

PEI Landscape Pesticide Applicator Training Course

Training Module 1 General Information

Disclaimer

This training module is intended to be used by qualified trainers only for the purpose of instructing individuals who wish to improve their general knowledge base on the safe handling and management of pesticides or to assist agricultural pesticide applicators seeking first-time certification or re-certification.

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General Information

Pests affect our daily lives. They can impact human health, property values, food supplies, and forest resources. Sometimes, pests will need to be controlled.

- The most responsible approach to pest control is to use an integrated pest management (IPM) program.
- IPM uses a number of pest control measures, depending on the type of pest to be controlled.

- A responsible IPM program will sometimes require the use of chemicals (or pesticides).
- If not used responsibly, pesticides can be hazardous to humans and the environment.
- Safe pesticide use will help you to better protect yourself, your family, clients, bystanders, animals, and the environment from potential harm.

Learning Objectives

Completing this training module will help you to:

- **Understand and use proper pesticide terms.**
- **Understand the way different pesticides work.**
- **Understand the way different adjuvants work.**
- **Understand pesticide compatibility.**

- Identify the types and properties of pesticides used in the landscape industry.
- Use this knowledge to make informed decisions to manage human and environmental risk.

General Comments

- It is important to understand pesticide-related terms when selecting, purchasing, and applying a pesticide.
- You should also be familiar with the active ingredient, formulation, common name, and trade name of those chemicals and chemical families that you use.

Pest

- **A pest is any harmful, noxious, or troublesome organism. Pests include weeds, insects, fungi, bacteria, viruses, rodents, or other plants or animals occurring where they are not wanted.**

Pesticide

- A pesticide is any device, organism, or mixture intended to prevent, destroy, repel, kill, or mitigate a problem caused by any insect, rodent, weed, nematode, fungus, or other pest; and any other substance or mixture intended for use as a plant growth regulator, defoliant, or desiccant.

Pesticide Terminology

Active Ingredient (a.i.)

- Is that part of a pesticide mixture that actually controls the pest.
- A pesticide can contain more than one active ingredient.
- The same active ingredient can be present in a number of products.

Inert (or Inactive) Ingredients

- **Are liquids or solids added to the active ingredient to make it better suited for storage, handling, or application.**

Formulations

- **Are mixtures of one or more active and inert ingredients that together create the saleable product.**

Formulation Types

Pesticides can be liquids, solids, or gases.

Liquids

- Emulsifiable concentrates
- Flowables
- Microcapsulated suspensions
- Solutions

Formulation Types

Solids

- Dusts
- Granulars
- Pellets
- Baits
- Dry flowable powders
- Wetable powders

Special Formulations

Fumigants

- Available as gases, liquids, and solids.
- Liquid fumigants become gases when released (applied).
- Solid fumigants are available as dusts, pellets, or tablets.

Special Formulations

Soluble Packages

- Are pre-weighed amounts of product packaged in a water soluble, plastic bag.

Carrier

- Is mixed with the active ingredient to make the product safer to apply, easier to handle, or better suited for storage.
- Examples: water, oil, solvents, or clay.

Ready-to-use products do not need a carrier.

Adjuvants

- Can be added to the pesticide by the manufacturer or the applicator.
- Adjuvants make the product safer, more effective, easier to handle, or easier to apply.

Types of Adjuvants

<i>Type</i>	<i>Activity</i>
Penetrants	Allow the pesticides to get through the outer layer of a treated surface.
Spreaders	Allow the pesticides to form a uniform coating over the treated surface.
Stickers	Allow the pesticide to remain on the treated surface.
Surfactants	Improve the spreading, dispensing, or wetting properties of a pesticide.
Antifoaming Agents	Reduce foaming of spray mixtures that require vigorous agitation.
Buffering Agents	Increase the solubility of pesticides in water or slow the chemical breakdown of some pesticides by lowering the pH of alkaline water.
Drift Retardants	Increase the droplet size of the spray material, reducing particle drift.

Naming Pesticides

Common Name

- Is the name(s) of the **active ingredient(s)** in the product.
- Appears in lower case letters, often next to the word “guarantee” on the principal panel of the label.

Trade or Product Name

- Is the registered trademark chosen by the manufacturer (e.g., Roundup, Killex).

Examples of Trade and Common Names

Trade /Product Name

Roundup

Dithane

Killex

Sevin

Common Name

Glyphosate

Mancozeb

2,4-D + Dicamba + Mecoprop

Carbaryl

Understanding how pesticides work, the pests they control, and their chemical family can help you choose the best product for an application.

It can also help you better protect human health and the environment when using pesticides.

Pesticide Groupings

Pesticides are grouped according to:

- Target Pests
- Mode of Action
- Chemical Family

Pesticide Groupings

1. Target Pests

Target Pest

fungi

plants (weeds)

insects

nematodes

birds

rodents

fish

Type of Pesticide

fungicides

herbicides

insecticides

nematicides

avicides

rodenticides

piscicides

Pesticide Groupings

2. Mode of Action or Route of Entry

Indicates the way that a pesticide works to stop the normal functioning of a pest, and eventually control or kill the pest.

Many pesticides can have more than one mode of action.

■ Modes of Action

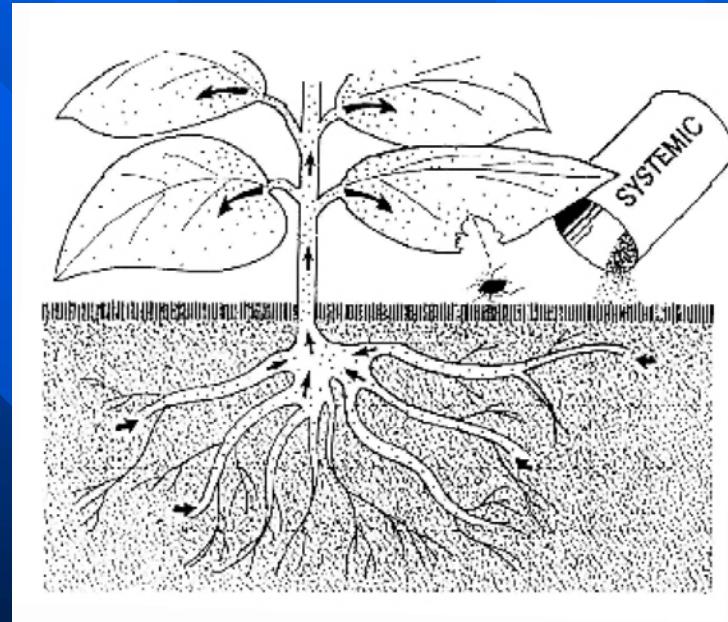
- 1. Contact
- 2. Systemic
- 3. Stomach Ingestion
- 4. Fumigants
- 5. Attractants
- 6. Protectants
- 7. Eradicants
- 8. Growth Regulators
- 9. Repellants

Modes of Action

- Contact pesticides control pests by direct contact.
- Systemic pesticides are applied to the leaves or roots of plants. The pesticides are absorbed and move (or are translocated) throughout the plant to the place where they interrupt plant function.

Systemic Insecticide

A systemic insecticide enters a plant through the roots and then moves throughout the entire plant.



- **Stomach ingestion pesticides** control insect pests after an insect eats a pesticide-treated plant.
- **Fumigants** work as a gas and control pests that breathe in the gas.
- **Attractants** have a smell or scent that attracts insects to a trap.

- **Protectant pesticides** prevent disease by providing a protective covering or a barrier between the pest and the plant...before the disease arrives. Many fungicides are protectant pesticides.
- **Eradicant pesticides** kill a pest once the pest has infected a plant, but before the pest becomes well established.

- **Growth regulators**, when ingested, act like a pest's own hormones. They disrupt normal development and cause the pest to die before it grows and reproduces.
- **Repellents** produce an odour to repel insects from treated plants.

3. Chemical Family

- A chemical family is a group of pesticides with a similar chemical makeup.
- Pesticides in the same chemical family often have similar modes of action, poisoning symptoms, and persistence in the environment.

Knowing a pesticide's chemical family will help you:

- **Select the proper pesticide.**
- **Determine the personal protective equipment needed.**
- **Understand the handling precautions needed for each pesticide.**

Pesticide active ingredients can be grouped as inorganic or organic.

Inorganic Pesticides

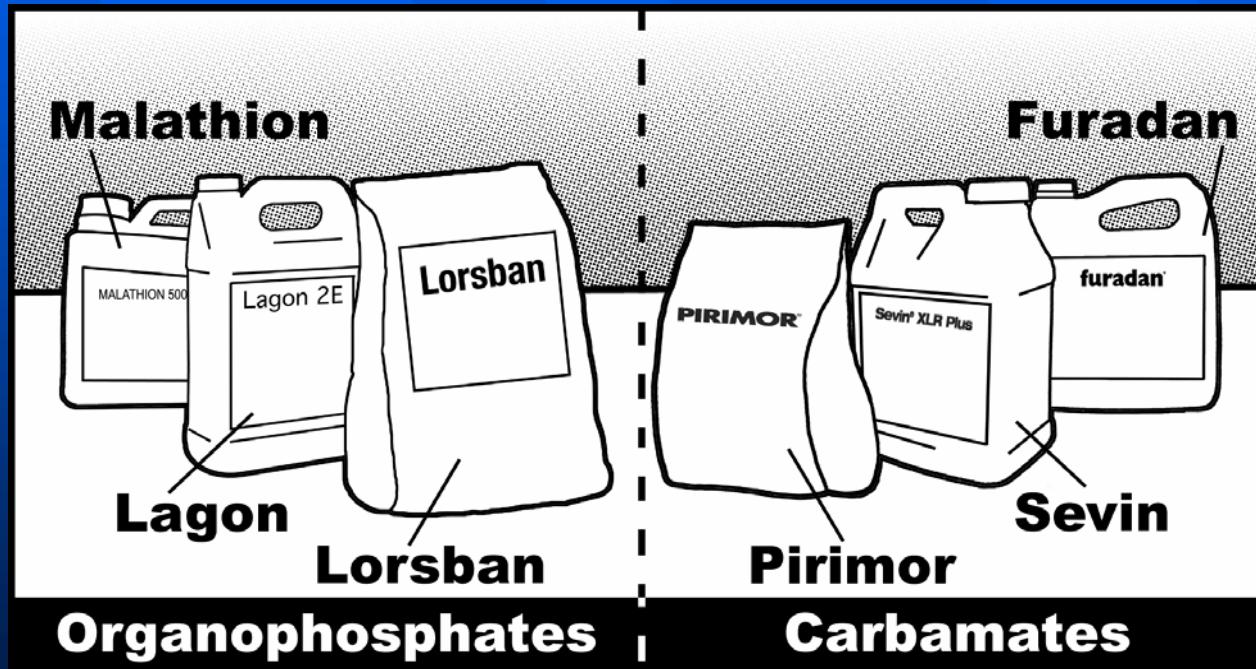
- Do not contain carbon.
- Have a mineral (copper, sulphur,) or a salt (copper sulphate, sodium chlorate) base.

Chemical Family

Organic Pesticides

- Contain carbon.
- Most are made from petroleum compounds.
- Organic pesticides derived or made from plants are referred to as 'botanicals'.
- The most important families are:
Organophosphates (OP's), Carbamates, Organochlorines (OC's), Triazines, and Phenoxies

Examples of organic pesticides:



Insecticide Families

Organophosphates (OP's)

- Most are insecticides.
- These are among the most toxic pesticides used in Canada.
- They act by inhibiting the cholinesterase enzyme (See: Chapter 4 Human Health).
- They tend to have a short persistence in soil.
- Examples: malathion, diazinon, and trichlorfon.

Insecticide Families

Carbamates

- Include insecticides, fungicides, and herbicides.
- Most have a short persistence in the soil.
- They are moderately toxic.
- All are cholinesterase inhibitors.
- Examples: aldicarb, carbaryl, and mancozeb.

Insecticide Families

Petroleum Based Products

- Products act by suffocating pests.
- Examples: dormant oils and summer oils.

Botanical

- These are rapidly degrading contact pesticides.
- Natural pyrethroids are extracts from plants (e.g., pyrethrum).

Insecticide Families

Synthetic Botanical Insecticides

- These are man-made equivalents of natural pyrethrums.
- Examples: resmethrin and permethrin.

Insecticide Families

Microbial Insecticides

- Have been developed from commonly occurring microorganisms.
- Bt. (*Bacillus thuringiensis*) is the most common example.
- These are slow acting and very species-specific.

Herbicide Families

Synthetic Auxins

- These are plant growth regulators.
- They act by interfering with the growth of new stems or leaves.
- They are most commonly combined as a mixture for the control of a range of broadleaf weeds.
- Examples: Phenoxy (e.g., 2,4-D, MCPA, and mecoprop) and benzoic acid (e.g., dicamba) families of herbicides.

Herbicide Families

Phosphate Synthetic Inhibitors

- These act by interfering with the phosphate production cycle.
- They are non-selective and commonly used to control broadleaf and grass weeds.
- Example: Glyphosate (Roundup).

Herbicide Families

Bipyridium Herbicides

- These are the most toxic herbicides used in landscape applications.
- They can irritate the skin and mucus membranes of the eye.
- Examples: diquat and paraquat.

Compatibility with Other Pesticides

- Compatible products can be mixed and applied at the same time.
- Mixing non-compatible products can result in:
 - A negative chemical reaction
 - Poor pest control
 - Plant damage
 - Damaged equipment

Tank Mixing

Tank Mixing

- Mixing of two or more pesticides in the same tank is legal only when clearly stated on the product labels.
- Labels will give rates and orders of mixing.
- Approved tank mixtures have been tested and are guaranteed to be effective, compatible, and safe.

General Safety Guidelines

**Each time a pesticide is used or handled,
the applicator should:**

- **Select the correct product for the job.**
- **Handle the product safely.**
- **Keep detailed application and storage records.**

Safe Handling

To handle a pesticide safely:

- **Read and follow label information and directions.**
- **Wear clean, appropriate protective equipment.**
- **Take first-aid and safety training courses.**
- **Keep work areas clean.**
- **Do not wear contact lenses.**

- **Never eat, drink, smoke, or chew tobacco when working with pesticides.**
- **Always wash your hands before eating, drinking, or using the washroom.**
- **Do not shake hands or pick up a child until you have washed your hands and removed affected clothing.**
- **Wash your body, hair, and fingernails well.**

Pesticide Selection

Consider the following factors when selecting the best pesticide to control a given pest situation:

- Pest(s) to be controlled (target pest).
- Product registration and applicator safety.
- Necessary application equipment.
- Personal protective equipment.

- Product compatibility with other pesticides.
- Your work schedule.
- Pest resistance.
- Environmental factors.

Target Pest

- It is important to identify the target pest(s) and the economic risk they pose when choosing a pesticide.
- Pest identification and control are discussed in Module 7: Pest Management.

Product Registration

- The pesticide must be registered by Health Canada for use on both the **crop** and the **pest** to be controlled.
- Pesticide registration is discussed in **Module 2: Regulations**.

Beneficial Organisms

- It is important to choose the pesticide that will pose the least hazard to beneficial organisms (e.g., bees and birds).
- Beneficial Organisms are discussed in Module 6: Environmental Safety.

Safety, Risk of Exposure

- The pesticide should present the least risk to the applicator, other people, animals, and the environment.
- Safety is discussed in more detail in Module 4: Human Health, Module 5: Safe Pesticide Use, and Module 6: Environmental Safety.

Required Application Equipment

- The pesticide should be compatible with available application equipment.
- Common types of application equipment are discussed further in Module 8: Application Technology.

Personal Protective Equipment

- You should wear the correct personal protective equipment (PPE) required to apply a chosen product.
- Make sure all PPE is clean and in good working condition.
- The pesticide label will sometimes call for specific PPE.
- PPE is discussed in more detail in Module 5: Safe Pesticide Use.

Environmental Factors

- Pesticide applicators should consider temperature, rainfall, wind, topography, and soil types at the treatment site when choosing a pesticide.
- Environmental factors are discussed further in Module 6: Environmental Safety and Module 8: Application Technology.

PEI Landscape Pesticide Applicator Training Course

Training Module 2 Regulations

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Pesticide Regulations

Pesticide regulations are designed to protect vendors, buyers, applicators, the public, and the environment.

Federal, provincial, or municipal governments may establish pesticide legislation or by-laws.

Learning Objectives

Completing this chapter will help you to:

- Interpret and apply federal pesticide laws.
- Interpret and apply provincial pesticide laws.
- Interpret and apply municipal pesticide by-laws.
- Access current laws and by-laws.

Federal Pesticide Legislation

Pest Control Products Act (PCP Act)

- Is the principal federal pesticide legislation.
- Is administered by the Pest Management Regulatory Agency (PMRA), a division of Health Canada.

- Establishes regulations that address the registration, labelling, classification, and re-evaluation of pesticides for all of Canada.
- Focus is on human health, environmental protection, and pesticide effectiveness.

The PCP Act ensures that pesticides:

- Are manufactured, stored, displayed, distributed, and used safely.
- Are not packaged, labelled, or advertised in a way that is misleading or likely to create a false impression of the product.

Only those pesticides that are registered and have a Pest Control Product (PCP) number can be sold in, or brought into, Canada.

Pesticide Registration

To apply for product registration in Canada, a pesticide manufacturer must supply PMRA with:

- **Product chemistry (how the pesticide behaves).**
- **Human health effects (acute and chronic toxicity, feeding studies).**
- **Metabolism (breakdown products in the environment or in plants and animals).**

Pesticide Registration

- **Residues** (in the soil or in a crop after application, half life).
- **Environmental impact** (effect on non-target animals and the environment).
- **Effectiveness** under Canadian conditions.

Pesticide Registration

The information provided by the manufacturer allows the PMRA:

- To make sure that the product does not pose an undue risk to human health, plants, animals, or the environment.

- To decide which precautionary statements and hazard symbols must appear on the label. This will help those who handle the product to assess potential hazards.
- To make a final decision regarding registration of the product and the assigning of a Pest Control Product (PCP) registration number.

Pesticide Classification

Pesticides are classified by their use.

- There are four classes
 - Domestic
 - Commercial (agricultural or industrial)
 - Restricted
 - Manufacturing
- The class appears on the product label.

Domestic Class

- **Designed for use in or around the home or garden.**
- **Minimal personal protective equipment is needed for safe handling.**
- **Training is not required to purchase or handle a Domestic pesticide.**

- Sold in small packages.
- Ready to use, or only minimal mixing is required.
- Have a low toxicity and pose a low risk to users and the environment when handled according to label directions.

Commercial Class

- Term ‘Agricultural’ or ‘Industrial’ often appears on the label.
- Used in agriculture, forestry, industry, and other commercial operations.
- Active ingredient (a.i.) can be the same as that in Domestic class.
- Often packaged in large containers or prepared with higher concentrations of active ingredient.

- Can pose a greater risk to human health or the natural environment.
- May be too toxic, persistent, or hazardous to be used by the general public.
- Special training is required before purchasing or handling these products.
- Personal protective equipment must be used when handling these products.

Restricted Class

- Placed in Restricted class due to high toxicity, method of application (e.g., aerial), or the level of risk to the environment.
- Used in agriculture, forestry, industry, and other commercial operations, with added restrictions noted on the label.

Manufacturing Class

- Used in manufacturing, formulating, or repackaging.
- Pesticide applicators do not have access to these products.

Other Federal Legislation

Food and Drugs Act (Health Canada)

- Regulates the sale, import, and export of food that might contain harmful or poisonous substances.
- Protects the health of consumers by setting a **Maximum Residue Level (MRL)**, the maximum amount of pesticide residue, at the time of harvest, that may be contained in food.
- Food is tested under this Act to ensure that MRL's are not exceeded.

Other Federal Legislation

- Pesticide Residues Compensation Act
- Migratory Birds Convention Act
- Fertilizers Act
- Feeds Act
- Fisheries Act
- Transportation of Dangerous Goods Act
- Canadian Environmental Protection Act (CEPA)
- National Building Code of Canada (NBC)

Provincial Pesticide Legislation

PEI Pesticides Control Act and Regulations

- Administered by the Department of Environment, Energy and Forestry.
- Establishes the licence requirements for commercial pesticide applicator and vendor businesses.
- Establishes the certification requirements for private and commercial pesticide applicators, and for vendor sales staff.

- Establishes pesticide applicator categories (agricultural, forestry, aerial, landscape, structural, biting fly control, etc.).
- Regulates pesticide sale, transport, display, storage, application, special-use permits, disposal, and record keeping once products enter the province.
- Establishes penalties for violations.

PEI *Pesticides Control Act and Regulations*

Topics covered

- Transportation
- Disposal
- Buffers
- Wind speed
- Storage
- Licenses/Certification
- Notification
- Scheduled products

Transportation Regulations

- Pesticide cannot be transported with foodstuffs, feed, household furnishings, bedding, clothing, or similar commodities.
- Pesticide must be transported in the manufacturer's sealed container.

Transportation Regulations

- The container must be:
 - in a separate, enclosed, leak-proof compartment that is securely affixed to the transport vehicle, OR
 - secured to the transport vehicle using appropriate tie-down straps.

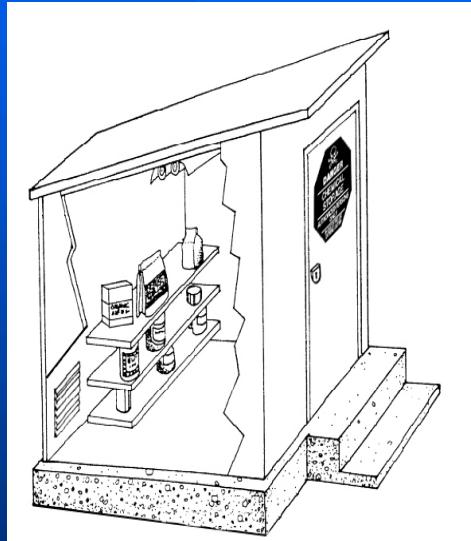
Disposal Regulations

- Pesticide must be disposed of only as prescribed by the manufacturer or the Minister.
- It is illegal to bury or burn ANY pesticide container.

Application Regulations

- No container can be brought **within 25 metres** of an open body of water.
- No application equipment can be filled, discharged, washed, or flushed **within 25 metres** of an open body of water or a well.
- No person can apply a dry formulation, or a liquid formulation under pressure, when the wind speed exceeds **20 km/h**.

Storage Facility Regulations



Every holder of a Pesticide Applicators Business Licence who possess pesticides in amounts in excess of 100 kilograms or 100 litres of formulated product shall ensure that the pesticide is stored in a storage facility that:

- a) is maintained and used exclusively for the storage of a pesticides;**
- b) is free of an accumulation of waste materials other than pesticide containers;**
- c) has a floor constructed**
 - (i) of concrete or other water-impervious material that**
 - (A) is recessed by at least 10 centimetres from the entrance, or**
 - (B) has a liquid-tight sill that is raised by at least 10 centimetres from the floor, and**
 - (ii) in a manner that will contain and control up to 150% of the volume of any liquid pesticide stored in the facility; or**
- d) has a separate containment unit that is constructed**
 - (i) of concrete or other water-impervious material, and**
 - (ii) in a manner that will contain and control up to 150% of the volume of any liquid pesticide stored in the containment unit;**

- e) provides adequate ventilation, either mechanical or natural;**
- f) has conspicuously placed 'NO SMOKING' signs;**
- g) has a sign that states 'WARNING—PESTICIDE STORAGE AREA' on all doors;**
- h) is not accessible to the public and is locked when the holder of the licence or an employee of the that person is not present on the premises on which the pesticide is stored;**
- i) has properly maintained and approved safety equipment to be used in emergency situations;**
- j) includes secure shelving, raised flooring, or otherwise provide for 'off the floor' product storage;**
- k) has no floor drainage;**

- l) is positioned not less than 8.0 metres from incompatible materials (e.g., fuels, fertilizers);**
- m) has posted, by the nearest phone, the following emergency telephone numbers:**
 - a. 911 (fire, police, ambulance),**
 - b. provincial pesticide enforcement office,**
 - c. provincial or regional poison control centre,**
 - d. provincial environmental emergency office;**
- n) includes an up-to-date product storage inventory; and**
- o) includes, on-site, reference Material Safety Data Sheets (MSDSs) for all stored pesticides.**

Pesticide Applicator Certificate

A person cannot purchase or apply a non-domestic pesticide unless they hold a valid applicator certificate in the proper category.

