect-pest/plant pathogen) in (common name /scientific name of crop). The selection of crop, cultivar and test insects/plant pathogen must be relevant to the (proposed) label/leaflet claims. Specify objective of the trial and basic information on type of trial, environment of trial like field, glasshouse, etc.

### **1.2. Trial Conditions**

Trial should be conducted on crops with a known history of uniform high infestation/infection of the target insect-pest(s)/disease(s). Cultural conditions (e.g. soil type and pH, fertilizers, tillage, row and plant spacing, etc.) should be uniform for all the plots of the trial and should conform to local agricultural practices. A series of trials for the relevant pest or disease should be carried out in different locations with distinct environmental conditions over an entire growing period of the crop (e.g. about 2 trials in 2 locations or seasons). Trials can be done under semi-field conditions (e.g. outdoor, but protected environment or cages) or involving larger scales in farmers' fields. Generally, highly mobile pests require larger scales than less mobile pests. The relevant conditions of the plot and crop should be described like sowing or planting date, row spacing, crop condition and pest/diseases densities etc.

### **1.3. Design and Layout of the Trial**

#### **1.3.1. Treatments**

Test product(s) and untreated control are to be arranged in any statistically suitable design. Describe design and layout of the plots like type of experimental design, number, size and shape of plots etc.

### 1.3.2. Plot Size and Replication

Net plot size will depend on the type of crop/ pest and disease /product under study and location of trial. Highly mobile pests might require larger plot sizes for evaluation (e.g. 60-80 sp.m. or larger). For perennial trees it is recommended to use 2 trees/plot for big trees and 4 trees /plot for small trees. There should be at least four reps per treatment.

## 2. APPLICATION OF TREATMENTS

- 2.1. Test Products (s): The product (s) under investigation should be the named formulated product(s).
- 2.2. Mode of Application: All Applications should comply with good experimental practices.
  - 2.2.1. Method of Application: The method of application (e.g. spray, broadcast, soil application, etc.) will normally be specified on the proposed label/leaflet of the product.
  - 2.2.2. Type of Equipment Used: application equipment used should be a type in current use, properly calibrated to give intended application rate and droplet spectrum in case of sprays. It should provide an even distribution of product on the whole plot or accurate directional application where appropriate. Factors which may affect efficacy such as operating pressure, nozzle type, spray volume, depth of incorporation in soil should be recorded, together with any deviation in dosage of more than 10 %. Precaution should be taken to avoid drift between plots.
  - 2.2.3. Time and Frequency of Application: time and frequency of application will normally be specified on the proposed label/leaflet of the product. The number of applications and the date of each application should be recorded. Additional general information on factors influencing time and frequency of application like growth stage of the crop, threshold levels or development stage of pest or infestation level must be recorded. Many microbial products should be used in a preventative manner rather than curative; that means these products are applied when pest/disease incidence is lower and insect stages are young for instance. Different modes

of action when compared with synthetic pesticides usually result in a longer reaction time between application and the observation of visible effects. Thus, proper timing of application is crucial for success.

- 2.2.4. Doses and Volumes Used: The product should be tested at a dose range that accommodates for environmental and target pest variability. The recommended application dose would be recommended based on the results of the official field testing. The spray volume should be uniform for all the plots and should be used as per recommendations on the label/leaflet. For sprays, data on concentration (%) and volume (lit/ha) should also be given.

### **3. MODE OF ASSESSMENT, RECORDING AND MEASUREMENTS**

#### **3.1. Characterization of the location**

Record characteristics of the location including GPS coordinates, elevation, climatic zone, etc.

#### **3.2. Type, Time and Frequency of Assessment**

##### **3.2.1. Type**

Type of assessment depends on the type of the insect-pest(s)/disease(s) under investigation, but normally by number of insects on selected plants in the trial or by percentage of damage/percent infection (damage) per unit area of plant parts on selected plants in the trial is adequate.