To obtain a certificate the person must:

- Successfully complete an approved examination appropriate to the class of certificate, with a mark of not less than 75%.
- be 18 years of age.

Class E Certificate

- Holders are authorized to apply a pesticide to ornamental vegetables, golf course turf, and other non-crop areas.
- Certificates are valid for 5 years from the date of their issue.

Requirements of Certification

Every Person who holds a Pesticide Applicators Certification shall, keep records of each pesticide use or application, which shall include the following:

- a) the name, address and telephone number, and Pesticide Applicator Certificate Number of the pesticide applicator;**
- b) the name, address, and telephone number of the person for whom the pesticide is being applied;**
- c) the location and dimensions of the area where the pesticide was applied;**
- d) the date and start time of the pesticide application;**
- e) the air temperature, wind speed, and wind direction measured at the point of application at the start time of the pesticide application;**
- f) the name of any pest to be controlled or the purpose of the pesticide application;**
- g) the trade name and *PCP Act (Canada)* number of the pesticide applied;**
- h) the rate of pesticide application.**

Notification Requirement

No person shall apply a non-domestic pesticide for the control of a landscape or soil-based pest unless the person has provided notice, in accordance with subsection (2) (*see next slide*), to all persons who own property that is located within 25 metres of the proposed pesticide application, measured from the edge of the area to which the pesticide is to be applied,

- (a) in writing, at least 24 hours but not more than 48 hours prior to the pesticide application; or
- (b) by phone, at least 24 hours but not more than 48 hours prior to the pesticide application and in writing immediately prior to the pesticide application.

Notification (Subsection 2)

The notice shall include:

- a) the trade name and *PCP Act* Number of the pesticide being applied;
- b) the active ingredient or ingredients of the pesticide or pesticides being applied;
- c) the pest or pests for which control is being undertaken;
- d) the proposed date and time of the application;
- e) the name and phone number of the pesticide applicator;
- f) the recommended caution interval and re-entry time, if such is available from the pesticide manufacturer, or as appears on the pesticide label.

Posting Requirements

No person shall apply a non-domestic pesticide for the control of a landscape or soil-based pest unless, immediately prior to the pesticide application, the person posts a notice, in accordance with subsection (2) (*see next slide*), on the area to which the pesticide is to be applied.

The notice required shall include:

- the trade name and *PCP Act Number* of the pesticide being applied;
- the active ingredient or ingredients of the pesticide or pesticides being applied;
- the pest or pests for which control is being undertaken;
- the date and time, or proposed date and time, of the application;

The notice required shall include:

- **the name and phone number of the pesticide applicator;**
- **the recommended caution interval and re-entry time, if such is available from the pesticide manufacturer, or as appears on the pesticide label.**

Posting Requirements

The signs on which the notice is posted :

- a) Must measure not less than 22 cm by 28 cm;
- b) Be constructed of weather-resistant materials;
- c) Have all the required information printed, in weather-resistant ink, on both sides of the sign; and
- d) Be positioned in such a manner, and in such quantity, as to make them clearly visible to the public.

Signs are to remain in place for at least 48 hours following the application.

Schedule 1 Products (Require a Permit)

SCHEDULE 1 PESTICIDES FOR WHICH A PERMIT IS REQUIRED

1. Dinoseb 300 EC *PCP Act No. 15086*
2. Vecto Bac 200 G *PCP Act No. 18158*
3. Vecto Bac 600L *PCP Act No. 19455*
4. Vecto Bac 1200L *PCP Act No. 21062*
5. Guthion Spray Concentrate *PCP Act No. 8106*
6. Guthion Spray Concentrate Insecticide *PCP Act No. 9398*
7. Guthion 50% WP Crop Insecticide *PCP Act No. 10101*
8. Azinphos Methyl 50W Wettable Powder 50% *PCP Act No. 15645*
9. APM 50W Wettable Powder Insecticide *PCP Act No. 16412*
10. Azinphos Methyl 240 EC *PCP Act No. 17533*
11. Guthion Solupak *PCP Act No. 21374*
12. Clean Crop Azinphos-M 50W *PCP Act No. 22087*
13. Azinphos Methyl 35W *PCP Act No. 22265*
14. Clean Crop Azinphos-M 240 EC *PCP Act No. 22562*
15. APM 50W Instapak *PCP Act No. 22864*
16. Sniper 50W *PCP Act No. 23287*
17. Sniper 50W Clean Pak *PCP Act No. 23323*
18. Sniper 240 E *PCP Act No. 23337*
19. Vapam Liquid Solution Soil Fumigant *PCP Act No. 6453*
20. Terr-o-gas 67 Preplant Soil Fumigant *PCP Act No. 13477*
21. BASF Basamid Granular (Soil Fumigant) *PCP Act No. 15032*
22. Busan 1020 *PCP Act No. 19421*
23. TCC Methyl Bromide Fumigant *PCP Act No. 19498*
24. BASF Metam Fluid 380 G/L *PCP Act No. 19556*
25. Chloropicrin 100 Liquid Soil Fumigant *PCP Act No. 25863*
(EC761/05)

Schedule 6 (Prohibited Pesticides)

SCHEDULE 6 PROHIBITED PESTICIDES

1. Telone II Liquid Soil Fumigant *PCP Act No. 15893*
2. Telone C-17 Liquid Soil Fungicide and Nematicide *PCP Act No. 16324*
3. Vorlex Plus Liquid Soil Fumigant *PCP Act No. 18353*
4. Vorlex Plus CP Liquid Soil Fumigant *PCP Act No. 18354*
(EC761/05)

PEI *Pesticides Control Act* and Regulations

- Applicators must understand these regulations before purchasing and handling pesticides.
- A copy of the *Act* and regulations can be obtained by contacting:

Pesticide Regulatory Program

(902) 620-3110

www.gov.pe.ca/go/pesticides

Municipal Pesticide Legislation

Municipal authorities

- May have legislative power to establish by-laws concerning pesticides.
- May establish by-laws and building codes that restrict the location, construction, or operation of pesticide storage facilities.

Contact local municipal councils for more information.

PEI LANDSCAPE PESTICIDE APPLICATOR TRAINING COURSE

Training Module 3, Part 1 Labelling

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Learning Objectives

Completing this training module will help you to:

- Understand the legal status of pesticide labels.
- Interpret and apply label information.
- Interpret and apply information on toxicity.

Product Label

The label is a legal document.

- Every pesticide sold in Canada must have an approved label.
- The label provides detailed information about the product and its use.
- The label is the best information source on a pesticide product.

Product Label

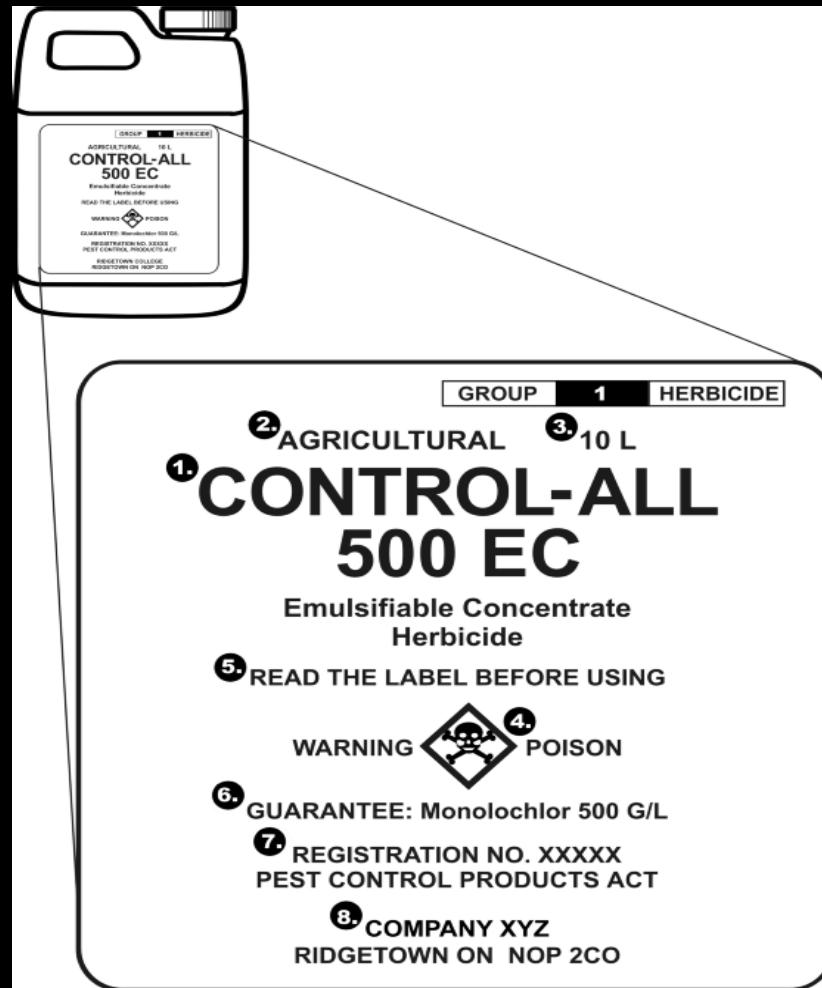
- Always READ THE LABEL before purchasing, transporting, storing, applying, or disposing of a pesticide.
- The label is often fastened to the pesticide container.
- It can also take the form of a small booklet or pamphlet packaged with, or on, the container.

Product Label

- Contact the vendor for replacement labels.
- Never use information provided by another source in place of the information on the label.
- The label has a **Primary Display Panel** and a **Secondary Display Panel**.

Primary Display Panel

GENERIC EXAMPLE



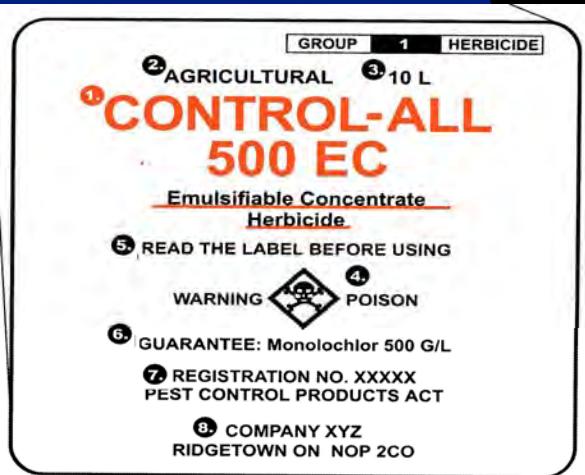
1. Product or Trade Name

CONTROL-ALL 500 EC

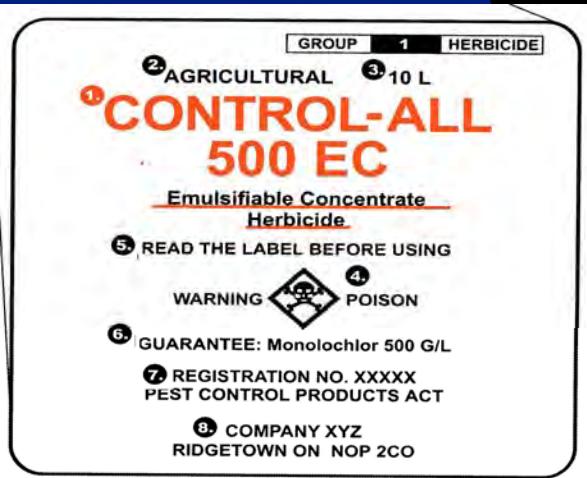
EMULSIFIABLE CONCENTRATE

HERBICIDE

- Usually the largest lettering.
- Is the registered name under which the manufacturer (registrant) has chosen to sell the product. (Roundup, Killex).
- May indicate the **formulation** in full or as an abbreviation. In this case, E.C. means an emulsifiable concentrate.



- The Product or Trade Name May indicate the **formulation** in full or as an abbreviation.
- In this case, E.C. means an emulsifiable concentrate.



Formulation

- A **formulation** is the form in which a pesticide is sold. This can be as a solid, liquid, or gas.
- It includes everything that is in the container (active ingredient, carriers, dilutants, or other materials).
- The same active ingredient can be present in more than one formulation.

Formulations and their Abbreviations

A formulation can be a gas, liquid, or solid. Each formulation has a unique name and abbreviation.

Gases

- Fumigant (FU)

Formulations and their Abbreviations

Liquids

- Emulsifiable Concentrate (EC)
- Flowable (F)
- Solution (S or SN)

Formulations and their Abbreviations

Solids

Dust (DU)

Granular (G)

Pellet (P)

Seed Treatment (ST)

Soluble Powder (SP)

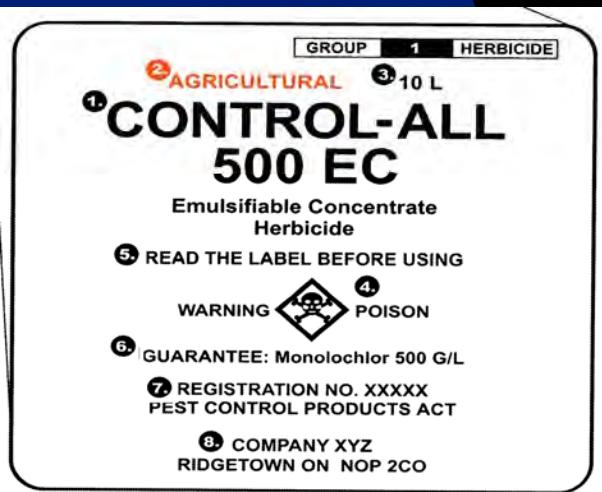
Granule Powder (GP)

Wettable Powder (WP)

2. Class Designation

Agricultural

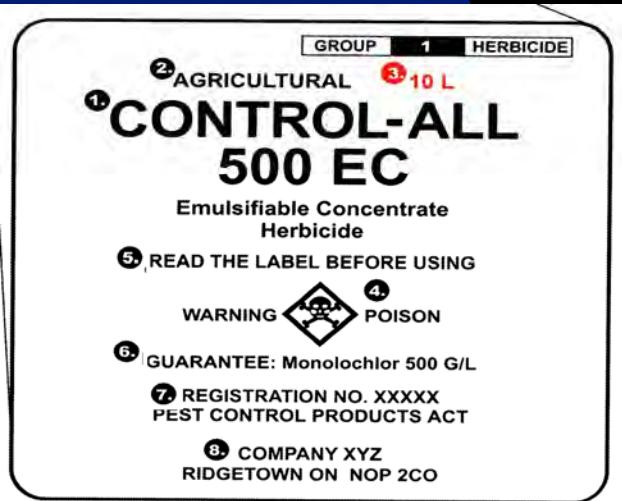
- Designates this as a **Commercial** class pesticide (under the *PCP Act*).
- Only those trained in safe pesticide handling and application can use **Commercial** (Agricultural or Industrial) class pesticides.



3. Net Contents

10 L

- Indicates the total volume (litres) or weight (kilograms) of product in the container.
- In this example the container holds 10 litres (L).



4. Precautionary Symbols and Words

Skull and cross bones symbol:

- Indicates the type and level of hazards associated with this pesticide.



Precautionary Pictograms

Pictograms are used to indicate the type of acute hazard associated with a product.



A skull and crossbones on a label indicates that a product is a poison.



A flame indicates that a product is flammable.

Precautionary Pictograms

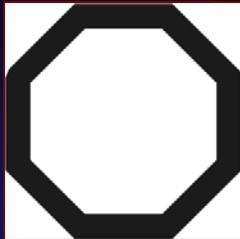


A **bony hand** indicates that a product is corrosive.



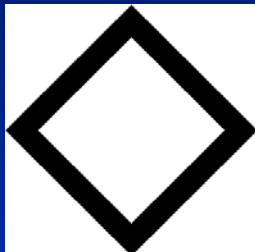
An **exploding grenade** indicates that a product is explosive.

Precautionary Shapes and Words



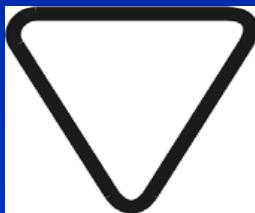
An **octagon** on the label indicates an extreme hazard.

danger



A **diamond** indicates a moderate hazard.

warning



An **upside-down triangle** indicates a slight hazard.

caution

Toxicity

- **Toxicity is a measure of how harmful or poisonous a substance is (i.e., its ability to cause injury, sickness, or other unwanted effects).**
- **Toxic effects can vary with sex, health, age, and weight of the individual; the route of entry; or the duration of exposure.**
- **Toxicity can be classified as chronic or acute.**

Chronic Toxicity

- **Chronic toxicity** results from a number of exposures to small pesticide doses.
- Adverse effects (symptoms) occur and persist over time.
- Effects are often irreversible.

Acute Toxicity

- Acute toxicity results from one or more exposures to a pesticide.
- Adverse effects (symptoms) occur within a few hours to a few days.
- Effects are often reversible.

Acute Toxicity

Acute toxicity is measured primarily by determining the LC_{50} or LD_{50} of the pesticide.

- LC_{50} is the lethal concentration (in parts per million) of vapour that will kill 50% of the test animals when inhaled over a given time period.

- **LD₅₀** is the lethal dose of substance (measured in mg per kg of body weight) that will kill 50% of the test animals when ingested (swallowed) or applied to the skin.
- The lower the number of the LC₅₀ or LD₅₀ the more toxic the pesticide.

The Lower the Number of the LC₅₀ or LD₅₀ the More Toxic the Pesticide.

<u>Pesticide</u>	<u>Oral LD₅₀ (mg/kg)</u>	<u>Toxicity</u>
Metam (Vapam)	97	high
MCPA medium	700 – 1,000	
Metribuzin (Sencor, Lexone)	1,937 – 2,345	low
Glyphosate (Roundup)	4,320	low

The level of acute toxicity is indicated on the pesticide label using precautionary symbols, words, and statements.

How Precautionary Shapes and Words Are Determined for a Label

POISON HAZARD SYMBOL — the shape indicates one (or more) characteristics below	DANGER POISON	WARNING POISON	CAUTION POISON
acute oral LD ₅₀	less than 500 mg/kg	500—1,000 mg/kg	1,000—25,000 mg/kg
acute dermal LD ₅₀	less than 1,000 mg/kg	1,000—2,000 mg/kg	2,000—5,000 mg/kg
respirator	required	advisable in confined spaces	advisable in confined spaces
eye protection	required	required	advisable — may be eye irritant

Combining Shapes and Pictograms on a Label

Example

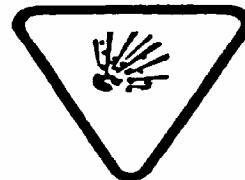
DANGER



POISON



FLAMMABLE



EXPLOSIVE

Warning
poison

Danger
flammable

Caution
explosive

5. “Read the Label” Statement



6. “Guarantee” Statement



The guarantee statement provides:

- The common name and the concentration of all the active ingredients (a.i.) in the pesticide.

6. “Guarantee” Statement

- Concentration can be shown as weight per unit volume (g/l) or percentage by weight (50% by weight).
- The label example indicates that there are 500 grams of the active ingredient Monolochlor.
- This also means that there are approximately 500 grams of other substances (water or adjuvants) in each litre of this product.

Example “Guarantee” Statement

KILLEX® 500

GUARANTEE:

2,4-D 385.25 g/L

Mecoprop-P 75.00 g/L

Dicamba 18.75 g/L

- Label example indicates that there are **three active ingredients** in Killex 500.

Adjuvants

Adjuvants are substances added by the manufacturer or applicator to improve one or more of the pesticide's qualities, or to promote better application of the active ingredient.

Examples:

Surfactants

Improve the spreading, dispersing, and/or wetting properties of a pesticide mixture.

More Examples of Adjuvants

Stickers

Allow pesticides to stay on the treated surface.

Drift Retardants
and Thickeners

Increase droplet size and reduce drift.

Anti-foaming
Agents

Reduce foaming of spray mixtures.

Selecting an Adjuvant

- Applicators wishing to add adjuvants must follow pesticide label directions.
- The label on the adjuvant will list the pesticides and formulations with which it can be safely combined.
- Use of an unregistered adjuvant is illegal under the Pest Control Products (PCP) Act. It could also change the product's effectiveness or cause injury to the non-target life.

7. Pest Control Products Act Registration Number (PCP Number)



- Shows that the product has been registered with Health Canada.
- The Pest Control Products Act Number is unique to the pesticide formulation.
- Any change in the formulation by the manufacturer will require a new number.

- Higher PCP numbers indicate more recent product registrations.
- Do not purchase a product unless the registration or PCP Number is on the label.
- Poison control data bases are tied to this number.
- Give this number to the doctor when seeking medical help.

8. Pesticide Registrant (manufacturer)



- Provides information on the company that registered the product.
- Assists you to contact the registrant in case of an emergency, or when seeking more information on the product.

PEI Landscape Pesticide Applicator Training Course

Training Module 3, Part 2 Labelling

Disclaimer

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This training module is not in any way intended to nullify or detract from any requirements contained in municipal, provincial or federal laws or by-laws, regulations or legislation.

Learning Objectives

Completing this training module will help you to:

- Interpret and apply label information found on the Secondary Panel.
- Find, interpret, and apply Material Safety Data Sheet (MSDS) information.

Product Label Review

The label is a legal document.

- Every pesticide sold in Canada must have an approved label.
- The label provides detailed information about the pesticide and its use.
- The label is the best information source on a pesticide.

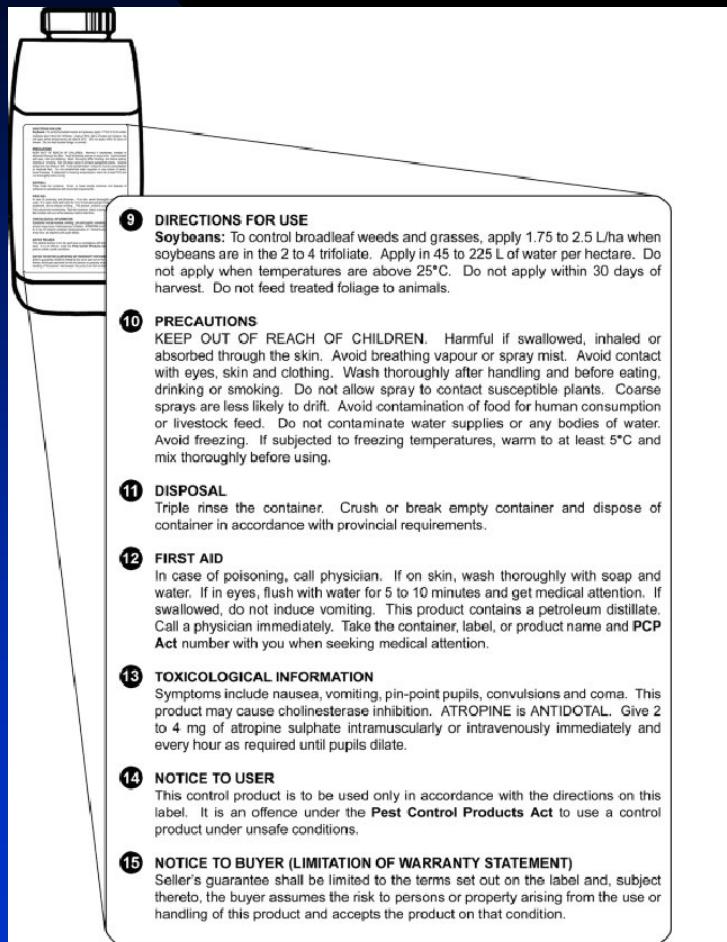
Product Label Review

- Always **READ THE LABEL** before purchasing, transporting, storing, applying, or disposing of a pesticide.
- The label is often fastened to the pesticide container.
- It can also take the form of a small booklet or pamphlet packaged with, or on, the container.

Product Label Review

- Contact the vendor at once to replace a missing or damaged label.
- Never use information provided by another source in place of the information on the label.
- The label has a Primary Display Panel and a Secondary Display Panel.

Secondary Display Panel



- 9. Directions for use.**
- 10. Precautions.**
- 11. Disposal instructions.**
- 12. First aid instructions.**
- 13. Toxicological information.**
- 14. Notice to user.**
- 15. Notice to buyer.**

9. Directions for Use

Information provided includes:

- Pests that can be controlled (e.g., weeds, insects, or diseases).
- Location where the product can be used.
- Amount of product needed and how it should be mixed.
- Application procedure and rate(s).

- Type of application equipment needed.
- How to ensure a safe application.
- When the product should not be used.
- Timing and number of applications pre season.

Example Statement: Killex 500

Directions for Use

“Do not apply to newly seeded turf until after the second or third mowing. Grass seed can be safely sown 1 to 2 weeks after application at recommended rate.”

Some ‘Example Statements’ refer to Killex 500

Registration No. 16971

Handout is available

10. Precautions

Information provided includes:

- Hazards that can result from product use.
- How to use the pesticide safely.
- How to protect the user and others when mixing, applying, storing, and disposing of product.

- Human health or environmental concerns.
- Storage, application, handling, and buffer zone requirements.
- Re-entry Intervals.

Example: Killex 500

Precaution statement:

“May cause severe eye irritation and reversible eye damage. Wear goggles when handling this product. This product may cause skin sensitization reactions in certain individuals.”

11. Disposal

Provides directions on how to safely dispose of the product and product containers.

More detail on “cleaning and discarding of containers” is provided in Module Confirm Later.

Example Disposal Statement:

“Triple rinse the container. Crush or break empty container and dispose of container in accordance with provincial requirements.”

12. First Aid Instructions

Label provides a primary source of First Aid information.

- **ALWAYS** read this section of the label before handling a pesticide. Also, ensure that family and fellow workers are familiar with this information.

- Tells you what to do if someone is poisoned or injured by the pesticide, or if the pesticide is spilled on skin, splashed in the eyes, or swallowed.

Example Statement: Killex 500

“If on skin, wash with soap and water. If in eyes, splash repeatedly with plenty of clean water. If irritation persists, obtain medical attention. If swallowed, INDUCE VOMITING. Obtain medical attention or contact a Poison Control Centre IMMEDIATELY. Take container, label or product name and Pest Control Product Registration Number with you when seeking medical attention.”

13. Toxicological Information

Provides information that may be needed by medical personnel in case of pesticide poisonings or injuries.

- May list common signs and symptoms of acute pesticide poisoning for exposure to this product.
- May give information on an antidote.

- May describe other substances that can affect treatment.
- In the event of an accident give the PCP Act registration number and toxicological information to medical authorities.

Pesticide Poisoning

- **ALWAYS** read the **Toxicological Information** section of the label before using a pesticide. This lists the acute poisoning symptoms.
- Knowing these symptoms can help you to quickly identify a poisoning.
- If someone is exposed to a pesticide, and any of these symptoms begin to show, seek medical help at once.

Example Statement: Killex 500

“This product is highly irritating to eyes on contact. Treat symptomatically.”

Common Symptoms of Pesticide Poisoning

Mild Symptoms:

Headaches; perspiration; fatigue (feeling tired); diarrhea; loss of appetite; dizziness; thirst; weakness; moodiness; nausea; and irritation of the skin, eyes, nose, or throat.

Common Symptoms of Pesticide Poisoning

Moderate Symptoms:

Nausea, stomach cramps, trembling, vomiting, loss of muscular co-ordination, diarrhea, excess saliva, mental confusion, blurred vision, sweating, tightened throat or chest, rapid pulse, laboured breathing, cough, and flushed or yellow skin.

Common Symptoms of Pesticide Poisoning

Severe Symptoms:

Vomiting, pinpoint pupils, loss of reflexes, convulsions, increased breathing rate, unconsciousness, inability to breathe, muscle twitching, and fever.

Generic Example Statement:

**“Symptoms include nausea and vomiting,
pin-point pupils, convulsions and coma.
This product may cause cholinesterase
inhibition. ATROPHINE is ANTIDOTAL.”**

14. Notice to User

Example Statement:

“This control product is to be used only in accordance with the directions on this label.”

- It is an offence under the *PCP Act* and *P.E. I. Pesticides Control Act* to use a pesticide in an unsafe way.

15. Notice to Buyer

Example Statement:

“Seller’s guarantee shall be limited to the terms set out on the label and, subject thereto, the buyer assumes the risk to persons or property arising from the use or handling of this product and accepts the product on that condition.”

Additional Information That Can Appear on the Pesticide Label

- Re-entry period
- Spill cleanup instructions
- Emergency contact statements
- Steps to reduce drift
- Compatibility
- Soil type precautions

Additional Information That Can Appear on the Pesticide Label

- Environmental hazards
- Buffer zone statements
- Total number of applications per season
- Storage information
- Resistance management statements

Re-entry Period



- The **re-entry period** is the minimum time between a pesticide application and the time when it is safe to re-enter a treated area.

Example Statement: Killex 500

Re-entry Interval Statement

“Do not allow people (other than applicator) or pets on treatment area during application. Do not enter treated areas until spray has thoroughly dried.”

- Label statements may also identify personal protective equipment (PPE) needed for re-entry to a field or greenhouse.
- Handling treated plants or going back into the application area too soon could result in poisoning.

Example Statement:

Handling Dilute Solutions of Killex 500

“During application or repairing or cleaning equipment: Wear a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes. Rinse gloves before removal.”

Spill Cleanup Instructions

Example Statement:

“Wear appropriate protective equipment (gloves, glasses, apron) when attempting to clean up the spill. If the container is leaking, secure leak and place the container into a drum or heavy gauge plastic bag. Contact company (see emergency telephone number) for further information.”

Emergency Contact

Example Statements:

“In case of a major spill or fire, call 1-800-XXX-XXXX.”

“In case of pesticide poisoning, call the Poison Control Centre at 1-800-XXX-XXXX.”

Environmental Hazards

- Potential environmental hazards appear under the **Precautions** section of the secondary display panel.
- The statements will be specific to each product.

Example Statements:

“This product is extremely toxic to fish and aquatic invertebrates.”

“This product is very toxic to bees; avoid spraying when bees are foraging. Spray deposit should be dry before bees commence foraging in treated crop.”

Buffer Zone Statements

- Tells how to protect areas (water, habitation) next to a pesticide application.
- Distance for the buffer is determined by Health Canada during product registration.
- Not all labels have **buffer zone statements**.

- Even if no information appears on the label, remember.... **Buffer zone are a provincially regulated requirement.** (see: **Provincial Legislations**)
- Always comply with the most restrictive requirement.



Example Statement:

“A buffer zone of 25 metres for ground applications to protect surface water bodies including lakes, streams, ponds, or sloughs from drift must be observed.”

Total Number of Applications Per

Number of applications per season can be limited for some products due to risk of plant damage or development of pest resistance.

Example Statement:

“Do not make more than two (2) applications at 0.75 L or one application at 1.5 L per season.”

Storage Information

Pesticides can release toxic vapours, be highly flammable, or react with other chemicals. For example, stored herbicides can emit vapours that contaminate other pesticides.

Example Statement:

“Store this product at least 10 metres (10 m) from other pesticide products.”

Instructions to Minimize Drift

- Explains the steps needed to protect nearby areas.
- Some pesticide labels set legal wind speeds.
- Provincial laws can prohibit pesticide application above or below certain wind speeds.

- Even if no information appears on the label, remember—**maximum wind speeds are a provincially regulated requirement.** (see: **Provincial Legislations**).
- Always comply with the most restrictive requirement.

Example Statements:

“Do not spray in winds exceeding 10 km/hour.”

“Spray drifting of this herbicide can be reduced by using high volume sprays under low pressure and coarse sprays.”

“Do not apply this product in the vicinity of sensitive crops when the temperature on the day of application is expected to exceed 30° C.”

Resistance Management Statements

Resistance management statements provide direction on how to avoid pest resistance to a given product.

Example Statements:

“For resistance management purposes, it is recommended that this product be applied not more than twice in sequence or more than six times per crop (annually) or per year for control of perennials.”

“Use a sound resistance management program that includes the use of other products with different modes of action.”

Compatibility Information

Provides information on whether a product is registered and safe for **tank mixing** with other pesticides.

- Mixing pesticides that are not compatible can reduce their effectiveness, injure the treated crop, plug sprayer nozzles, or damage equipment.

Tank Mixing

Tank mixing is the combining of different pesticides in the same spray tank to be applied to the same area at the same time. This can save time and cost.

All registered tank mixes will be listed on the label of one, or both, products.

Compatibility Information

Example Statements:

“This product is compatible with most Roundup formulations. However, do not mix with lime or other alkaline materials.”

“Do not use tank mixes containing this product on bent grass.”

Soil Type Precautions

- Address pesticide residual activity, or the risk of product **leaching**.
- Will sometimes contain statements that limit the soil types on which a product may be used.

Example Statement:

“Do not apply the high rate to sandy soils, since leaching could occur.”

Material Safety Data Sheets (MSDS)

Material Safety Data Sheets

- Are not legal documents, nor are they a substitute for the label.
- Can provide additional information on health hazards, safety precautions, and guidelines to protect the environment.

Material Safety Data Sheets (MSDS)

- Applicators should have a copy of, and review, the MSDS for any pesticide they use.
- Your pesticide vendor or product manufacturer can supply copies of MSDS.

Components of MSDS

- Product identification
- Hazardous ingredients
- Physical data
- Occupational procedures and preventive measures
- First aid and emergency procedures
- Fire and explosion hazard
- Toxicity and health effects
- Reactivity data
- Preparation data and group

Example of a MSDS

Page 1

MATERIAL SAFETY DATA SHEET		Company XYZ Emergency number - 24 hours: 519-674-SSSS		
Chemical Product and Company Identification				
Product Identifier:	CONTROL-ALL 500 EC			
Registration Number:	54321			
Chemical Class:	aromatic hydrocarbon solvent 40%			
Product Use:	herbicide to control broadleaf weeds and grasses			
Preparation Date:	2004/05/21			
Supersedes:	2002/08/11			
Manufacturer/Distributor:	see above			
Composition/Information on Ingredients				
Active Ingredient:	monolochlor, 500 g/L emulsifiable concentrate			
CAS No:	10101-22-3			
Chemical Identity:	3-(1-methylethyl)-2H-2,1-monolochlor			
Hazards Identification				
Warning Statements: PRECAUTION! Keep out of reach of children. MAY CAUSE EYE AND SKIN IRRITATION. HARMFUL IF SWALLOWED. This product is slightly toxic to fish and aquatic invertebrates.				
Potential Health Effects: Likely routes of exposure: eyes, skin, lungs, mouth Eye contact: may cause eye irritation Skin contact: may cause skin irritation. Prolonged contact may cause increased skin irritation. Inhalation: may cause irritation to the nose, throat and lungs. Ingestion: ingestion may produce irritation of the mouth, nausea, vomiting and diarrhea. Refer to section 11 for toxicological information.				
First Aid Measures				
Skin Contact:	Immediately remove contaminated clothing and wash affected skin with soap and water.			
Eye Contact:	Flush eyes with plenty of water for 15 minutes and seek medical advice immediately.			
Inhalation:	Remove victim to fresh air and if breathing has stopped, give artificial respiration. Seek medical attention. If swallowed, do not induce vomiting but rush victim to nearest hospital taking the container or this sheet with you.			
Ingestion:	Use gastric lavages and saline cathartics.			
Storage Precautions:	Do not handle or store near flame, heat or strong oxidants. Do not store near food or animal feed. Avoid freezing temperatures.			

Example of a MSDS

Page 2

MATERIAL SAFETY DATA SHEET		Company XYZ Emergency number - 24 hours: 519-674-SSSS
Fire Fighting Measures		
Flash Point and method: Ignition Point: Extinguishing Media:		70°C Setaflash closed cup N/D Dry chemical, foam or carbon dioxide. Water or foam may cause frothing when applied to flammable liquids with flash points above 100°C. Fire-fighters should wear full protective clothing and self-contained breathing apparatus.
Accidental Release Measures		
Procedures for dealing with release or spills: Before handling any spills, wear protective equipment - see section 8. For small spills, absorb with sand or other non-combustible material like clay or kitty litter. For large spills, dike up and contain the spill. Collect into a suitable container. Absorb the rest with sand, earth or clay. Decontaminate the area and equipment with laundry bleach or hydrated lime.		
Handling and Storage		
Handling Practices: Keep Out of Reach of Children. Avoid contact with eyes, skin or clothing, and wash immediately after exposure. Avoid contact with eyes, skin or clothing, and wash immediately after exposure. Avoid inhalation of spray. Always wash thoroughly after handling. Remove contaminated clothing promptly, and wash it before wearing again.		
Appropriate storage practices: Store in a well-ventilated, secure area set aside for pesticides. Do not store food, beverages, or tobacco in the same area. Protect from heat.		
Exposure Control/Personal Protection		
Personal Protective Measures: Preventative Measures: Technical Protective Measures: Special Precautions for Transport:		Wear respirator; neoprene gloves; goggles or face shield Do not smoke, eat or drink while working with this product and wash thoroughly before doing so. Avoid breathing vapours, ventilate enclosed spaces and wear cartridge type respirator. Keep containers tightly closed when not in use.
Physical and Chemical Properties		
Appearance: pH: Odour: Form: Water Solubility: Boiling Point: Specific Gravity:		clear, viscous, yellow 8 - 8.5 aromatic odour liquid miscible EC formulation 86°C 1.002

Example of a MSDS

Page 3

MATERIAL SAFETY DATA SHEET		Company XYZ Emergency number - 24 hours: 519-674-SSSS		
Stability and Reactivity				
Chemical Stability:	stable			
Hazardous Polymerization:	will not occur			
Incompatibility:	Avoid contact with strong acids, alkalis, and strong oxidants; nitric acid, acetaldehyde, hydrogen peroxide, chlorinated compounds.			
Hazardous Decomposition Products:	Thermal decomposition may produce toxic smoke, CO and CO ₂ .			
Toxicological Information				
Acute Oral LD ₅₀ :	756 mg formulated product/kg body weight (rats)			
Acute Dermal LD ₅₀ :	1480 mg formulated product/kg body weight (rats)			
Inhalation LC ₅₀ :	>3.63 mg/L air (4 hour) (rats)			
Dermal Irritation:	mild irritant (rabbits)			
Dermal Sensitization:	Dermal sensitization, Guinea pig - not a sensitizer			
Carcinogenicity:	Monolochlor was found not to be carcinogenic in studies with rats and mice.			
Reproductive toxicity:	Monolochlor is not developmentally toxic, and does not affect reproductive performance.			
Teratogenicity:	Monolochlor was not teratogenic in a study with rats.			
Ecological Information				
Aquatic Invertebrates:	48-hr EC50 Daphnia magna: 24-37 mg/L; slightly toxic			
Warmwater Fish:	96-hr LC50 Bluegill sunfish: 5.8-14 mg/L; slightly to moderately toxic			
Terrestrial Invertebrates:	48-hr LD50 Honeybee: >0.1 mg/bee; Practically Nontoxic			
The results of degradation and bioconcentration studies with this material indicate that the active ingredient is rapidly adsorbed to soil, readily biodegrades in soil and water, and does not bioaccumulate.				
Disposal Considerations				
Waste Disposal: Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, Provincial, and local regulations. Do not flush to surface water or sanitary sewer system. Triple rinse the container. Offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill in accordance with the provincial and local regulations. Do not re-use empty containers.				
Transport Information				
TDG Classification – Road/Rail: not regulated				

PEI Landscape Pesticide Applicator Training Course

Training Module 4, Part 1 Human Health

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Human Health

Topics to be Covered

- Pesticide Poisoning.
- High Risk Pesticide Families.
- Cholinesterase Blood Testing.
- Pesticide Risk.

Learning Objectives

Completing this training module will help you to:

- Manage pesticide poisoning.
- Identify the causes of pesticide poisoning.
- Recognize the symptoms of pesticide poisoning.
- Identify how toxicity relates to pesticide families.

Learning Objectives

Completing this training module will help you to:

- **Recognize the role of a cholinesterase blood test.**
- **Identify general health effects of pesticides used in the landscape industry.**
- **Calculate and assess risk.**

Managing Pesticide Poisoning

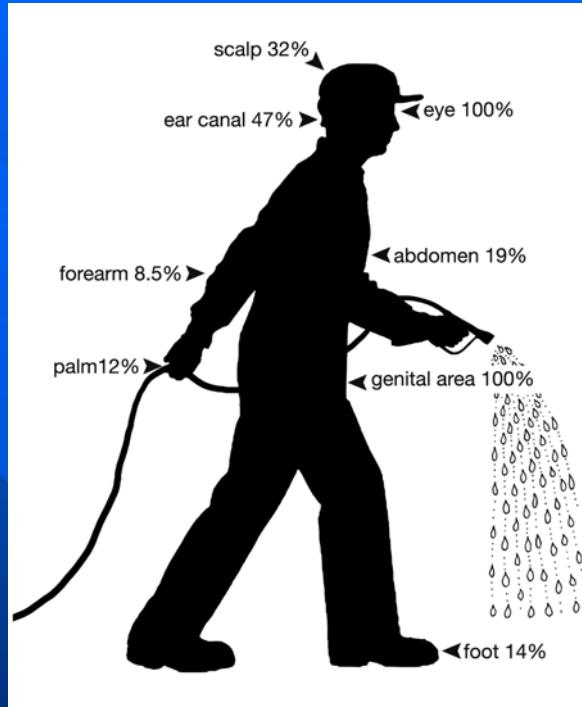
Before Working With Pesticides:

- Have a full medical examination.
- Understand that respiratory or heart disease may stop you from using a respirator.
- Tell your employer of any medical conditions.

Managing Pesticide Poisoning

- Avoid exposure when handling and using a pesticide.
- Review poisoning symptoms on the pesticide label before using any pest control product.
- Seek medical help at once if someone is exposed to a pesticide, and any of the **acute pesticide poisoning symptoms** noted on the label begin to show.

Managing Pesticide Poisoning



- Pesticide absorption rates vary depending upon the body part exposed.

Common Causes of Pesticide Poisoning

DERMAL EXPOSURE

- Not washing hands after handling pesticides, containers, or equipment.
- Splashing /spilling pesticide on skin.
- Not wearing gloves when removing pesticide-contaminated personal protective equipment.
- Applying pesticides in windy weather.
- Not wearing gloves when touching treated plants or when handling spray equipment.

Common Causes of Pesticide Poisoning

ORAL EXPOSURE

- Not washing hands before eating, smoking, or chewing.
- Splashing pesticide into mouth.
- Storing pesticide in anything but the original container.

Common Causes of Pesticide Poisoning

INHALATION EXPOSURE

- Handling pesticides in confined or poorly ventilated areas without wearing a respirator.
- Handling dusts or powders without wearing a respirator.
- Using an inadequate or poorly fitting respirator.

Common Causes of Pesticide Poisoning

INHALATION EXPOSURE

- Being exposed to drift without wearing a respirator.
- Not washing hands before smoking.

Common Causes of Pesticide Poisoning

EYE EXPOSURE

- Rubbing eyes or forehead with contaminated gloves or hands.
- Splashing liquid or dry formulations without wearing goggles.
- Applying pesticides in windy weather without wearing goggles.

Sensitivity

- Exposure to active ingredients or components of the formulation can appear as a sensitivity.
- Repeated exposure can make individuals even more sensitive (Chronic Toxicity).
- Sensitivity can appear as a rash, headache, watering eyes, itchy skin, or breathing problems.

Sensitivity

- Some people are especially sensitive to pesticides.
- Read the toxicological section of the label before using a pesticide so you can recognize acute symptoms of pesticide poisoning.

Pesticide Poisoning

Review:

- **Acute pesticide poisoning** can occur after one exposure to a product. Symptoms can appear within a few minutes to 96 hours.
- **Chronic poisoning** occurs after a number of exposures to a pesticide over a long time. Symptoms appear over time and persist.

Pesticide Families

- Products within the same family can produce similar poisoning effects. Some families are more toxic than others.
- Knowing the chemical family of a pesticide will help you to handle and use it properly.
- **Organophosphate and carbamate** pesticides are the most acutely toxic landscape pesticides.
- Excess exposure can inhibit the function of the enzyme cholinesterase.

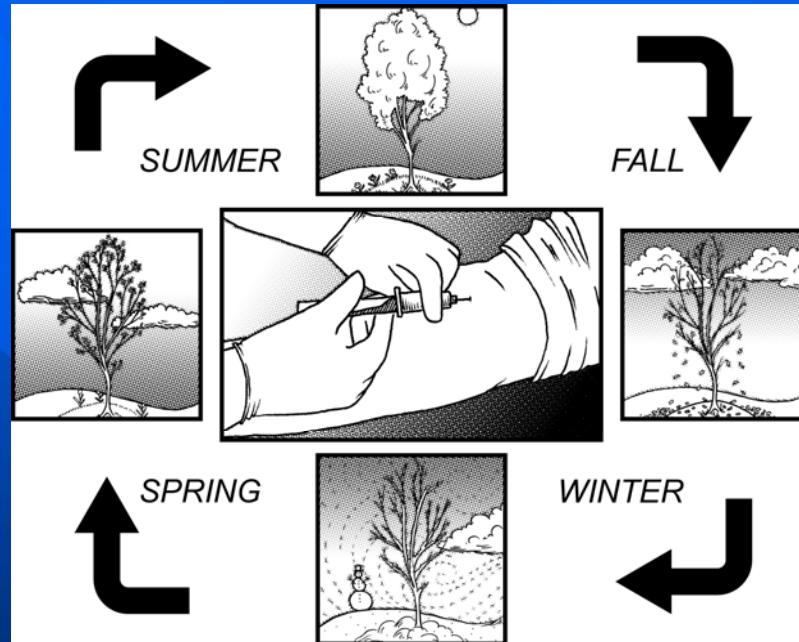
Cholinesterase Inhibition

- Interfering with the levels of the body enzyme cholinesterase will affect messages being sent by the brain to various parts of the body.
- This can cause trembling, twitching, convulsions, or trouble with breathing and the heart. It can even cause death in severe cases.
- Always check the toxicological section of the secondary label panel for statement: “This product may cause cholinesterase inhibition”.

Cholinesterase Blood Test

- A test is available to determine the level of cholinesterase in the blood. Contact your family doctor to arrange a baseline test.
- The **baseline level** of cholinesterase varies between individuals, so your first blood test should be taken **before** handling, using, or being exposed to these pesticides.
- This will determine your **personal baseline level** of cholinesterase.

Cholinesterase Blood Test



Tests should be done at various times of the year to set your baseline value and determine if levels are acceptable.

Cholinesterase Blood Test

- Medical professional will advise if further action is required.
- Early detection of unacceptable exposure avoids chronic poisoning.
- Without further exposure, blood cholinesterase levels will return to normal after about 120 days for organophosphate poisoning (recovery is more rapid for carbamate poisoning).

High Risk Landscape Pesticides

Organophosphates (OP)

- Repeated exposure can cause acute and chronic poisoning.
- There is often little long-term effect unless exposure continues.
- They are quickly adsorbed through the skin, lungs, or digestive tract.

High Risk Pesticide Families

- Affect the nervous system by reducing blood levels of cholinesterase.
- This can be a concern for workers in the landscape industry.
- Workers should have their blood tested for cholinesterase before the start of each season.