##### **3.2.2. Time and Frequency**

Biopesticide assessments are depended on the mode of action of the product under question, the type of plants, and the biology of the pest population. Because microbial product show long-term effects, it is recommended to observe during a whole cropping season.

#### **3.3. Direct Effects on the Crop**

Crop should be examined for presence or absence of phytotoxic effects. The type and extent of these effects should be recorded.

### **3.4. Quantitative and /or Qualitative Recording of Yield**

If the proposed label of the product claims an effect on yield then yield should be included in the field evaluation of the product. Quantitative and/or qualitative yield should be recorded wherever relevant in each treatment and should preferably be converted in to kg/ha for statistical comparison.

## **4. RESULTS REPORTING**

The results should be reported in a systematic form and the report should include an analysis and evaluation. The report of the trial should include a biological dossier containing the individual efficacy trial reports or their summaries and record keeping and reporting of individual trials (field note book, trial report including objective of the trial, organizational aspects, methodology, results, discussions and conclusions).

## **5. REFERENCES**

Lace L.A. & Kaya H.K., eds. (2007) Field Manual of Techniques in Invertebrate Pathology. Application and Evaluation of pathogens for control of insects and other invertebrate pests. Springer, Dordrecht, Netherlands

Caldwell, B. et al. (2013) Resource Guide for Organic Insect and Disease Management. Cornell University.

## **ANNEX 2: INVENTORY FORMS FOR RECORDING OBSOLETE PESTICIDES (Adapted from FAO).**

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This product form needs to be completed for each product (if one product is kept in different types of containers, separate form should be completed for each type of container).

Date: .....

Owner of product: .....

Location: .....

Labels on containers: Complete information / incomplete information /  
label not readable / label missing

Trade name: ..... Active Ingredients(S):  
.....

Formulation type: .....Concentration: ..... g/  
litre or g/kg

Manufacturer: .....

Batch No. ....

Manufacture date: .....

Arrival date: .....

Container type: .....

Unit size: .....

Number of containers: .....

Quantity: .....

**ORIGIN:**

Purchased by Government/ received as donation (name donor) .....

.....

Imported by private company (name company): .....

.....

Condition of pesticide: usable / unknown / deteriorated

Condition of containers: good/ minor damage / serious damage/  
transportable / not transportable: Description of damage: .....

.....

Repacked: Yes/No

Have containers been opened? Yes / some / no / not certain

Reason for not using the product:

Expired / deteriorated / banned / wrong formulation/ no need / stock too  
large / no longer recommended

Other: .....

.....

REMARKS: .....

.....

.....

.....

Name(s) of person(s) who perform the inventory: .....

.....



## **ANNEX 3: SUMMARY TABLE OF PRODUCTS**

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To obtain a quick overview of stocks at each store it is advisable to transfer key data from individual product forms to a summary table as given below.

| <b>Active ingredient<br/>(common name)</b> | <b>Formulation Type</b> | <b>Concentration<br/>(g/kg)</b> | <b>Unit Size</b> | <b>Quantity</b> | <b>Container condition</b> |
|--|-------------------------|---------------------------------|------------------|-----------------|----------------------------|
|  |                         |                                 |                  |                 |                            |
|  |                         |                                 |                  |                 |                            |
|  |                         |                                 |                  |                 |                            |
|  |                         |                                 |                  |                 |                            |
|  |                         |                                 |                  |                 |                            |

## ANNEX 4: PESTICIDE FORMULATION SAMPLING SHEET

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Sample ID No.: ..... Date: ...../...../.....

Name and address of store: .....

Trade name: .....

Active ingredient (S): .....

Formulation type: .....

Declared concentration: ..... weight/weight weight/volume

Manufacturer: ..... Batch No.: .....

Date of manufacture: .....

Container size: .....

Stored quantity: .....

Container type: .....

Container condition: .....

Weight of volume as declared on package: .....

Present weight or volume in package: .....