Examples: **azinphos-methyl (Guthion), malathion (Malathion) and dimethoate (Cygon)**

Common Symptoms of Acute Pesticide Poisoning with Organophosphates

Mild Poisoning Symptoms:

Headache; perspiration; fatigue (feeling tired); diarrhea; loss of appetite; dizziness; thirst; vision problems; weakness; moodiness; nausea; and irritation of the skin, eyes, nose, or throat.

Common Symptoms of Acute Pesticide Poisoning with Organophosphates

Moderate Poisoning Symptoms:

(Contact a doctor if any of these symptoms are noticed.)

Nausea; stomach cramps; vomiting; loss of muscular co-ordination (trembling); diarrhea; salivation; mental confusion; blurred vision; sweating; tightness of throat or chest; slow pulse; laboured breathing; and flushed or yellow skin.

Common Symptoms of Acute Pesticide Poisoning with Organophosphates

Severe Poisoning Symptoms:

(Contact a doctor if any of these symptoms are noticed.)

Vomiting; pinpoint pupils; loss of reflexes; convulsions; breathing troubles; coma; unconsciousness; bluing of skin; muscle twitching; heart trouble; and loss of bowel control.

Pesticide Families

Carbamates (C)

- Can cause acute poisoning.
- Can affect the nervous system by reducing the level of blood cholinesterase.
- Cholinesterase levels recover quickly after carbamate exposure, and the effect is usually short-lived.
- Symptoms are similar to acute OP poisoning.

Examples: carbaryl (Sevin), and carbofuran (Furadan)

Other Pesticides Families

Phenoxy Herbicides (Examples: 2,4-D and MCPA.)

- Acute toxicity can be low to moderate.
- Exposure to the solvent can produce ill effects.
- Some solvents are moderately irritating to the skin, eyes, respiratory tract, and gut lining.
- Symptoms: Weakness, anorexia, muscle weakness (chewing and swallowing), lack of energy, and diarrhea.

Other Pesticide Families

Botanical Insecticides

- Pyrethrum is the most common of the natural pyrethroid group.
- Have a high human LD50 and poisoning is rare.
- Dermal exposure can cause an allergenic reaction.
- Inhalation can cause throat or lung irritation.

Other Pesticide Families

Synthetic Botanical Insecticides

- Poisoning is rare.
- Cymbush has an LD50 of 247 mg/kg body weight).
- Dermal exposure can cause an allergenic reaction.
- Inhalation can cause throat or lung irritation.
- Avoid breathing product vapours.

Other Pesticide Families

Dithiocarbamate and Thiocarbamate

- Have a low acute toxicity and do not inhibit cholinesterase.
- Some can irritate the skin, eyes, nose, throat, or lungs and must still be treated with caution.
- Can also cause nausea, vomiting, or muscle weakness (in very large doses).

Petroleum-based Products

Petroleum Distillates

- Are used as part of the pesticide formulation as a diluent or as a pesticide themselves.
- Symptoms of acute poisoning include: Nausea, vomiting, coughing, lung irritation (can cause bronchial pneumonia with fever and cough), weakness, dizziness, unconsciousness, and convulsions.

Petroleum-based Products

Aromatic Hydrocarbons

- Are used as part of the pesticide formulation (example: xylene).
- Acute poisoning symptoms include: Dizziness, euphoria, headache, nausea, vomiting, tightness in the chest, staggering, blurred vision, paralysis, rapid breathing, convulsions, and unconsciousness.
- Repeated exposures are hazardous.

Pesticide Risk

Risk of exposure exists any time you handle a pesticide. It is important that you know how to measure, assess, and reduce risk.

Risk = level of exposure X toxicity

- **Exposure** is the amount of contact with a pesticide.
- **Toxicity** is a measure of how harmful or poisonous a pesticide is.

Pesticide Risk

To reduce the risk from pesticides:

- Choose a less toxic product.
- Reduce the level of exposure.

PEI Landscape Pesticide Applicator Training Course

Training Module 4, Part 2 Human Health

Disclaimer

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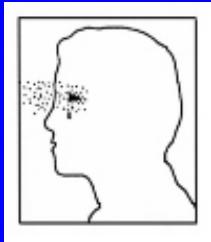
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Learning objectives

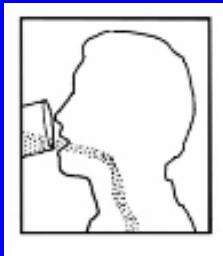
Completing this section will help you to:

- **Identify routes of pesticide exposure.**
- **Identify sources of pesticide poisoning.**
- **Identify and select proper personal protective equipment.**
- **Clean, maintain, and store personal protective equipment.**

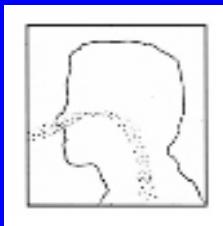
Routes and Sources of Exposure



Absorption: taken in through the eye or skin at any place on the body



Ingestion: Taken into the stomach through the mouth

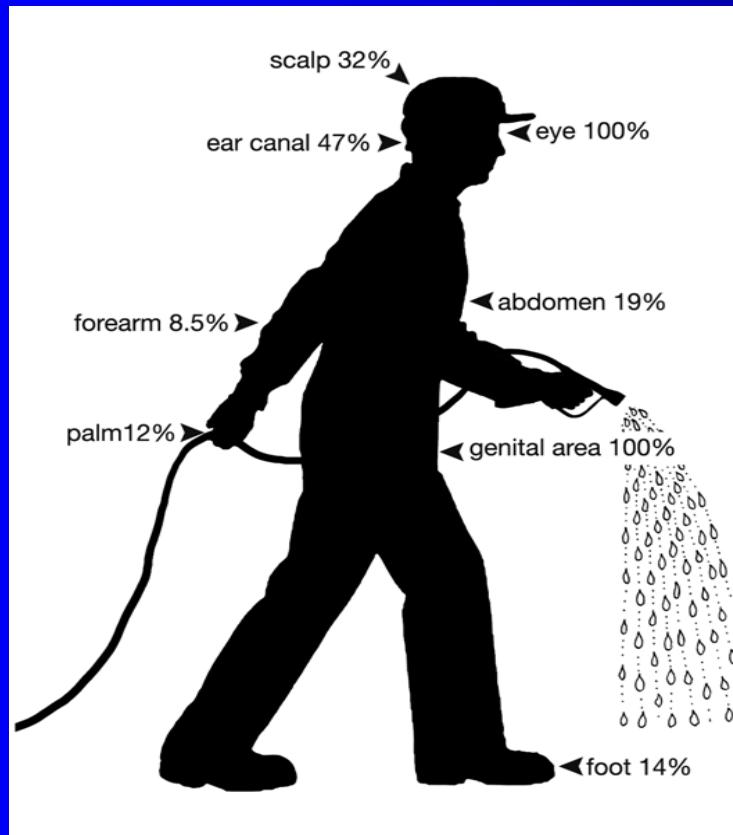


Inhalation: Breathed into the lungs through the nose or mouth

Absorption

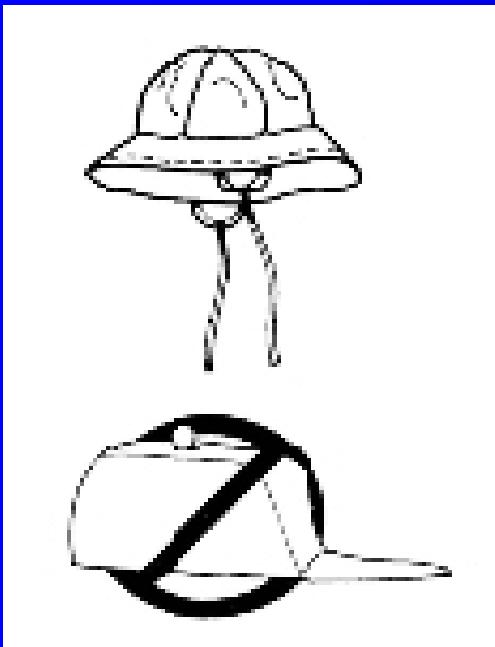
- The most common route is though the skin.
- The absorption rate depends on the pesticide and the affected location on the body.
- The head, small of the back, armpits, and groin are the most absorptive body areas.
- Pesticide is absorbed at a faster rate through a cut or sweaty skin.
- Risk can be reduced by wearing proper PPE.

Areas That Need Protection From Absorption



- Head
- Eyes
- Body
- Hands
- Feet

Protection of the Head



- The hat should be wide-brimmed, non-absorbent (**not a cloth or leather baseball cap**), and easy to clean.

- Always wear a hat when handling a pesticide. The head can absorb a pesticide faster than most other parts of the body.
- Wash the hat with other contaminated clothing.

Protection of the Eyes

Face and eye protection is especially important when mixing and loading a pesticide. Product can be quickly absorbed and some can directly damage the eyes.



Protection of the Eyes

Goggles and face shield

- Wear a full-face respirator, goggles, or a face shield any time pesticide might splash or spray, or dust could pose a risk to the face or eyes.
- Wash eye protection equipment thoroughly with a brush, soap, and water after each use.
- Store protective equipment away from contact with pesticides.

Protection of the Body



- Wear long-sleeved shirts and long-legged pants, or one-piece coveralls.
- Clothing material should have a tight weave.
- Protective clothing should be clean and pesticide free.
- Wear cuffs over gloves and boots.

Protection of the Body



- Wear waterproof material (splash pants) if clothing could become wet during a pesticide application.
- Wear a waterproof apron when measuring, mixing, or loading pesticides.

Maintenance of Protective Clothing

- Rinse off waterproof clothing before removing it.
- Store contaminated clothes in disposable plastic garbage bags before washing.
- Wash contaminated clothing daily.
- Discard clothing that is heavily contaminated by pesticide residue.

Laundering Protective Clothing

- Wash protective clothing separate from other laundry.
- Wear gloves when handling contaminated clothing.
- Pre-soak and wash contaminated clothing separate from normal laundry.
- Fill washer with hot water and use a heavy duty detergent. Do not overload the washing machine.

Laundering Protective Clothing

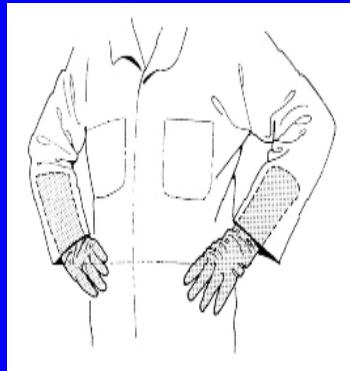
- Repeat the wash cycle, if necessary, to remove stronger chemicals.
- Rinse the empty washing machine by running a full cycle of clean water before washing other clothes.
- If possible, hang wash outside to dry.

Protection for the Hands

Gloves should ALWAYS be worn when:

- Handling or applying a pesticide.
- Rinsing containers.
- Working on spray equipment.
- Taking off and cleaning PPE.

Protection for the Hands



Gloves:

- Wear clean, **unlined gloves** made of non-absorbent, **chemical-resistant material** (butyl rubber, neoprene,).
- ‘Roll up’ the cuff to prevent dripping.
- Gloves must be long enough to cover the wrist and be worn under the sleeves.

Proper Glove Removal



Avoid exposure by
properly removing
contaminated gloves.

Wearing and Maintenance of Gloves

- After handling a pesticide, wash gloved hands in soap and water before removing other PPE.
- Gloves should be the last item of PPE removed.
- Turn gloves inside out as you remove them.
- Wash gloves with soap and water and then rinse.

Wearing and Maintenance of Gloves

- Check gloves for cuts or holes and throw them away if they become damaged.
- Store clean gloves away from pesticides.
- Always wash your hands with soap and water.

Protection of the Feet

Boots:

- Should be unlined and made from chemical-resistant material, such as rubber.
- Should always be worn when handling a pesticide.
- Should be at least ankle height.

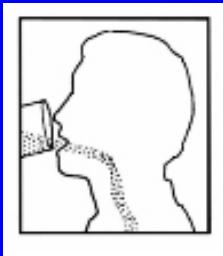
Do not wear leather or cloth footwear (e.g., sneakers).

Wearing and Maintenance of Boots

Boots should be:

- Worn tucked under pant legs.
- Washed inside and out after each use.
- Stored away from pesticides.





Ingestion

Cause

Accidental ingestion.

Transfer of pesticide onto food or drink containers.

Product splashed into mouth.

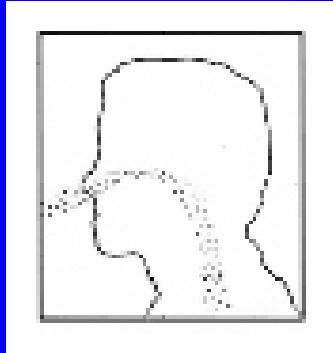
Prevention

Store product in its original container only.

Wash hands after handling pesticides.

Wear splash shield when mixing product.

Inhalation



- Pesticide vapours can be breathed in through the mouth or nose and drawn into the lungs.
- Vapours are quickly and fully absorbed through the lungs and into the blood.
- Vapours pose the greatest hazard when using fumigants.

Respiratory Protection

- Breathing protection is important because pesticides can damage the nose, throat, and lungs.
- A **respirator** is a unit that covers the mouth and nose to prevent the lungs from taking in pesticide spray droplets, particles, and vapours.
- Wear a **respirator** when the pesticide label tells you to, and when there is a risk of exposure to harmful levels of airborne pesticides.

Respiratory Protection

A respirator should:

- Be MSHA-NIOSH or BHSE approved.
- Come with a cartridge to block organic vapours.
- Be worn when the pesticide label tells you to and when there is a risk of exposure to harmful levels of airborne pesticide.
- Fit properly.

Respirator Types



Dust Mask

Stops dust particles but
**DOES NOT STOP
PESTICIDE VAPOURS.**

Respirator Types



Cartridge Respirator

Provides protection against low pesticide vapour concentrations.



Canister Respirator

Provides protection against high pesticide vapour concentrations.

Respirator Types

Air-powered Purifying Respirators

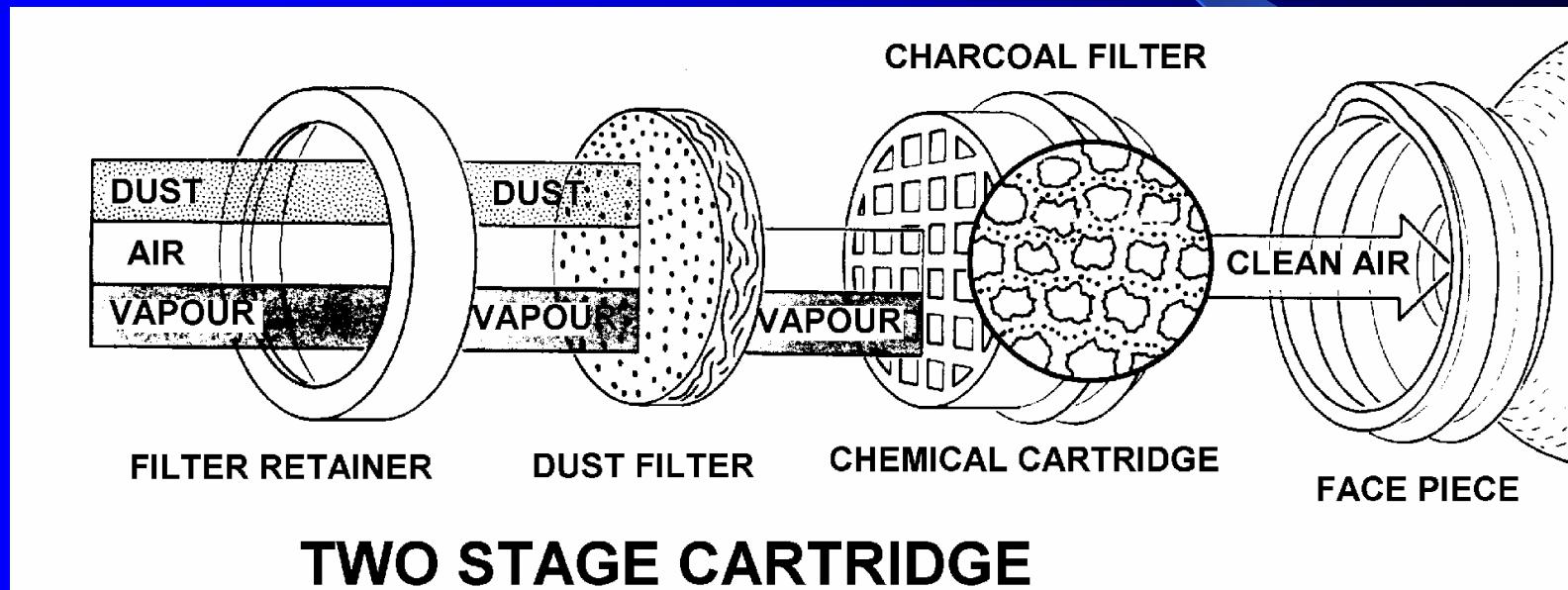
- Use an electric pump to draw air through a charcoal cartridge.
- The purified air is brought to a tight-fitting facemask, loose-fitting helmet, or into the tractor cab.
- Air-powered purifying respirators can be costly.

Respirator Types

Self-contained Breathing Equipment

- Clean air is supplied through a tube from a pressurized tank on the wearer's back.
- This type of equipment should be worn in areas of low oxygen, while applying a fumigant, or when fighting a fire in a pesticide storage area.

How a Cartridge Respirator Works



How Often Should You Change Charcoal Cartridges?

- As a minimum, at the start of each spray season.
- After several hours of use, if the concentration of pesticide vapour is high.
- If the respirator is properly fitted and a pesticide smell or odour is still detected.
- If breathing through the respirator becomes difficult.

Fitting a Cartridge Respirator

- Respirators come in a number of shapes and sizes.
- For proper protection, select one that fits securely.
- A tight seal cannot be achieved if the wearer has a beard or other facial hair.
- Do a fit test each time you put on the respirator.

Steps for Fitting a Cartridge Respirator



- Place the palm of your hand over the exhalation valve cover and breath out gently.
- Proper fit occurs when the face piece will bulge slightly (no air leaks between the face and face-piece).
- If there is a leak, take off the respirator and put it on again or readjust the tension of the elastic straps.

Steps for Fitting a Cartridge Respirator

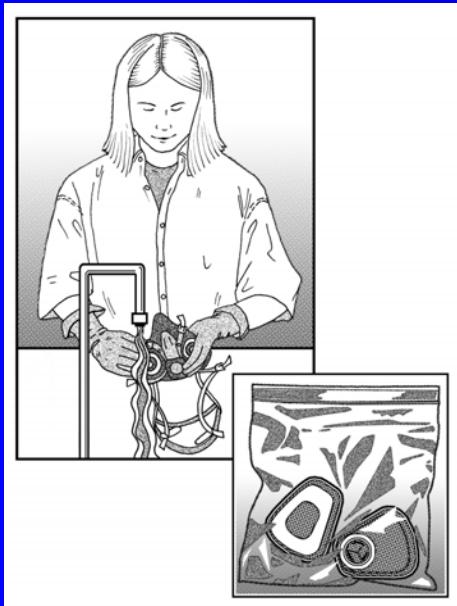


- Place a piece of paper or palms over the cartridge openings and breath in gently. Hold for 10 seconds.
- Proper fit occurs if the face piece collapses (no air leaks between the face and face piece).
- If there is a leak, take off the respirator and put it on again or readjust the tension of the elastic straps.

Maintaining a Respirator

- Check respirators regularly for damage.
- Make sure all valves, mechanical pre-filters, and charcoal cartridges are properly attached and sealed.
- Remove pre-filters and cartridges/canisters after each day of use, or when they are not in use.
- Keep filters and cartridges in clean, sealed, plastic bags to extend their life.

Washing the Respirator



- Put on your gloves.
- Remove pre-filters and cartridges/canisters.
- Wash the respirator face-piece in warm water.
- Use a mild detergent and rinse well.

Overhead Applications

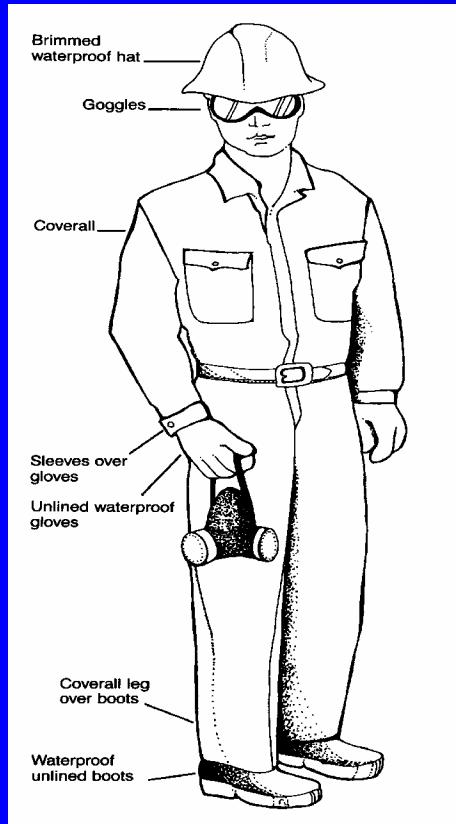


- **Avoid spraying above shoulder height to minimize exposure and drift.**
- **Wear full-face protection, respirator, long chemical resistant gloves, and water repellent clothing and head protection if you must apply a pesticide above shoulder height.**

General Guide for Wearing PPE

- Wear PPE that is appropriate to the type of pesticide application.
- Stop work immediately if protective equipment stops working properly.
- Wear coveralls and chemical-resistant, unlined gloves and boots when handling sod or grass clippings recently treated with pesticides.

General Guides for Storing Personal Protective Equipment



- Do not store PPE in the pesticide storage area or with street clothing.
- Store PPE in a cool, dry area, close to your pesticide storage site for quick access.

- Keep waterproof clothing (e.g., gloves, boots, apron, and hats) away from sunlight to extend their life.
- Keep charcoal cartridges in clean, airtight containers or sealed plastic bags to extend their life.
- Change the pre-filter dust pads when cartridges are changed.

PEI Landscape Pesticide Applicator Training Course

Training Module 5 Safe Pesticide Use

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Learning objectives

Completing this section will help you to:

- **Work safely when handling pesticides.**
- **Safely select, purchase, transport, store, mix, and apply pesticides.**
- **Clean up safely after a pesticide application.**

Attitude and General Precautions

- Pesticide use in the landscape industry has the potential to cause harm to people, pets, beneficial organisms, and the environment.
- It is the responsibility of those handling pesticides to reduce risk by working responsibly at all times.
- This can be accomplished through training, adopting a professional attitude, and following basic safety guidelines at all times.

Employee Safety

- **Employers** are responsible for overseeing employee workplace health and safety, training employees to handle pesticides safely, providing information on the pesticides being handled (labels and MSDS's), and providing suitable PPE.
- **Employees** can reduce risk by having a positive attitude, and continually reviewing and following label and company policy safety procedures.

General Precautions for Safe Handling of Pesticides

- **Read and follow label information.**
- **Wear clean PPE when handling pesticides.**
- **Wash after handling pesticide containers, applying pesticides, and working on application equipment.**
- **Never eat, drink, or smoke while applying pesticides.**

General Precautions for Safe Handling of Pesticides

- Remove contaminated clothing immediately.
- Shower, wash hair, and clean fingernails at the end of each day of product use.

Pesticide Selection

You need to consider the following factors when choosing the best pesticide for a given situation:

- Pest(s) to be controlled, pest resistance, and possible impacts on beneficial organisms.
- Products are registered for intended use.
- Select least toxic to human health and environment.

- **Applicator safety or risk of exposure and personal protective equipment.**
- **Bystander safety.**
- **Application equipment.**
- **Environmental factors.**
- **Regulatory compliance.**

Pesticide Safety

Practice safety any time you are working with pesticides.

- Applicators regularly face a risk of exposure to pesticides. Their actions also determine the extent of risk to bystanders and the environment.
- Always work safely and follow good safety practises when handling and managing pesticides.

Pesticide Safety Issues

- Keep up-to-date on safety issues.
- Always read and follow product label directions.
- Follow provincial regulations for safe transport, storage, use, and disposal.



Guidelines for the Purchase of Pesticides

- **Read the label to make sure a product is correct for your needs and application equipment.**
- **Purchase only pesticide containers having clear, readable labels.**
- **Do not accept broken bags, cartons, or leaking containers.**
- **Ask the vendor for a copy of the Material Safety Data Sheet (MSDS) for each product purchased.**

- **Minimize the need for storage by purchasing only the amount of pesticide needed for immediate use.**

Amount Needed

Label application rate X Size of treatment area

Number of containers

Amount needed ÷ Amount in each container

Transportation Legislation

Federal

Transportation of Dangerous Goods (TDG) Act

- Federal Act governing the movement of commercial and restricted class pesticides.
- New regulations can be found at www.tc.gc.ca/tdg/clear/tofc.htm

Provincial

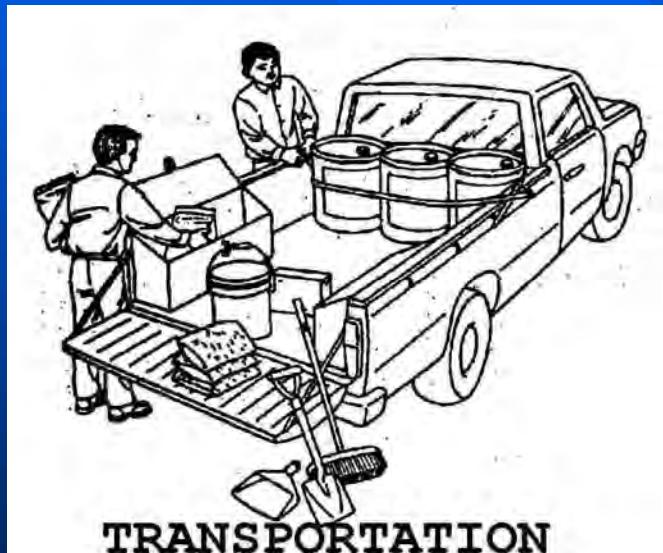
PEI Pesticides Control Act and regulations

Provincial Regulations

When transporting a concentrated pesticide the containers:

- Must be labelled.
- Cannot be transported with foodstuffs, feed, household furnishings, bedding, or clothing.
- Must be in their original sealed container.
- Must be enclosed within a leak-proof compartment that is separate from and securely affixed to the vehicle.

General Guidelines for the Safe Transport of Pesticides

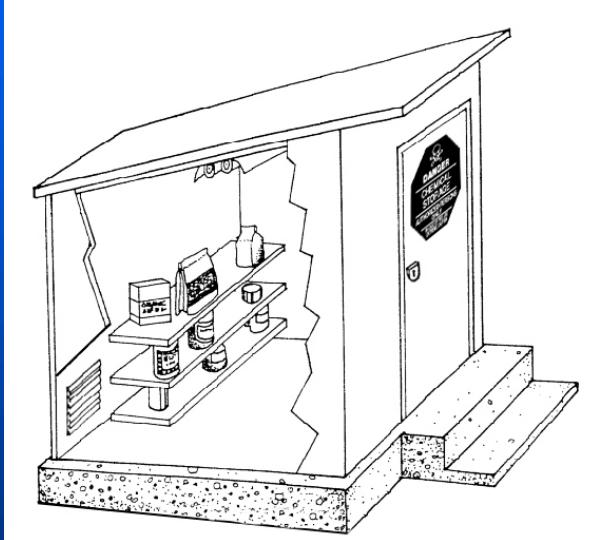


- Pack containers securely and upright to reduce the risk of upsets, leaks, or spills.
- Never transport pesticides in the passenger compartment.

- **Carry a shovel, absorbent material, and safety equipment in case of a pesticide spill.**
- **Protect paper and cardboard containers from moisture.**
- **Never leave pesticides in an unsupervised vehicle.**
- **Decontaminate the vehicle if pesticide contamination results from broken bags, cartons, or leaking containers.**

Pesticide Storage

General Guidelines



- Store pesticides separately from foodstuffs and animal feed.
- Maintain the storage area in a clean and orderly manner.
- Ensure the storage area is well ventilated.

Pesticide Storage Guidelines

- Ensure there are no floor drains.
- Have approved safety equipment available nearby.
- Store personal protective equipment outside of the storage area.
- Equip the building with the proper number and type(s) of fire extinguishers.

Pesticide Storage Guidelines

- **Store only pesticides or related equipment.**
- **Control access and lock the facility when it is unattended.**
- **Check regularly for leaking containers.**
- **Maintain an up-to-date list of all stored pesticides and keep a copy at a location away from the pesticide storage area.**

Pesticide Storage Guidelines

- Have available material needed to clean up a pesticide spill.
- Check regularly for leaking containers.
- Use older product first.
- Post **PESTICIDE STORAGE AREA** signs on each point of entry.

Safe Handling of Pesticides

- The risk of exposure to pesticides is greatest when mixing and loading product.
- People who handle pesticides should use personal protective equipment (PPE) and follow proper safety measures.
- The label will provide precautionary symbols, warnings, and toxicological information, and explain how to handle and use pesticides safely.

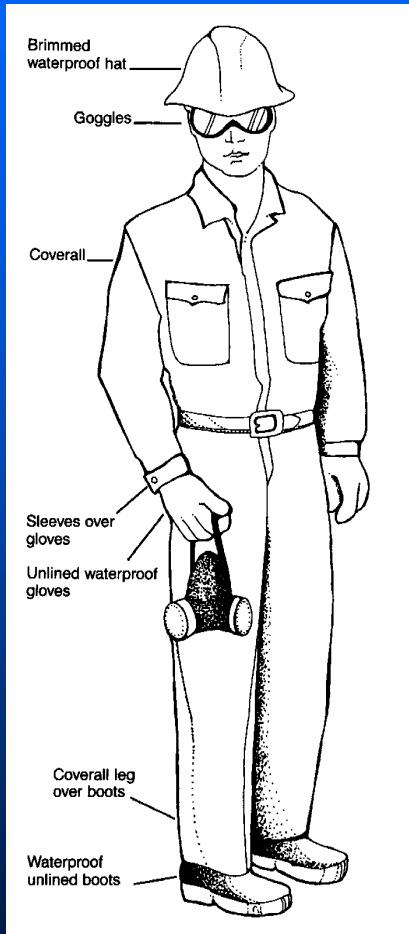
Before Mixing or Loading

- **Read the label to make sure the pesticide is registered for the planned use.**
- **Confirm mixing directions, application rates, and limits to use.**
- **Check safety precautions.**
- **Review poisoning and first aid information.**

Before Mixing or Loading

- Calculate and prepare only the amount of mixture required for the application.
- Make sure clean-up and first aid equipment is nearby (in each vehicle) and easy to access.
- Choose a mixing and loading site that minimizes your risk of exposure, and eliminates any risk of contaminating water and the environment.

Protection While Mixing and Loading



Wear the following protective clothing and safety equipment:

- Coveralls
- Head protection
- Chemical-resistant gloves and boots
- Face shield or goggles
- Waterproof apron
- Respirator

Mixing and Loading Site

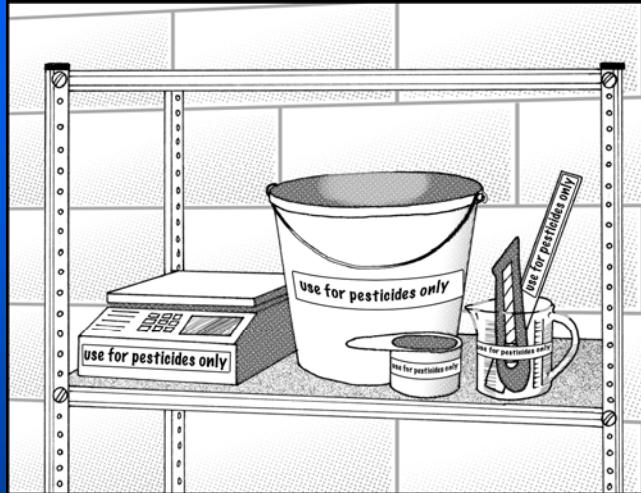
A good pesticide mixing and loading area will be:

- **Located outdoors and away from other people and pets.**
- **On a level site near the pesticide storage area.**
- **Away from drinking water wells and surface waters.**

Mixing and Loading Site

- Mix and measure pesticides on a strong, level bench or table covered with heavy-duty plastic or a material that will not absorb pesticides.
- Do not use this bench or table for any other purpose.
- Keep a shovel, absorbent material, and safety equipment nearby in case of a product spill. Stop and clean up spilled or splashed pesticide at once.

Measuring Equipment



- Use proper tools to open pesticide containers. Open bags using a sharp knife and **clean well after each use.**
- Use scales, measuring cups, and premixing containers to measure product.

Measuring Equipment

- Use these items only with pesticides.
- After use, wash these items with soap and water and store them in a locked area.

Steps for Mixing and Loading

- Do not mix pesticides under windy or adverse weather conditions.
- Follow proper procedures for rinsing of empty containers (Explained later in this Section).
- Follow proper procedures for removing, maintaining, and storing personal protective equipment (see Module 4 Part 2 Human Health).

Steps for Preparing a Tank Mix

- Put half of the total clean water required in the tank and turn on the tank agitator.
- Slowly add the pesticide to the tank. Hold the pesticide container below eye level. Stand on the ground or on a strong, level platform when loading pesticide into a sprayer tank.
- Triple rinse or pressure wash empty pesticide containers.

Steps for Preparing a Tank Mix

- Add the rinse water from the container to the spray tank.
- Wash the measuring equipment used, and add this rinse water to the spray tank.
- Fill the tank to the desired level without overfilling it.
- Wash gloved hands and apron before leaving the site.

Ways to Reduce Exposure Risk

To further reduce the risk of exposure during pesticide mixing and loading use:

- **Premix slurries**

- Dilute concentrated pesticide solution before loading product, then carefully add this slurry to the spray tank.

- **Soluble packaging**

- Place pre-weighed, water soluble, PVC packages of pesticide directly into the sprayer tank.

Ways to Reduce Exposure Risk

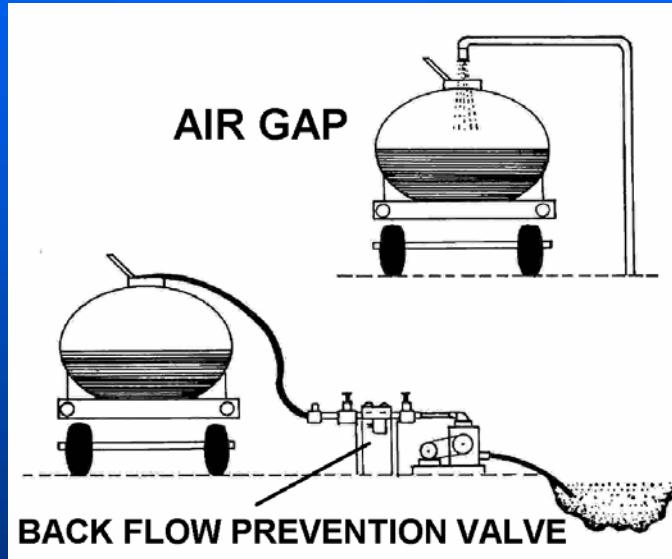
■ Closed loading systems

- Product is pumped directly from the original container into the application equipment without any exposure to humans or the environment.

How to Minimize Water Contamination

- Fill sprayers away from open bodies of water by using a nurse tank.
- Never leave the application equipment unattended.
- Take all materials and equipment with you when you leave, and clean it properly.

How to Minimize Water Contamination



- Keep the filler hose above the water line.
- Use an anti-backflow device.

Safe Pesticide Application

To reduce risk when applying a pesticide:

- **Carry a supply of clean water on the vehicle while at the application site. Use this water to clean items (e.g., PPE) and to wash between job sites.**
- **Cover up or remove items such as animal/bird feeders, water containers, toys, BBQ's, or food utensils to prevent contamination from pesticide drift.**

- **Notify property owner and adjoining property owners, as required by law.**
- **Post the area to be treated BEFORE treatment.**
- **Ensure that anyone who might enter a treated area is aware of the re-entry interval.**
- **Avoid working alone if handling pesticides under hazardous conditions.**

- Plan an application route that avoids passing through treated areas.
- Direct spray inward around the property borders.
- Stay out of recently treated areas.
- Start moving before turning on a granular applicator.

- **Keep application equipment clean and in good working order.**
- **Calibrate equipment for the type of application.**
- **Stop the application when moving over an area that does not require treatment (e.g., driveways or walkways).**
- **Shut off spray nozzles on the boom when turning.**

- If application equipment breaks down...
STOP... shut off equipment, put on proper PPE and make needed repairs at once.
- Always wear gloves and goggles when changing or cleaning nozzles. Use a soft brush and clean water (or compressed air). A hard object can damage the nozzle.
- Never blow out a nozzle with your mouth.

Safe Pesticide Application

Environmental factors to consider:

- Certain ambient temperatures can be required for a pest to be active.
- Rain before an application can limit the amount of pesticide that sticks to the plant.
- Rain too soon after an application can wash the product off plant leaves.
- Rain might be needed for a pesticide to reach the root zone of the weed.

- Risk of pesticide drift increases with increasing wind speeds.
- Steep slopes can limit or restrict the use of certain pesticides that could wash into watercourses. Buffer zone widths may need to be increased.

- Leaching is more likely to occur in highly porous, sandy soil types.
- The solids content and ph of water used to prepare a pesticide mixture can influence the pesticide's effectiveness.

Re-Entry



- Humans and pets can be at risk if they enter treated areas too soon.
- Follow re-entry guides on the label and wait until liquids have dried.
- Advise customers and post signs.
- Put on PPE if you have to re-enter early.

Care of Application Equipment

A pesticide mix should not be left in application equipment for extended periods because it could:

- Weaken hoses, gaskets, and plastic parts.
- Cause corrosion and mechanical problems.
- Be carried over to the next mixture.

- Allow suspensions to settle out.
- Allow granules to absorb moisture and form lumps.
- Reduce pesticide effectiveness.

Cleaning Application Equipment

Application equipment should be emptied and cleaned:

- After each day of use.
- When changing pesticides.
- Before off-season storage.

Wear proper personal protective equipment whenever cleaning or working around application equipment.

Cleaning Application Equipment

- Clean application equipment away from open bodies of water and wells.
- Fill the tank with clean water to dilute the spray residue.
- Flow this water through the sprayer.

Details on caring for application equipment are covered in Module 8: Application Technology.

Safe Pesticide Application

To avoid having leftover spray mix:

- Take accurate measurements of the area to be treated.
- Follow label application rates.
- Frequently re-calibrate application equipment.
- Double check your calculations.
- Keep good application records from previous years.

Discarding Old or Unwanted Pesticide

- Avoid having excess product by buying only the amount of pesticide needed for one season.
- Keep inventory records, and use older stock before buying new product.
- Dispose of pesticide concentrates according to label or provincial regulatory requirements.
- Return unopened containers of pesticide to your vendor.

Cleaning and Disposal of Pesticide Containers

Contaminated, empty pesticide containers can be a point source of pollution.

To decontaminate containers:

- Completely drain the contents of the container into the spray tank. Shake out bags into the tank or hopper.

- **Triple rinse (or pressure rinse) containers.**
Gently rinse bags once (single rinse)
- **Add all rinse water to the sprayer.**
- **Cut, puncture, or crush plastic, metal, or paper containers.**
- **Dispose of the containers according to product label directions or provincial law.**

- Containers cannot be buried, burned, or disposed of except at an approved site or in a manner approved by provincial regulations or recommended by the manufacturer.

2009 CONTAINER RECOVERY PROGRAM SITES

SITE	LOCATION
Robinson's	Albany
McCain Fertilizer	Bloomfield
McCain Fertilizer	New Perth
McCain Fertilizer	Summerside
Cavendish Agri	Kensington,
Cavendish Agri	Montague
Cavendish Agri	Charlottetown,
Cavendish Agri	Oleary
Cavendish Agri	Summerside
Cardigan Feed	Cardigan

PEI Landscape Pesticide Applicator Training Course

Training Module 6, Part 1 Environmental Safety

Disclaimer

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General Comments

- Everyone shares responsibility for protecting the natural environment. To make the best choices, you will need to understand the short- and long-term effects of pesticides on the environment.

General Comments

- Landscape programs can require application of pesticides close to people, pets, sensitive plants, and wildlife.
- Care must be taken at all times to reduce non-target exposure and protect the environment.

Learning Objectives

- Completing this module will help you to:
- Understand what happens to pesticides in the environment.
- Understand the impact that improper pesticide use can have on the environment, people, and animals.

- Understand how to prevent contamination in an urban environment.
- Understand how to prevent contamination of water and land by planning and problem solving.

Environmental Risk

Landscape applicators should:

- Understand that long-term impacts can show up as contaminated land and water, and loss of public support.
- Select and apply pesticides that will cause the least harm to the environment.

- Understand that as an applicator you are largely responsible for minimizing the impacts of pesticide use on human health and the environment.

Risk of Exposure

Possible Problems

- People (especially children) and pets can be exposed by walking into newly treated areas.
- Pet dishes and toys can become contaminated during treatment.
- Surface water can be contaminated from surface run-off.

- Neighbouring property can be contaminated by drift or leaching of pesticides.
- Bees or bird nests can be exposed when applying pesticides.
- Sensitive plants or gardens can be damaged.

Processes That Decide the Fate of Pesticides in the Environment

- **Absorption** – the movement of a product into plants, animals, soil, or structures.
- **Adsorption** – the binding of a product to soil particles.
- **Desorption** – the release of a product from soil particles.
- **Volatilization** – the evaporation of a product.

- **Spray Drift** – the airborne movement of spray drops or particles away from a treatment site during application.
- **Run-off** – the movement of water down a slope.
- **Leaching** – the movement of pesticides (or other chemicals) with water through the soil.
- **Degradation** – the breakdown of a product.

Absorption



- Refers to the movement of pesticides into organisms (plants or animals) or structures (soil or wood).
- Absorption into an organism is not always bad, since many of these organisms can break pesticides down into non-toxic compounds.
- In most cases, a pesticide will not be absorbed if it has adsorbed.

Adsorption

- Is the binding of a chemical to soil or another substance.
- The amount of pesticide that binds to soil depends on:
 - pesticide type and concentration,
 - moisture content,
 - pH, and
 - texture of the soil.

- **Organic soils or soils with a fine clay texture are most adsorptive.**
- **Pesticides adsorbed to soil can be moved with the soil by wind or water erosion onto adjacent properties or into watercourses.**

Desorption

- Occurs when a pesticide bound or adsorbed to soil or another substance is released.
Example: a herbicide bound to soil particles can be released if the soil particles move into a watercourse. When the herbicide moves into the water, aquatic plants can then take up the herbicide and be negatively affected.

Volatization

- Volatization is the process where a solid or liquid becomes a vapour (gas).
- A pesticide is more likely to become a vapour in hot, dry, windy weather and if the spray droplets are small.
- A pesticide vapour can readily move away from the treatment site onto nearby property and affect sensitive plants.
- This movement is referred to as Vapour Drift.

Vapour Drift

Vapour drift can be reduced by:

- Using low spray pressures and large droplet sizes.
- Spraying only when it is relatively cool.
- Following label precautions for application in high temperatures.
- Using low volatile formulations.

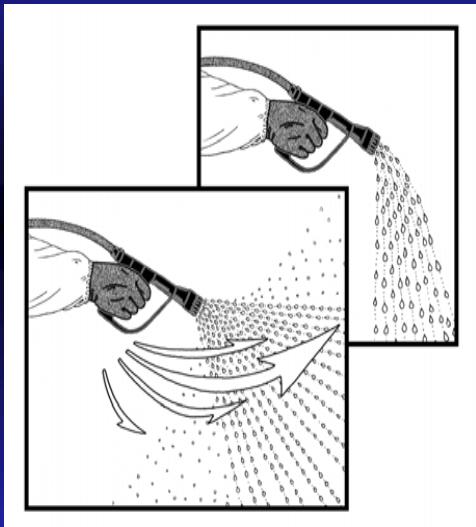
Particle (Spray) Drift

Particle (spray) drift :

- Refers to the airborne movement of spray droplets away from the application site during an application.
- Can reduce the effectiveness of pest control as a lesser amount of product is delivered to the pest.

- Can result in off-target contamination and damage.
- Is more prone to occur:
 - at higher wind speeds,
 - as the distance between nozzle and target increases, and
 - if the droplets are small.

Particle (Spray) Drift



High pressure produces small droplets, which are more likely to drift.

To reduce particle (spray) drift :

- **Avoid using high spray pressures.**

To reduce particle (spray) drift :

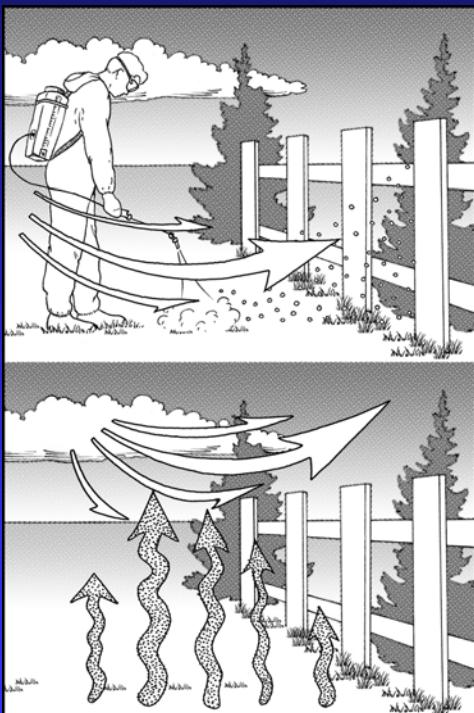
- Avoid applying pesticides when winds are strong.
- Follow wind speed directions on the pesticide label or as required by provincial law.
- Add a low-drift adjuvant to the spray tank to decrease drift.

To reduce particle (spray) drift :

- Select nozzle types to produce droplet sizes that are just small enough to give good coverage.
- Decrease the distance between nozzles and the target.
- Consider using a granular product if you need to apply pesticides near sensitive plants.

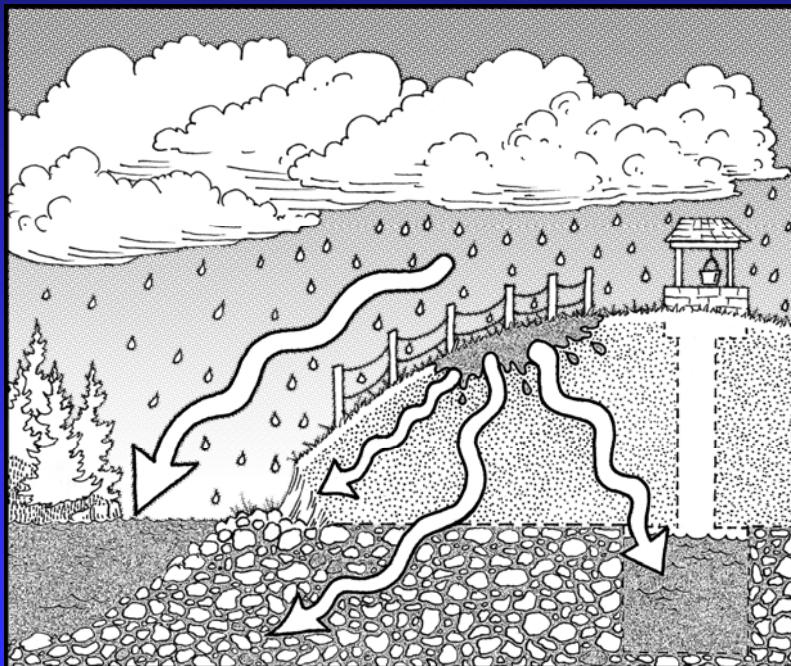
Review

Particle (Spray) Drift vs Vapour Drift



- **Particle (spray) drift** is the movement of spray particles during an application.
- **Vapour drift** occurs after an application.