*(To provide an indication as to what extent the volume has reduced as a result of evaporation)*

Storage duration in the country: .....

Average storage temperature: .....°C

Remarks on storage conditions: .....

Sample size: .....

No. of samples taken from the batch: .....

**Remarks for Laboratory**

(Special analytical testing requirements, or relevant observations regarding the sample): .....

.....

.....

.....

Name of Sampler: .....

## ANNEX 5: REGULATIONS AFFECTING PESTICIDE DISPOSAL OPERATIONS

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Obsolete pesticides are classified as hazardous waste and are subject to various regulations governing transport and disposal of dangerous goods and/or hazardous waste. Such regulations include:

- National regulations on the transport of dangerous goods in the countries of export, transit and import;
- National regulations on the import and disposal/incineration of hazardous waste in the country of destination; international and/or regional regulations on the transport of hazardous waste.
- The United Nations Recommendations on the transport of dangerous goods (1995) provides the basis for several global and regional regulations on the transport of dangerous goods. Among other things, the recommendations cover: principles of classification and definition of classes; listing the principal dangerous goods; general packing requirements; testing procedures; marking; labelling or placarding; and shipping documents.

The following global conventions and agreements regulate the international transport of dangerous goods on the basis of the United Nations recommendations and are directly relevant to the international transport of obsolete pesticides:

### *Sea transport*

Legislative framework: International convention for the safety of life at sea (SOLAS, 1974) and the International convention for the prevention of pollution from ships (MARPOL, 1973, 1978). Practical instruments: International maritime dangerous goods code (IMDG), which provides standards for the shipment of dangerous goods by sea.

### *Air transport*

Legislative framework: Convention on international civil aviation (Chicago Convention). Practical instrument: Technical instructions for the safe transport of dangerous goods by air. A commercial field reference entitled IATA dangerous goods regulations is available from IATA.

### *Rail transport*

Legislative framework: Convention concerning international carriage by rail (COTIF). Practical instrument: Regulations concerning the international carriage of dangerous goods by rail (RID).

In addition, there is the Basel Convention on the control of Transboundary movements of hazardous wastes and their disposal, which is a global convention, and a number of regional conventions and protocols governing the transboundary movement of hazardous waste. An example of a regional convention is the Bamako Convention on the ban of the import into Africa and the control of transboundary movement and management of hazardous wastes within Africa.

The Basel Convention comprises measures to reduce and strictly control the movement of hazardous wastes; to minimize the generation of these wastes; to ensure that they are disposed of in an environmentally sound manner as close as possible to their source of generation; and to protect public health and the global environment from the possible harmful effects of the movement and disposal of wastes. Parties to the convention agree to follow certain rules and procedures for the export and import of hazardous waste. Some of the conditions for a transboundary movement of hazardous waste are that the exporting country does not have environmentally sound disposal facilities; the importing country has such facilities and agrees to permit import of the waste for destruction, recovery or recycling; the method of transport is environmentally safe; and that both the exporting and importing country are parties to the convention. This means that developing countries which are not parties are not permitted to export their pesticide waste to an incinerator in a country which is a party. Nor developing countries which are parties, send their waste to an incinerator in a country which is not a party. However, Article 11.1 of the convention allows a party to enter into bilateral, multilateral or regional arrangements with non-parties to permit the shipment of hazardous waste, provided that such arrangements stipulate provisions that are not less environmentally sound than those provided for by the convention, in particular taking into account the interests of developing countries. In September 1995, the conference of parties to the Basel Convention decided to amend the convention by introducing a provision to restrict the export of hazardous

waste further: countries listed in an annex to the amendment (i.e. member states of OECD and EU) prohibited export of waste to countries not listed in the annex, with immediate effect for hazardous wastes destined for final disposal, and after a phasing-out period for hazardous wastes destined for recovery/recycling, until 31 December 1997, with a prohibition as of that date. The amendment serves further to protect the interests of less-developed countries.