Physical Processes That Affect Mobility



- Surface runoff
- Leaching
- Soil erosion

Surface Runoff

- Is the movement of water down a slope.
- Any pesticide mixed in this water will also move.
- The amount of runoff can be reduced by:
 - Delaying applications if rain is expected.
 - Using extra care when treating sloped areas.
 - Never applying pesticide to bare ground.

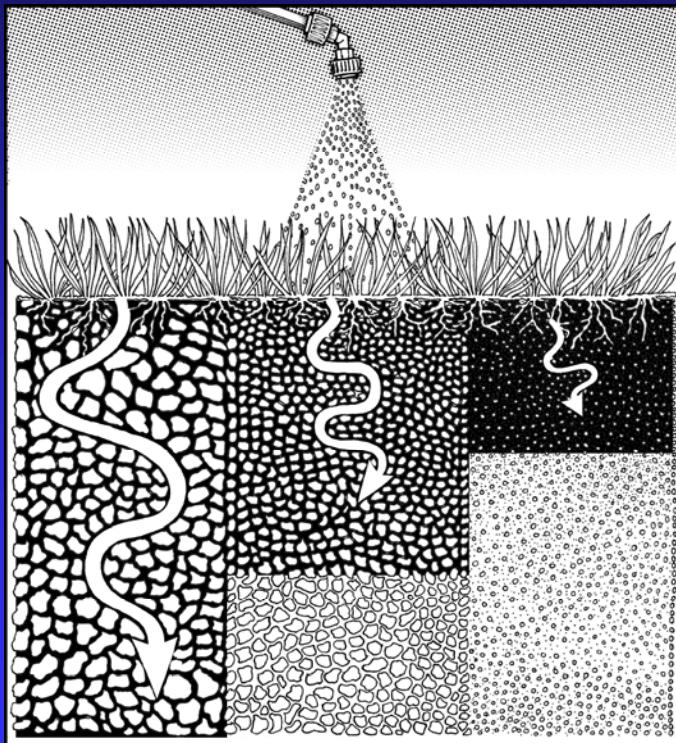
Leaching

- Is the movement of chemicals (pesticides, fertilizers) with rain or irrigation water through the soil.
- The movement can be downward, upward, or sideways.
- Product that leaches can get into surface or ground water.

PEI Landscape Pesticide Applicator Training Course

Training Module 6, Part 2 Environmental Safety

Leaching



- Pesticides will leach through coarse-textured (sandy) soil faster than fine textured (clay) soils.

Leaching

The risk of leaching increases when:

- Pesticide solubility is high—this results in more product dissolved in the water.
- Adsorption is low—this makes more pesticide available for leaching.
- Desorption is high—this also makes more pesticide available for leaching.
- Excess water (irrigation) is added.

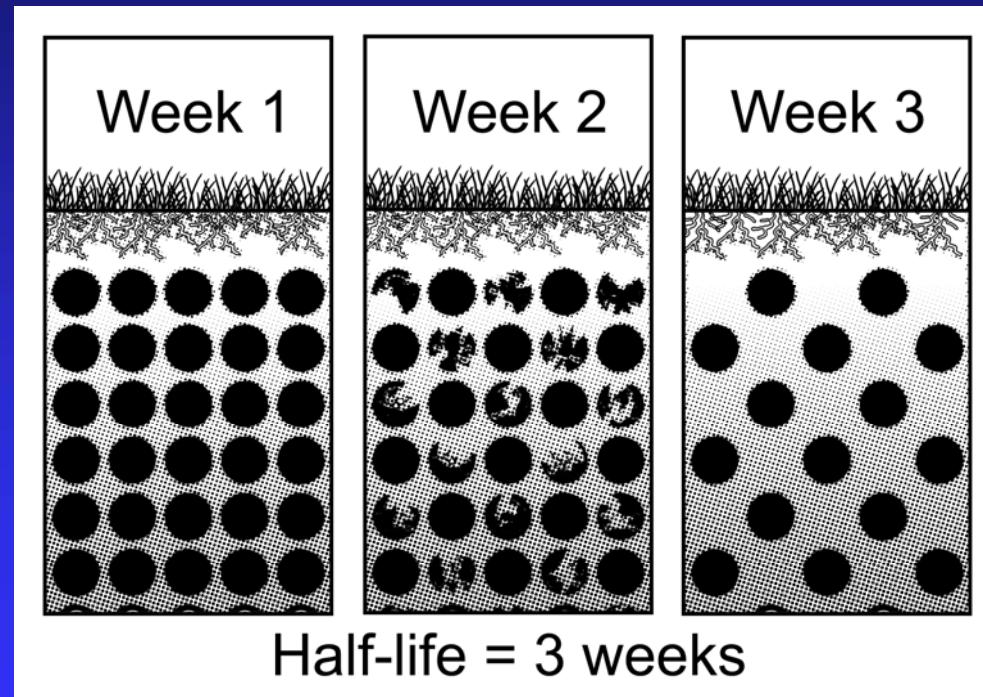
Degradation

- Is the breakdown of a product into other components.
- The active ingredient of a pesticide can be degraded by:
 - **Microbial degradation**
 - **Chemical degradation**
 - **Photodegradation**

Degradation and Half-life

- The rate of breakdown of a chemical in the environment is referred to as its half-life.
- Half-life is the time it takes for one-half of the initial amount of a pesticide to break down in the environment.
- Half-life can be measured in days (least persistent) or years (most persistent). Example: 3 week half-life.

Half-life



Persistent Pesticides

- Pesticides that do not break down quickly are described as **persistent**.
- The longer the active ingredient takes to break down --- the longer it is available to move, accumulate in plant or animal tissue, and pose a risk in the environment.
- Persistence can vary with soil type and climate.
- Products persist longer in cold, sandy soils that are low in organic matter.

Types of Degradation

- Microbial degradation
- Chemical degradation
- Photodegradation

Microbial Degradation

- Occurs when soil microorganisms use the pesticide as a food. This is the most common type of degradation.

Microbial Degradation

- Rate of degradation is affected by:
 - Soil temperature.
 - Soil pH, moisture, and fertility.
 - Presence of oxygen.
 - Chemical or physical properties of the pesticide.

Chemical Degradation

- Occurs when a chemical reaction breaks a pesticide into less hazardous compounds.
- Rate of degradation is affected by:
 - Soil temperature and moisture.
 - Soil pH
 - Chemical or physical properties of the pesticide.

Photodegradation

- Refers to the breakdown of a pesticide by sunlight.
- Products that photodegrade quickly usually have to be incorporated into the soil to be effective.

Contamination Sources

Point Source Contamination

- Occurs when a large amount of pesticide is released in a small area (e.g., spill, fire involving pesticides, improper disposal)

Non-point Source Contamination

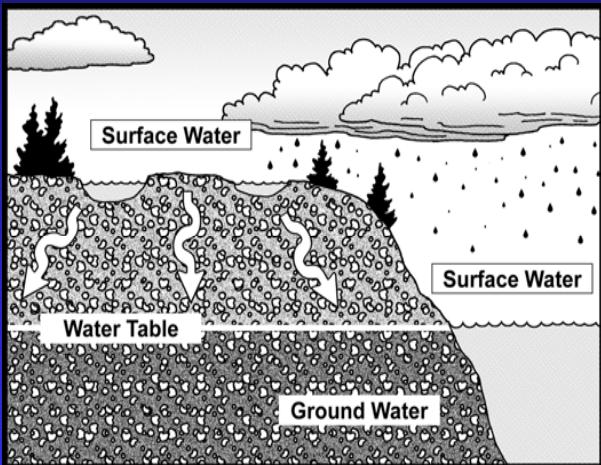
- Occurs when a pesticide is applied according to label rates and then moves from the application site.

Protecting Water Resources

Water is a valuable natural resource and needs to be protected.

To prevent damage to drinking water, waterways, and aquatic life always exercise care when handling or applying any pesticide.

Aquatic Impact of Pesticides



- Pesticides can contaminate surface water (water we see, such as ditches, streams, lakes, and ocean) and groundwater (water found in aquifers below the surface).

Aquatic Impact of Pesticides

- **Groundwater is the source of most of our drinking water.**
- **Once groundwater is contaminated, it can remain this way for a long time.**

Protecting Water Resources

Improper handling of pesticides can:

- Contaminate runoff water, or water used for irrigation.
- Contaminate surface water, and kill aquatic animals and plants.
- Disrupt fish mating and feeding, or damage aquatic plants.

Ways to Protect Water Resources

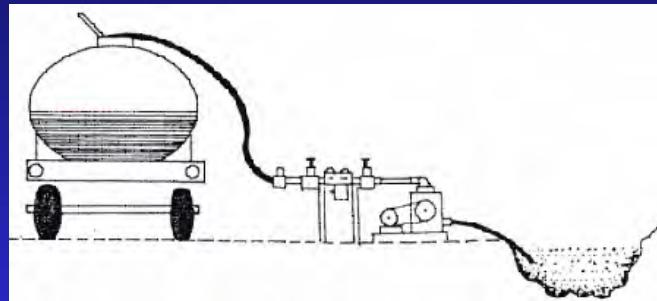
- Consult provincial and municipal authorities to identify the locations of municipal surface and groundwater supplies.
- Have property owners identify the location of private wells.
- Always mix pesticides, and wash application equipment, away from water sources.
- Put container rinse water into the spray equipment as part of the make-up water.

- Consult provincial authorities for instruction on the disposal of unwanted, mixed product.
- Follow label directions and provincial buffer regulations when mixing or applying pesticides near water (see: Section 2 Legislation).
- Take extra precaution when applying pesticides on steep slopes or to certain soil types.
- **Immediately clear up all spills.**

- **Apply product only under suitable weather conditions.**
- **Wash application equipment and protective clothing where this activity will not contaminate water sources.**
- **Clean-up any granular product from walkways or drive ways.**

- **Maintain application equipment and check regularly for leaks in tanks, hoses, and nozzles.**
- **Ensure that application equipment is properly calibrated.**
- **Follow all label directions.**
- **Prevent back siphoning.**

Prevent Back Siphoning



- Use a back-flow or one-way valve.
- Keep the end of the filler hose above the water level in the tank.
- Never leave equipment unattended.

Soil Contamination

Soil contamination as a result of a spill, poor container disposal, overflow of equipment, or exceeding label application rates can:

- Damage plants.
- Harm soil organisms.
- Contaminate drinking and irrigation water.

Protecting Soil Resources

Pesticides can contaminate soil when:

- The recommended product application rate is exceeded.
- Product is spilled during mixing and loading.
- Application equipment overflows.
- Containers or surplus spray mixtures are not disposed of properly.

Air Contamination

- Pesticides can enter the air through spray drift, vapour drift, or when contaminated soil erodes and is carried by wind.
- Airborne pesticide particles (droplets, mist, dust, or vapours) can move to water bodies, non-target organisms, or adjoining property and cause damage.

Protecting Air Resources

To help prevent air contamination:

- Limit spraying to proper weather conditions, as outlined on the label or in provincial regulations.
- Given an option, use low volatile pesticides.
- Use the lowest spray pressure possible to reduce generating mists and small droplets.

- Use low-drift nozzles that produce larger droplets.
- Reduce the travel speed of the application equipment.
- Ensure that the nozzle is at the proper height above the target.
- Match nozzle height to the nozzle type.

Non-target Organisms

- Garden plants, birds, beneficial insects (e.g., bees) and fish are considered to be non-target organisms.
- The toxicity of a pesticide to non-target organisms is usually stated on the product label (Warning Statement) or on the MSDS.

Protecting Non-target Organisms

- Impacts on non-target organisms can be reduced by reading the information under ‘Environmental Precautions’ found on the secondary panel of the label, and then following all label directions.

Examples of ‘Environmental Precaution’ Statements

- *“This product is very toxic to fish and aquatic organisms”.*
- *“Do not apply when weather conditions favour drift from the target area to sensitive plants”.*
- *“This product is very toxic to bees; avoid spraying when bees are foraging. Spray deposit should be dry before bees commence foraging in treated area.”*

Beneficial Insects

- Many insects are beneficial. Only a few cause harm or damage and are considered to be pests.
- Some insects (e.g., aphids) function as a key part of IPM programs by controlling pest populations.

Beneficial Insects

- A decrease in beneficial insect numbers can lead to an increase in harmful pest populations.
- Protect beneficial insects by:
 - minimizing product use,
 - choosing selective, least-toxic products,
 - not treating shelter areas, and
 - reducing drift.

Protecting Animals

Applicators can protect animals by:

- Following label directions.
- Selecting least toxic, target-specific products.
- Using caution when applying granular products.
- Storing and using pesticides safely.



- Leaving buffer zones for sensitive areas.
- Avoiding the use of products than can easily move from the area of application.

Toxicity to Non-Target Plants

Phytotoxicity (injury to plants) can occur when poorly applied herbicides contact non-target plants.

Example: *a broadleaf herbicide accidentally applied to ornamentals.*

- Damage can be minor (slight burning or browning of leaves) or severe (death of plant).

Ways to Reduce Phytotoxicity

- Prevent or minimize drift.
- Delay re-planting areas treated with a persistent herbicide.
- Follow label mixing directions for proper product application rate.
- Follow label directions when tank mixing (herbicide–herbicide and herbicide–fertilizer) or adding other additives.

Protecting Non-Target Vegetation

- Follow label buffer directions for non-target vegetation (flower and vegetable gardens).
- Do not apply herbicide closer than 1 metre out from the drip line (corresponds to the outer edge of the leaf canopy) of a tree or shrub.
- Prevent or minimize spray drift.

Preventing Accidental Release

- Keep equipment (tanks, storage compartments, backpacks, hoses, etc.) locked or secure on the transport or application vehicle when this is not in use.
- Develop a contingency plan to deal with spills.
- Equip each vehicle with a spill kit.
- Never leave behind empty containers, excess spray mix, or pesticide product at a client's property.

Preventing Property Damage

To prevent pesticides from staining siding, wooden fences, or sidewalks:

- Check the label for any special warnings.
- Minimize spray drift.
- Clean-up any spill (liquid or granular).

PEI Landscape Pesticide Applicator Training Course

Training Module 7, Part 1 Integrated Pest Management

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Learning Objectives

Completing this module will help you to:

- **Understand the principals of IPM.**
- **Know how to group landscape sites, and manage unique IPM challenges in urban landscapes.**
- **Manage and reduce pest resistance.**

Integrated Pest Management

- IPM is a prevention-based way to manage pests effectively, economically, and safely.
- The goal of IPM is to reduce pest numbers to an acceptable level, not to eliminate them.
- IPM helps reduce the need for chemical pesticides and can help protect human health, the environment, and beneficial insects.
- An IPM approach can provide a long-term solution to pest problems, even in urban areas where pesticides sometimes cannot be used.

Steps in an IPM Program

- Prevention
- Identification
- Monitoring
- Injury and Action Thresholds
- Treatment
- Evaluation of Results

Step 1: Prevention

Prevention is the basis of any IPM program.

- An IPM program uses:
 - planning and property management to keep unwanted pests from becoming a problem.
 - improved fertilizing, liming, soil development, over-seeding, mulching, and proper mowing to help develop weed- and insect-resistant turf.

Step 2: Identification

- **Correct pest identification is needed to understand pest biology and to protect beneficial species.**
- **Don't be fooled. Damage can be caused by temperature, wind, pets, stress, and not necessarily by pests.**
- **The internet, fact sheets, scientific publications, and services provided by private or government pest management experts can help you to identify pests and beneficial species.**

Step 2: Identification

Once a pest is identified you can determine:

- Its life cycle and growth stages (*to select the best time to apply treatment*),
- Its rate of reproduction (*to determine treatment timing and frequency*), and
- Its behaviour (*to select the best time and place for applying treatment*).

Step 3: Monitoring

Look for pest damage by conducting regular inspections (monitoring) of ornamentals and turf grass. Count the pests and record the results.

- Monitoring can be used to determine:
- The presence, species, and number of pests

Step 3: Monitoring

- The extent of pest damage.
- When the pest has reached the most susceptible life stage for a given control method.
- Whether treatment is required.

Step 3: Monitoring

Monitoring can be used to determine the:

- Weather conditions that can favour pest development.
- Health of the host plants.
- Effectiveness of previous control treatments.

Step 3: Monitoring

- Monitoring will also reveal the presence, species, and number of beneficial organisms.
- This will help you to determine if there are enough beneficial organisms to (naturally) keep the pest population below an acceptable level.

Step 3: Monitoring

Counting and measuring will help you to:

- Estimate the number and movement of pests.
- Compare pest population records from other sites.
- Determine injury and action levels.
- Evaluate the effect of pesticide treatments.

Step 3: Monitoring

Visual Inspections:

- Involve a close inspection to determine the presence or absence of pests or beneficial organisms.
- Are done when and where needed.
- Help to identify problem areas (e.g., weedy patches).

Step 3: Monitoring

- Can involve written comments (e.g., plant health, problem pests).
- Take less time than counting, but give limited information.
- Do not generate population numbers for comparison.

Counting and Measuring Methods:

- **Provide more detailed information than visual inspections.**
- **Provide results that can be compared from week to week.**
- **Deal with specific numbers, and remove the personal judgment calls of an inspector.**
- **Generate information that can be used to make good management decisions.**
- **Often involve taking samples.**

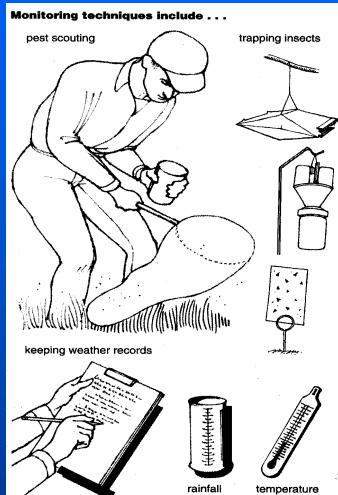
Sampling

- **Select a sampling method suited to the pest and the site (Transect Method or Grid Method (see: Pest Management of Weeds Module)).**
- **Take enough random samples to get an estimate that will reflect the situation for the entire area.**
- **Pick sample sites by chance (random sampling).**

Sampling

- Use the same sample method each time to better compare results.
- Sample when pest problems are expected.
- Keep records for future reference.

When counting and measuring, the following information should be recorded:



- The number of weed or insect pests in a measured area.
- The number of insects caught in traps.
- The size of the area affected.
- The number of days when weather favours the pests.
- Extent of damage on sample plants.

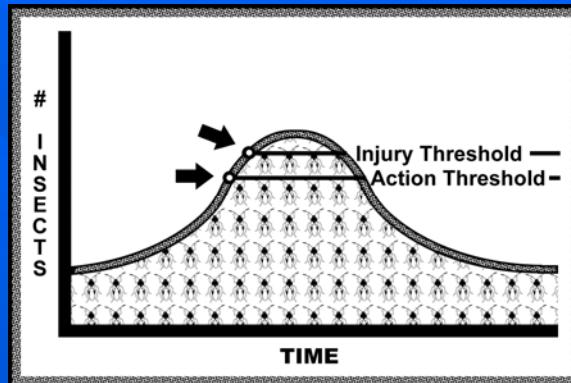
Counting and measuring methods are useful to:

- **Estimate the size and spread of a pest population.**
- **Compare records between sites and dates.**
- **Evaluate the effectiveness of a treatment method.**
- **Establish injury and action thresholds.**

Step 4: Injury and Action Thresholds

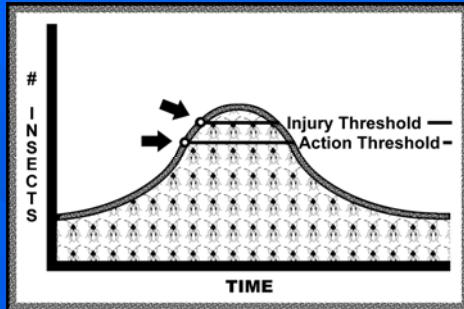
- The principal aim of IPM is to keep the pest population at an acceptable (economic, aesthetic, safe) level.
- Action is only necessary when pest numbers reach a certain level.
- When practicing IPM, a few pests can be tolerated.
- Objectives of a pest control program can be met by using injury and action thresholds.

Injury Threshold



- Is the maximum number of pests (weeds, insects) that can be tolerated.
- In landscaped areas, the injury threshold can be based upon safety, damage, aesthetics, client preference, or site classification.

Action Threshold



- Is the point (*number of pests*) where treatment should be taken to prevent pest numbers from reaching the Injury Threshold.
- This point will differ depending on the type of control method used (chemical vs biological pesticide).
- Thresholds are determined based upon when a pest is at its most vulnerable stage (e.g., larval stage for insects).



- A client's pest tolerance level can be different than yours.
- Some clients may want no weeds or insects; others will tolerate a few pests.
- It is important to work with clients when designing and explaining an IPM program.

Step 5: Treatment

Where possible, choose a combination of the following measures to control a pest.

Step 5: Treatment

Physical (Mechanical) Controls

- Screens to keep out insects.
- Mulches to suppress weeds.
- Cultivation to control weeds.
- Insect and slug traps.
- Pest-repelling devices.

Step 4:Treatment

Cultural Controls

- Good soil management.
- Disruption of a pest's life cycle.
- Improvement of soil quality.
- Removal of pest over-wintering sites.
- Use of pest resistant turf seed.

Step 4:Treatment

Biological Controls

- Involve the use of other organisms to control or kill the weed or insect pest (e.g., aphids, beneficial parasites, diseases, or predators).
- Are usually very species specific.
- Are usually perishable and limited to use under specific weather conditions.

Step 4: Treatment

Behavioural Controls

- Use of a pest's natural behaviour for suppression.
- Release of insect sex pheromones to confuse males and disrupt mating.
- Use of pheromones to lure pests into traps.
- Release of sterile male insects (e.g., codling moth).

Step 4: Treatment

Chemical Controls

- Use chemical pesticides to control, suppress, or repel pests.
- Products must be registered under Canada's Pest Control Products Act.
- Products that act as growth regulators, plant defoliators, or desiccants are also pesticides.
- Applicators must comply with label direction and provincial legislation.

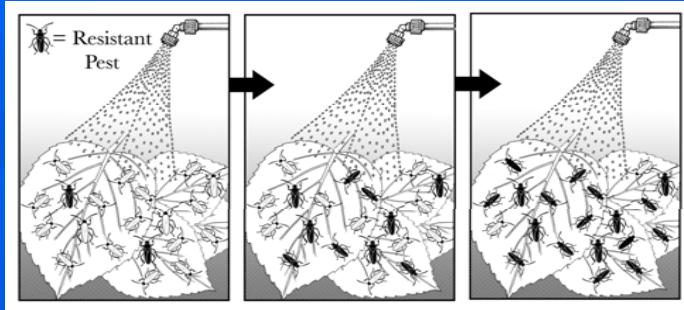
Chemical pesticides are grouped according to the following properties:

- **Selective vs non-selective.**
- **Residual vs non-residual.**
- **Persistence in the environment.**

- **Selective:** Toxic to specific species, with limited effects on others (e.g., Killex).
- **Non-selective:** Toxic to a range of species. Can harm beneficial and non-target species (e.g., Roundup).
- **Residual:** Remain effective for an extended period of time after application.

- **Persistent:** Remain active for many months after application.
- **Non-persistent:** Break down quickly in the environment.
(see: Chapter on Weed/Insect Pest Control)

Pesticide Resistance



- Resistance develops when a few of the pests survive a chemical pesticide treatment.
- Offspring of these pests are then resistant to the chemical.
- Once resistance develops, the use of even the highest label application rates can speed up greater resistance.

How to Delay Pest Resistance

To minimize or prevent pest resistance:

- Use a combination of physical (mechanical), cultural, biological, or genetic pest control measures.
- Use pesticides only when monitoring results indicate they are needed (Action Threshold).
- Alternate between different chemical families when using pesticides.

Record Keeping



- Date, time, and location.
- Target pest(s) (e.g., numbers, stage).
- Control method used (product).
- Application rate.
- Equipment settings.
- Weather conditions.
- Environmental factors.
- General observations.
- Evaluation of treatment results.

Step 5: Evaluation of Results

Preparing detailed records of the pest management strategies used can help you to:

- Evaluate current pest management programs.
- Compare control methods (e.g., products, equipment settings, and timing).
- Address post-treatment problems (e.g., property damage, off-site movement, complaints).

Step 5: Evaluation of Results

- Forecast future pest problems.
- Plan management programs for future years.

Developing an IPM Program

- An **Integrated Pest Management** program is a decision-making tool that involves planning and acting to control pests.
- The control measures used should be effective, affordable, and environmentally safe.
- The goal is to maximize pest control, while minimizing environmental and health risks.
- Pest control is used only when, after careful monitoring, it is called for.

Assemble Background Information

Before starting an IPM program:

- Record past pest problems and treatment methods.
- List pest problems common to the area (e.g., dandelions, hairy chinch bug).
- Review provincial legislation and municipal by-laws (for possible product limitations).

Assemble Background Information

- Carry out a site assessment (e.g., topography, sensitive areas, soil quality, sensitive plants, water courses).
- Determine client expectations.

Draft an IPM Program

- Use all applicable background information.
- Address the six IPM steps (prevention, identification, monitoring, thresholds, treatment, and evaluation).
- Include client input when drafting the program.
- Identify actions (e.g., proper mowing height and watering) that the client can undertake.

Putting IPM into Practice

- Start with a few small sites and build as experience is gained.
- Select a site with few pests (e.g., broadleaf weeds in turf).
- Start with a client who will practice good turf management (mowing heights, mulching, soil improvements, etc.) and who supports the principals of IPM.

Categorize Sites

- The most popular way to categorize sites is the three-level system (Classes A, B, or C).
- Class is based roughly on the level of damage tolerated and therefore the level of care required.
- Categorizing sites can help you to determine monitoring and treatment efforts.
- Different injury thresholds are set for each class.

Categorize Sites

Class A Sites:

- Have a high value and/or high visibility.
- Can tolerate little pest damage.
- Require high maintenance.
- Include: formal display beds, lawns around public buildings, front yards, golf courses, and professional sports fields.

Categorize Sites

Class B Sites:

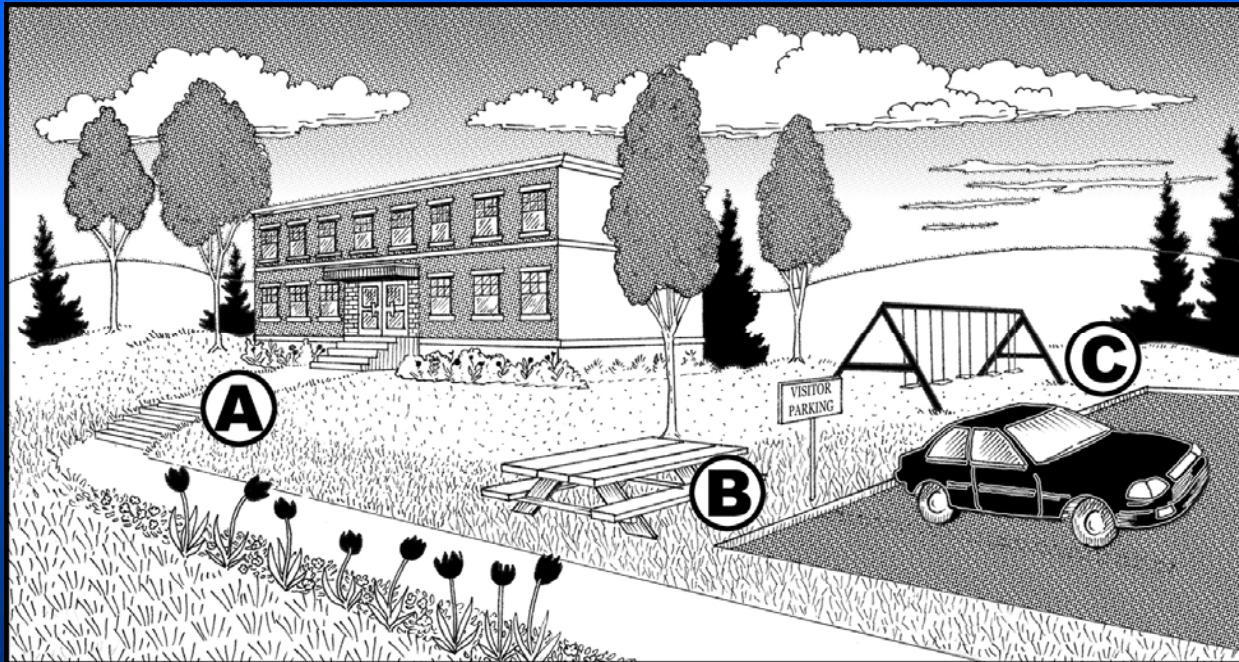
- Have a moderate value and/or visibility.
- Can tolerate moderate pest damage.
- Require moderate maintenance.
- Include: **roadway medians, park and playground areas, backyards, perennial beds in parks, and golf course fairways.**

Categorize Sites

Class C Sites:

- Are natural, low profile sites.
- Can tolerate a high level of damage.
- Include: natural parks, playground areas, work sites, golf course rough areas, parking lot beds.

Categorize Sites



Categorize the work area into different classes.

Environmental Considerations



- **Environmental factors can affect the safety and effectiveness of an application.**
- **Observe existing and predicted conditions at or near the application site.**

Environmental Considerations

- Factors include: temperature, relative humidity, precipitation, air movement, and topography.
- Always check the pesticide label for precautionary statements.

Environmental Considerations

Temperature

- Pests may not be active in cool temperatures.
Product may be lost (vapour drift) in high temperatures.

Environmental Considerations

Relative Humidity

- Can affect the development of some diseases and the effectiveness of some herbicides.
- Precipitation
- Rain reduces pesticide effectiveness by washing off the product.

Environmental Considerations

Air Movement

- High winds can carry product away from the site (particle drift), thereby reducing effectiveness or affecting non-target areas.

Topography

- Steep slopes can limit the use of specific application equipment, and increase the likelihood of product run-off from rain water.

Environmental Considerations

Sensitive Areas

- Chemical pesticides may not be useable because of sensitive areas (water bodies) or susceptible plants.

PEI Landscape Pesticide Applicator Training Course

Training Module 7, Part 2 Integrated Pest Management

Disclaimer

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Learning Objectives

Completing this module will help you to:

- Identify and control weed pests.
- Identify and control insect pests.
- Identify and control disease pests.
- Identify and control vertebrate pests.

Weed Control

A weed is any plant that grows where it is not wanted. Weeds can:

- Compete with cultivated plants for light, water, and nutrients.
- Become hosts for other pests.
- Add to site cost.

Weed Control Measures

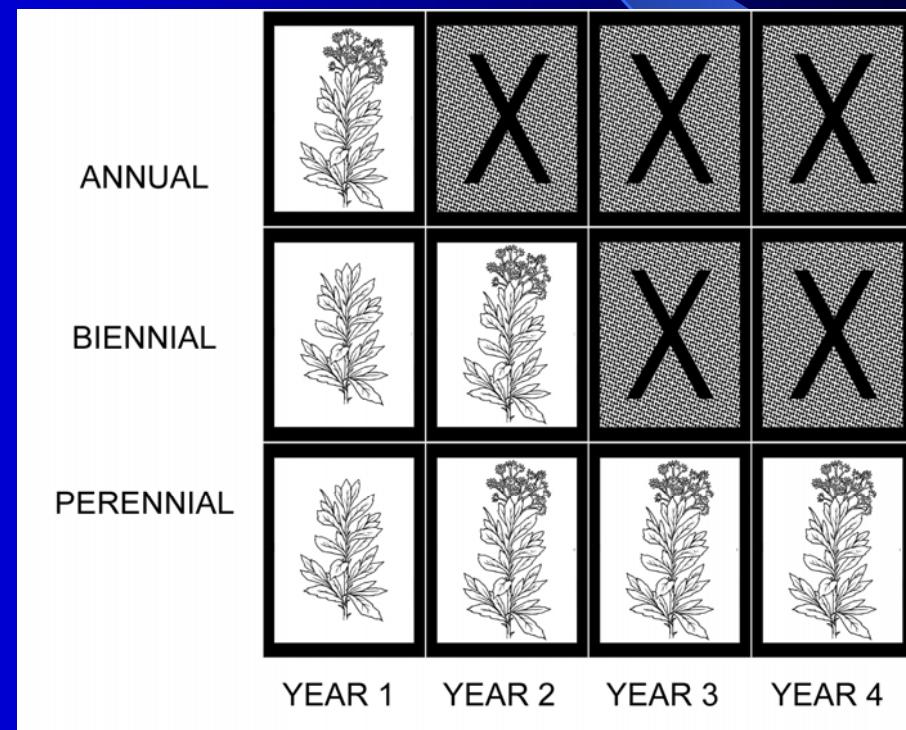
A good weed control plan begins before the turf is planted. You should:

- Monitor site for weeds.
- Identify weed varieties, life cycles, and characteristics.
- Choose the best measure of control when a weed problem is identified.

Weed Identification

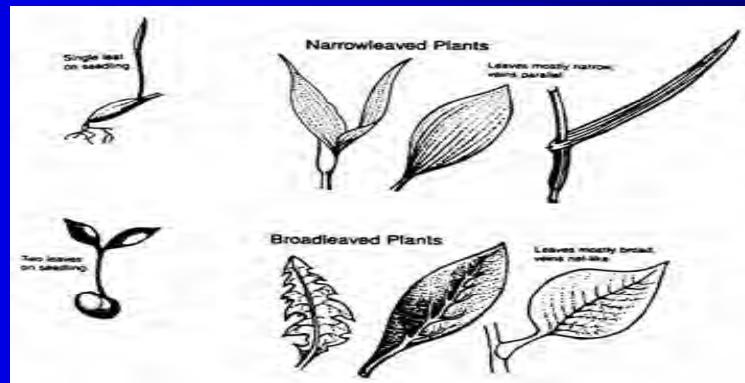
Each weed has its own life cycle and growth habits. These change the effect of control measures.

Weeds can be grouped or classified by their life cycle.



Weed Characteristics and Growth Habits

- The growth habits or shape of the plant parts (seeds, leaves, stems, roots) help in weed identification. Some weeds lie close to the ground. Others grow tall.



Weed Characteristics and Growth Habits

Plant features you can use to identify weeds include:

- Leaf types, appearance, and arrangement.
- Stem type (herbaceous, woody, cross sectional shape).
- Flower type (colour, stem arrangement).
- Root structure (taproots, fibrous roots).

Weed Management and IPM

Weed management can include the following controls:

- **Sanitation** (use of certified seed, clean farm machinery; application of well rotted manure; control of nearby weeds).
- **Cultural** (crop rotation, intercropping, minimal tillage).
- **Physical** (mowing, mulching, weeding).

Weed Management and IPM

- **Biological** (release of fungal pathogens and beneficial insects; using genetically modified herbicide-resistant crops, grazing animals).
- **Chemical** (involves the use of herbicides).

Chemical Control Using Herbicides

Knowing how a herbicide works can help you to choose the right product.

Herbicides differ by their:

- **Mode of Action** (contact vs. systemic).
- **Selectiveness** (selective vs. non-selective).
- **Timing of Application** (pre-plant, pre-emergence, post-emergence).
- **Residual Effect** (non-residue vs. residual).

Mode of Action

Contact Herbicides

- Do not enter the plant's system.
- Have little or no movement.
- Only kill contacted plant parts.
- Not usually suited for control of perennial weeds.

Systemic Herbicides

- Enter the plant via roots or leaves.
- Move through the plant by translocation.
- Kill the whole plant.
- Can be used to treat annual, perennial, and biennial weeds.

Selectiveness

Selective Herbicides

- Kill or damage only certain plants or plant types. 2, 4-D affects only broadleaf (non-grass) weeds.

Non-selective Herbicides

- Kill or damage all plants on contact. *Roundup*, *touchdown*, and *gramoxone* are non-selective herbicides.

Residual Effectiveness

Residual effectiveness refers to the time a herbicide continues to work after application.

Non-residual Herbicides

- Break down quickly, become inactive in the soil soon after application, and do not affect future crops. (*Roundup* is a non-residual herbicide.)

Residual Effectiveness

Residual Herbicides

- Do not break down quickly, can control weeds for weeks or months after application, require special safety precautions, can affect future crops, and can impact the environment.

Herbicide Effectiveness

A number of factors can change the effect of a herbicide application.

- Leaf shape and surface (how the herbicide stays on the plant).
- Environmental factors (temperature, humidity, rain during or after application, and wind).
- Weed age (systemic herbicides work best for young weeds).

Herbicide Effectiveness

- **Soil texture** (more herbicide may be needed on fine-textured [clay or silt] soils).
- **Soil moisture** (systemic herbicides work best on healthy, growing plants under moist, warm conditions).
- **Cultivation** (can improve or detract if weeds produce rhizomes).
- **Weeds can become resistant to herbicides.**

Weed Resistance

To avoid weed resistance to herbicides:

- Use a variety of chemical and non-chemical control measures.
- Use herbicides only when they are needed.
- Use herbicides from different chemical families and having different modes of action.
- Apply herbicides only at the label rate.

Insect Management and IPM

Steps in insect management:

- Identify the insect pest and understand its biology.
- Monitor crop areas to determine pest numbers, location, beneficial insects, and level of damage.

Insect Management and IPM

Steps in insect management:

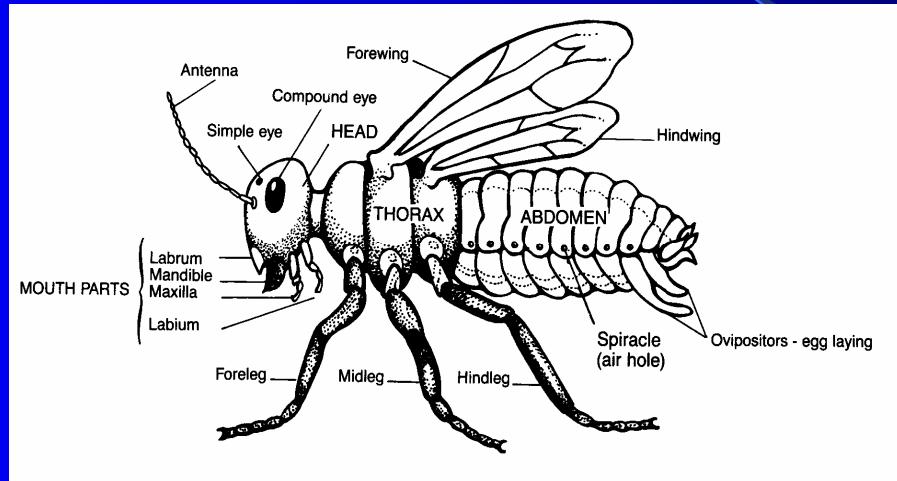
- Keep records of this information to determine patterns of infestations and projected pest numbers, locations, and crop damage.
- Undertake an insect control program to maintain crop value.

Insect Identification

Proper insect identification is important because:

- **Beneficial insects or ‘beneficials’ serve a valued function by preying on harmful insects or by pollinating crops.**
- **However, most insects that infest crops are considered to be pests, and need to be controlled when their numbers pose an economic threat.**

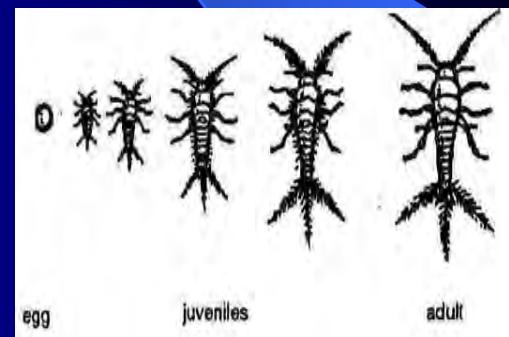
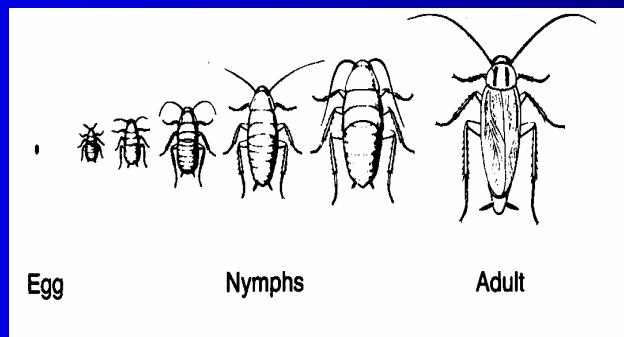
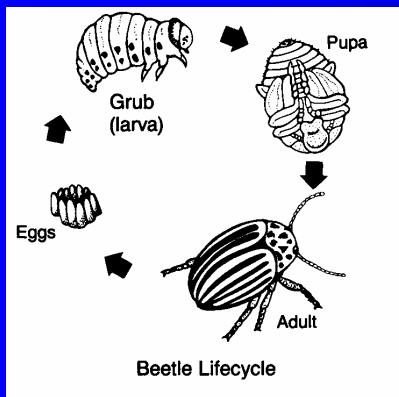
Insect Identification



Adult insects have an external skeleton that covers the entire body. The shape, size, and colour of the exoskeleton, wings, legs, and mouth parts can be used to identify the insect.

Insect Life Cycles

Insects will complete three or more changes or stages in a life cycle. A change is called a **metamorphosis**.



Complete
Metamorphosis

Incomplete
Metamorphosis

No
Metamorphosis

Insect Control

- The main concern in insect control is economic.
The value of the crop must be maintained.
- An insect control program should reduce pest damage, yet minimize harm to beneficial species.

Insect Monitoring

Monitoring for insect pests determines:

- If the number of pests is high enough to require control (economic threshold).
- The life stage of the insect. (This can determine the level of susceptibility to possible control options.)

Insect **monitoring** should include scouting and record keeping. Monitoring must be performed throughout the season.

Insect Control

- An IPM based insect control program should include a combination of **cultural, physical, biological, and chemical** methods of control.
- Insects are often best controlled during their early life stages (larvae or nymph).

Methods of Control and IPM

- **Cultural or Sanitation** (use of healthy plants, insect-resistant species; mowing, tilling, cultivation; good sanitation).
- **Physical** (traps that attract, capture, or kill insects).

Methods of Control and IPM

- **Biological** (release predators, parasites, or pathogens).
- **Chemical** (insecticide must be matched to the specific need, pest, crop, field location, and equipment available).

Chemical Control

Insecticides are often grouped by:

- Mode of action.
- Selectivity.
- Residual effect.
- Chemical classification.

Modes of Action

- **Stomach poisons** (kill insects when they eat treated crops).
- **Contact** (kill insects when they touch them).
- **Suffocating** (clog insect breathing systems).
- **Fumigants** (work as gases or vapours).
- **Microbials** (insects are killed when microbes are eaten).

Modes of Action

- **Growth regulators** (mimic insect growth hormones).
- **Attractants** (draw in egg-laying females, which are then captured or killed).
- **Repellents** (use odour to keep pests away from the host).
- **Sticky pastes or strips** (hold and kill insects).
- **Systemic** (move through the entire plant).

Chose an Insecticide Based on Selectivity and Residual Activity

Selectivity

- **Selective** insecticides control only certain insects. Generally, they do not harm non-target insects.
- **Non-selective** insecticides control all insects. They will harm both target and non-target insects.

Choose an Insecticide Based on Selectivity and Residual Activity

Residual Activity

- Residual activity is the length of time a pesticide remains effective after application.

Factors that Can Influence the Effectiveness of an Insecticide

- **Timing of the Application** (Insects can be more vulnerable during certain life stages.)
- **Environmental Conditions** (Humidity and temperature can affect an insecticide.)
- **Pesticide Resistance** (If insecticides from the same family are used repeatedly, insects can build up resistance over a few generations.)

Disease Management and IPM

- Disease causing organisms include **fungi, bacteria, viruses, and nematodes.**
- Disease pests can attack healthy plants.
- IPM for disease control includes knowing the signs of disease and the steps needed to control the disease in a crop.

Disease Management and IPM

Influence of Environmental Stress

- Poor environmental conditions, such as extreme levels of light, temperature, water, nutrients, or air pollutants, can weaken plants and cause abnormal growth or disease symptoms.
- Plants weakened by environmental stress are more likely to be affected by pests.

Disease Control

Three factors are needed for an infectious disease to occur. These are:

- A disease-causing organism (pathogen).
- A host that is susceptible to the disease.
- An environment that supports the disease organism.

Eliminating any one of these factors will prevent disease.

Disease Control and IPM

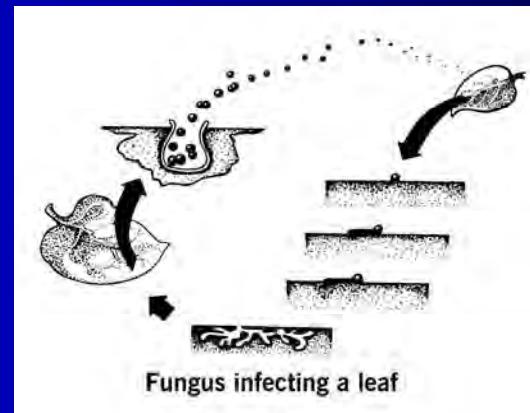
Cultural control includes:

- **Growing disease resistant plant varieties.**
- **Eliminating debris and other plant material that can carry disease.**
- **Removing plants known to host certain diseases.**
- **Ensuring proper nutrients, water, and soil pH.**
- **Using soil drainage and irrigation techniques.**

IPM Disease Control

Chemical Control

- Fungicides are the only pesticides used for disease control in agriculture.
- Fungicides can be classed by how they work. They include:
 - Protectants
 - Antisporulants
 - Systemics
 - Curatives
 - Eradicants



Disease Control and IPM

Protectant fungicides

- Cover potential host plants with a film that prevents fungal spores from germinating.
- Must be applied before the fungus has entered the crop.
- Can only protect a plant from further infection.
- Typically require repeated applications.

Disease Control and IPM

Antisporulant fungicides

- Can prevent the production of spores by disrupting life cycle processes.

Systemic fungicides

- Are absorbed by plants and move to areas of new growth.
- Can act as protectants, eradicants, or both.

IPM Disease Control

Curative fungicides

- Move within the plant to the site of infection. Like eradicants, they kill fungal organisms that have infected the plant but have not yet become well established. Curatives will also prevent further pathogen development.

Eradicant fungicides

- Kill fungal organisms that have infected the plant but have not yet become well established.

Fungicide Effectiveness

Factors that determine fungicide effectiveness include:

- **Timing of the application.**
- **Fungus life cycle.**
- **Rates of plant growth.**
- **Weather.**
- **Resistance.**

Vertebrate Management and IPM

- Common vertebrate pests include rodents and birds.
- These pests can carry disease or damage property, crops, or livestock.
- Control methods include sanitation, exclusion, nest removal, frightening devices, food elimination, traps, and some chemicals.

Vertebrate Management and IPM

It is an offence under the *Migratory Birds Convention Act* to harm a protected bird species or its nest, once the eggs are laid.
CHECK LOCAL LAWS.

Consider hiring a licensed pest control applicator to address bird control.

PEI Landscape Pesticide Applicator Training Course

Training Module 8 Disease

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Learning Objectives

Completing this module will help you to:

- **Understand what causes plant disorders and diseases, and distinguish between these.**
- **Better identify different types of diseases.**
- **Properly develop an IPM program for the control of diseases.**
- **Understand the factors that affect fungicide effectiveness.**

Plant Disorders

Abnormal plant growth or disease-like symptoms can occur as a result of stress.

- Stress can be caused by:
 - Environmental factors (air pollution, temperature extremes, lack of light or water).
 - Toxic chemicals (road salt, pet urine).
 - Soil compaction (heavy foot traffic).
 - Plant damage (mowers, trimmers).

Plant Disorders

Plant disorders can be treated by removing stress conditions.

Diseases

- Disease causing organisms include **fungi, bacteria, viruses, and nematodes**.
- Disease pests can attack healthy plants.
- Environmental stress (extreme levels of light, temperature, water, nutrients, or air pollutants) can weaken plants and cause abnormal growth or disease symptoms.
- Weakened plants are more likely to be affected by other pests.

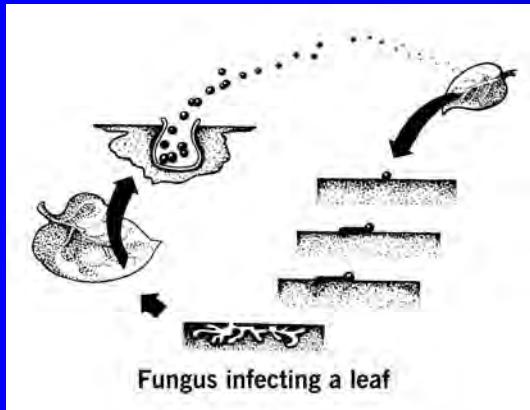
Fungal Diseases



Hollyhock Rust

- **Include molds, rusts, and mushrooms.**
- **Do not contain green plant material (chlorophyll).**
- **Feed on dead/dying plants (saprophytic) or on living plants (parasitic).**
- **Most grow and reproduce on a single host.**
- **A few require multiple hosts (cedar apple rust).**

Life Cycle



- **Fungal spores over-winter in soil or leaf litter.**
- **Spores are carried to plants (by contaminated equipment, rain, or watering).**
- **Under the right conditions, the spores germinate on plant surfaces.**
- **The germinating spores send out strands (hypae) that enter plant tissue.**
- **The next generation of spores is formed and spreads to new plants.**

Fungal Spores

- Require the right environmental conditions (cool, moist air) to germinate.
- Can remain dormant for years.
- Spread naturally by wind, soil, and birds.
- Spread by man (infected plants, contaminated maintenance equipment and pruning tools).
- Can be managed by using good sanitation and fungicides.

Bacterial Disease



Bacterial Leaf Spot

- **Caused by single-celled microorganisms.**
- **Can include leaf blights, wilts, leaf spots, galls, and root rots.**
- **Can enter a plant through wounds.**

Bacterial Disease



Xanthomonas campestris

- Is spread by rain, irrigation water, animals, insects, and contaminated equipment.
- Reproduction is affected by temperature and humidity.
- Must be managed by sanitation and prevention.

Viral Disease



Impatiens Necrotic Spot Virus

- **Viruses are small (microscopic) organisms.**
- **Can reduce plant vigor or kill plants.**
- **Reproduce in living cells.**
- **Symptoms include: wilting, mottling, streaking, discolouration, and abnormal growth.**

Viral Disease



Gloxinia Necrotic Spot Virus

- No pesticide can directly control a virus.
- Control can be achieved by:
 - Using virus-resistant plants.
 - Sanitizing tools (e.g., during pruning).

Nematodes



Plant Parasitic Nematode

- Are microscopic, worm-like organisms.
- Most are beneficial. Many improve soil or are parasitic on insect pests.
- Eggs and adults move through the soil on a film of water.
- Nematodes are transported in contaminated soil, containers, and equipment.



Nematode root damage in strawberry plants.

- Feed on plant roots, stems, and leaves.
- Can make wounds that allow other diseases to enter.
- Symptoms include wilting; leaf drop; stunting; lack of vigor; and deformation of roots, shoots, and leaves.
- Controlled by sanitation and nematocides.

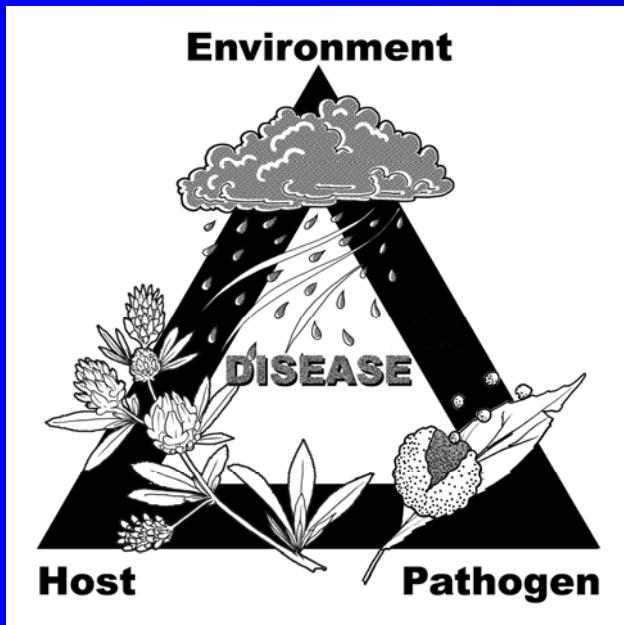
Developing an IPM Program for Plant Diseases

Three factors are needed for an infectious disease to occur. These are:

- A **disease-causing organism (pathogen)**.
- A **host that is susceptible to the disease**.
- An **environment that supports the disease organism**.

Referred to as the Plant Disease Triangle.

Plant Disease Triangle



- All three elements must be present for disease to occur.
- Eliminating any **one** of these factors will prevent the disease.

Three Steps of Prevention

- 1. Eliminate the pathogens.
 - Inspect and buy only healthy plants.
 - Remove alternate hosts.
 - Collect (rake) and remove (bag) diseased plants.
 - Prune and destroy (burn) infected plant parts.

Three Steps of Prevention

- 2. Avoid susceptible host plants.
 - Choose disease-resistant plants.
 - Replace susceptible plants with hardy plants.

Three Steps of Prevention

- 3. Make the environment less favourable.
 - Grow seeds in warm conditions to minimize damping-off.
 - Improve air circulation with pruning.
 - Avoid over-watering and let areas dry between irrigation cycles.
 - Correct soil compaction and improve drainage.

Identification

Disease **identification** can be difficult because symptoms can look quite similar to insect or herbicide damage.

- To help with identification:
 - Monitor symptoms over a period of time (days).
 - Check for a correlation between damage and prior weather conditions.
 - Collect affected plant parts for closer examination.

Monitoring

- Frequency of monitoring will vary depending on whether a disease develops slowly or rapidly.
- If a disease is known to develop rapidly, be proactive and monitor weather conditions that favour the disease.
- A more effective monitoring program can be planned when the biology of the common diseases in your area is understood.

Monitoring

Visual Inspections

- Visually inspect foliage, roots, and soil for signs and symptoms of disease, including:
 - Wilted or distorted plant parts.
 - Discolouration and spots.
 - Damaged roots.
 - Reproductive structures.

Monitoring

Visual Inspections

- **Look for conditions that allow infection (cuts or scrapes on bark or foliage), poor growing conditions (soil compaction, dry soil), and sucking insects.**

Weather Conditions

- It is important to keep good weather records as diseases will occur and grow under different climate conditions.
- Use these weather records to help:
 - Identify favourable growing conditions.
 - Develop a monitoring program.
 - Plan the frequency of fungicide applications.

Assessment Method

- On a regular basis assess:
 - The progress of the disease.
 - The number of diseased plants.
 - The size of areas infected.
- This is useful for determining how quickly the disease is spreading, and the extent of expected damage.

Injury and Action Thresholds

- Injury and Action Thresholds are site specific because they depend on:
 - How much damage can be accepted (e.g., less tolerance for golf greens).
 - Risk to long-term health of the plants.
 - Risk of disease spreading to new areas.

Injury and Action Thresholds

Injury Thresholds

- Can be based on the proportion of damaged leaves, number of affected plants on a site, or percentage of area affected.

Injury and Action Thresholds

Action Thresholds

- Depend on planned treatments or weather conditions that can favour disease development.
- Can be based on past history of disease development (highlights the importance to keeping good records).

Developing an IPM Program for Plant Diseases

Cultural control includes:

- Growing healthy, disease resistant plant varieties.
- Eliminating debris and other plant material that can carry disease.
- Removing plants known to host certain diseases.
- Ensuring proper nutrients, water, and soil pH.
- Improving soil drainage and following good irrigation techniques.

Treatments

Physical and Mechanical Control

- The removal of infected plants or plant parts is effective only in limited cases (e.g., ornamental plants).

Chemical Control

- Fungicides are the only pesticides used for disease control in turf management.
- Fungicides can be used to control, prevent, or alter the growth of fungi.

Fungicides

- Fungi are most susceptible at the incubation stage.
- Dormant and over-wintering stages of fungi are resistant to fungicides.
- Fungicides are classified by how they work.
This includes:
 - Contact (protectant) fungicides
 - Systemic (eradicant) fungicides

Fungicides

Contact fungicides

- Must be applied as a film over the entire plant.
- Must be applied before spore infection.
- Must be re-applied to protect new growth.
- Will not kill or eradicate fungi.

Examples: mancozeb and thimat.

Fungicides

Systemic fungicides

- Are absorbed and move throughout the plant.
- Can be applied before infection and act as protectants.
- Can be applied after infection and kill established fungi (eradicants).
- Usually a single treatment as will move into new growth.

Examples: triforine and benomyl.

Fungicide Effectiveness

Factors that determine fungicide effectiveness include:

- **Timing of the application.**
- **Fungus life cycle.**
- **Rates of plant growth.**
- **Weather.**
- **Resistance.**

PEI Landscape Pesticide Applicator Training Course

Training Module 9 Slugs and Snails

Disclaimer

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Learning Objectives

Completing this module will help you to:

- Use the biology and life cycle of slugs and snails to improve control.
- Apply IPM to manage slugs and snail pests.
- Know how to safely use different methods of control.

Slugs and Snails

- Both are classified as molluscs
- Having a soft body and using a single 'foot' for movement.
- Leave a protective slime trail as they travel.
- Both found in wet and humid areas.

Slugs and Snails

- Come out at night or cool cloudy days, so must be identified by the damage they cause.
- Hide during the day under objects or debris.
- Snails are protected by a hard shell, slugs are not.

Life Cycle

- There are three stages
 - Egg (oval and translucent, laid in a jelly-like mass).
 - Nymph.
 - Adult.
- May take months to years to mature.



Eggs



Brown Garden Snail



Gray Garden Slug

Snails



Snails hiding under
ground cover



Snail Damage
to Bark

Managing Snails and slugs

Prevention

- Remove objects, organic mulch, and weeds that serve as hiding places.
- Water flower beds in the morning.

Treatment

- Copper strips (act as a barrier).
- Bait traps (beer or yeast in water).
- Hand picking.

Control



Scrape off & drown



Copper Barrier



Beer Trap

Chemical Control

Molluscicides

- **Metaldehyde**
 - Liquid and pellet forms attract and kill molluscs.
 - Care must be taken in placement as **attractive to children, wildlife, and pets.**
- **Ferric phosphate**
 - Pellet form causes molluscs to dry out by disrupting formation of slime.
 - Not as attractive to wildlife and pets.

PEI Landscape Pesticide Applicator Training Course

Training Module 10 Insects & Mites

Disclaimer

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Learning Objectives

Completing this module will help you to:

- Identify differences between insects and mites.
- Use an insect's biology and life cycle to improve control.
- Apply IPM to manage common insect pests.
- Better understand various types of insecticides.

Mite Characteristics

Mites:

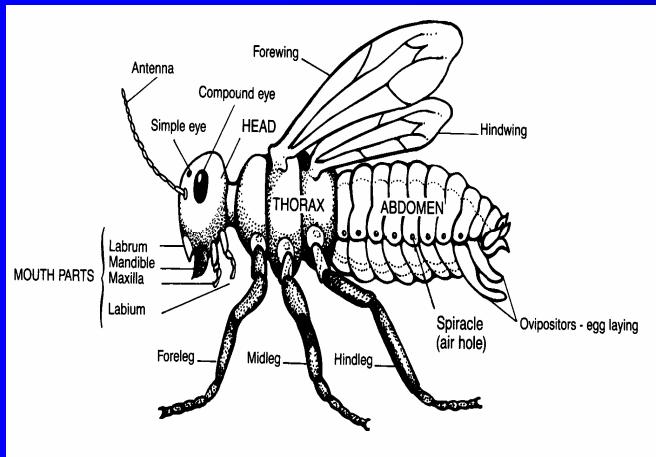
- Are related to spiders and have four pairs of legs.
- Have jointed bodies, jointed legs, and an outer skeleton (exoskeleton).
- Have the head and thorax combined.

Mite Characteristics

Mites:

- Are all without wings.
- Feed by sucking plant sap, sometimes causing a gall to form.
- Have a four-stage life cycle (egg, larva, nymph, and adult)

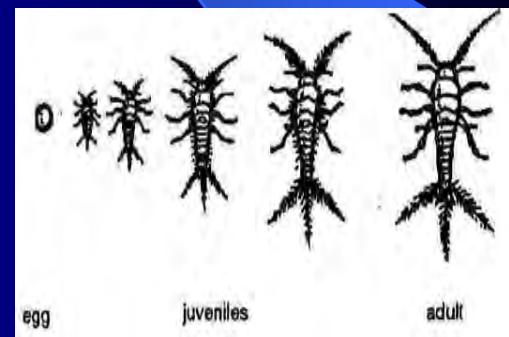
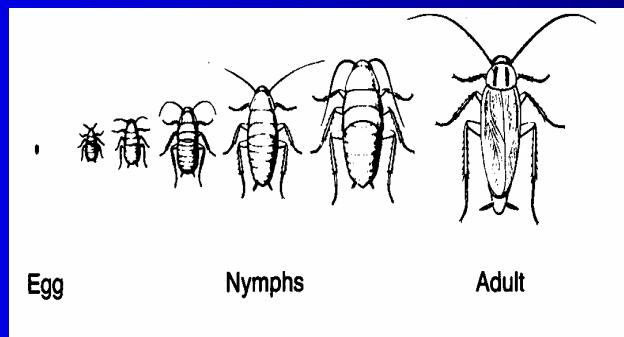
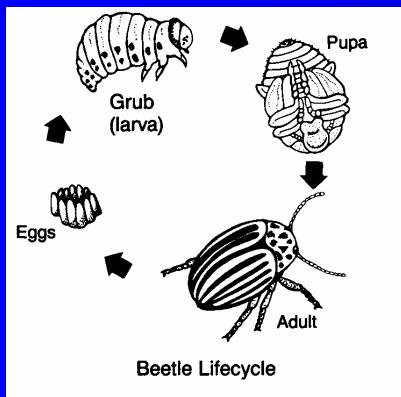
Insect Characteristics



- Adults have an **exoskeleton**.
- Body consists of a **head, thorax, and abdomen**.
- Adults have **three pairs of jointed legs**.
- Most have **two pairs of wings on the thorax**.
- There is a variety of mouthpart types (sucking, chewing, lapping, and siphoning).

Insect Life Cycles

Insects will complete three or more changes or stages in a life cycle. A change is called a **metamorphosis**.



Complete
Metamorphosis

Incomplete
Metamorphosis

No
Metamorphosis

Insect Management and IPM

Steps in insect management:

- Prevent insects from becoming a problem.
- Identify the insect pest and understand its biology.
- Monitor areas to determine pest numbers, location, beneficial insects, and level of damage.

Insect Management and IPM

Steps in insect management:

- **Keep records** of this information to determine patterns of infestations and projected pest numbers, locations, and turf damage.
- **Undertake an insect control** program to meet objectives.

Prevention

You can help to prevent insect pests by:

- Starting with a good site design, or improving an existing design.
- Correcting soil drainage, fertility, pH, texture, and depth.
- Matching plant species to the use and condition of a site.

Prevention

You can help to prevent insect pests by:

- **Understanding site characteristics (sun, shade, wind patterns, drainage, microclimates, and soil types).**
- **Avoiding monocultures by planting no more than 20% of plants from a single species (20 –1 plant species diversity rule).**

Plant Selection and Maintenance

Healthy plants and good site maintenance will help to discourage pests in turf and landscape areas.

- Choose well-grown planting stock.
- Check roots and foliage before purchasing.

Plant Selection and Maintenance

- Maintain plant health by:
 - Proper planting, watering, and fertilizing (e.g., slow release nitrogen for turf).
 - Mowing or pruning as required.
 - Maintaining healthy soil.

Insect Identification

Proper insect identification is important.

- **Beneficial insects or ‘beneficials’ serve a valued function by preying on harmful insects and by pollinating plants.**
- **Only a few insects are considered to be pests, and will need to be controlled when their numbers reach an unacceptable level.**
- **Use the internet, reference books, or insect guides to help with proper pest identification.**

Insect Monitoring

Monitoring for insect pests:

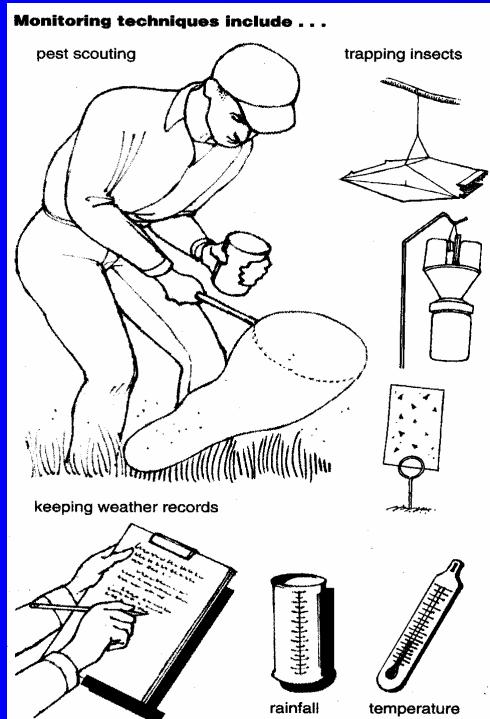
- Provides information required to make management decisions.
- Can help you determine if the number of pests is high enough to require control (see: Action Threshold).

Insect Monitoring

Monitoring for insect pests:

- **Identifies the life stage of the insect. (This can determine the level of susceptibility to possible control options.)**
- **Should be performed based on past history and weather conditions (growing degree days).**

Monitoring Methods



- Visual Inspections
- Indicator Plants
- Counting
- Drenching (floatation)
- Pheromone Traps
- Sticky Traps
- Beating

Monitoring Methods

Visual Inspection

- Use a hand lens to examine plants for root damage; leaf curl, roll, or other damage; leaf or stem discolouration; webs; or sticky patches.

Indicator Plants

- Check susceptible plants first as an early warning system.
- Requires careful observation over many years.

Monitoring Methods



Counting Method

- Involves counting the number of pests per turf area or leaf sample, or per plant.
- Numbers are recorded and compared with future counts.

Monitoring Methods

Drenching (floatation) Method

- Pour water mixed with lemon-scented dish detergent into a measured area (bottomless tin can inserted in soil).
- Count larva and adults that float to the surface.
- Excellent for Hairy Chinch bugs and leatherjackets.

Monitoring Methods



Pheromone Traps

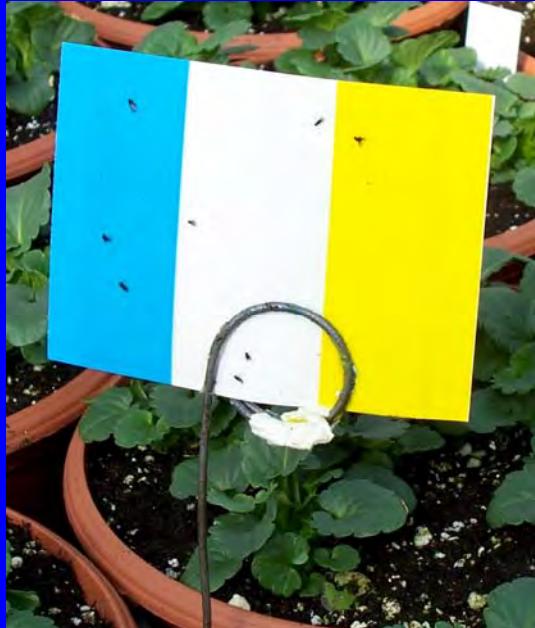
- Synthetic female sex pheromone used to lure males into a sticky trap where they can be counted.

Monitoring Methods

Pheromone Traps

- Pheromone is species specific and used for monitoring gypsy moth, cutworms, and leaf rollers.
- Traps need to be checked and counted weekly.
- Count numbers are useful for determining population numbers and timing of best control.

Monitoring Methods



Sticky Traps

- Typically are coloured traps coated with glue.

Monitoring Methods

Sticky Traps

- Attract and trap indoor and greenhouse plant pests.
- Need to be checked and counted weekly.
- Are not recommended for outdoor use (may attract 'beneficials').

Monitoring Methods

Beating Method

- Plant is shaken or beaten and dislodged pests are counted.

Monitoring Methods

Vacuum Method

- New approach for monitoring and collecting Hairy Chinch bugs.
- Tool for assessing the level of infestation and actual removal of the pests.

Injury and Action Thresholds

- Thresholds will be site (and client) specific (*See: IPM Module 6, Site Classification*).
- Healthy turf can tolerate higher thresholds and numbers of pests.
- May depend on:
 - Percent of leaf damage per plant or site.
 - Number of pests per plant or site.
 - Ratio of ‘beneficials’ to pests.

Insect Control

- An IPM based insect control program should include a combination of **cultural, physical/mechanical, biological, and chemical** methods of control.
- Insects are often best controlled during their early life stages (larvae or nymph).
- A combination of treatment methods is more likely to be effective.
- Attract ‘beneficials’ and use pest control methods that best protect them.

Methods of Control

Cultural or Sanitation

- Use healthy plants, insect-resistant species, mowing, tilling, and cultivation.
- Remove infected plant parts or over-wintering sites.

Methods of Control

Physical/Mechanical

- Use strong sprays of water to dislodge pests.
- Prune infected plant parts and webs/nesting sites.
- Use traps that attract, capture, or kill insects.
- Prevent pest migration by banding trunks.

Methods of Control

Biological

- Alter the landscape to encourage naturally occurring beneficial insects.
- Contact provincial regulatory authorities before releasing commercial predators, parasites, or pathogens.

Methods of Control

Biological

- Purchase beneficial insects only after proper identification of pests.
- Plant pest resistant species.

Methods of Control

Chemical

- A wide variety of insecticides is available to kill, attract, repel, or alter the growth of insect pests.
- Match insecticides to the specific need, pest, crop, field location, and equipment available.
- Active ingredient (a.i.) can be natural or synthetic.

Methods of Control

Chemical

- All must be registered under the Pest Control Products Act.
- Insecticides are classified by their mode of action (way they work), residual effect, selectivity, and chemical classification.

Modes of Action

Stomach poisons

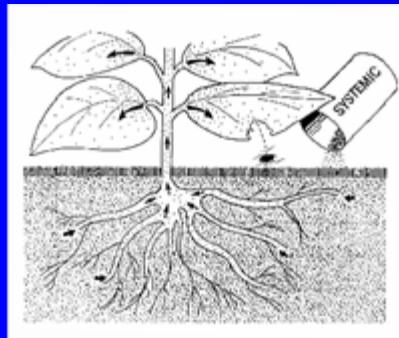
- Kill insects when they eat treated plant parts.
- Must be applied when pests are feeding.

Modes of Action

Contact insecticides

- Kill insects when they touch them.
- Can be applied to pests or to the plant surface.
- Can be effective for a number of weeks (e.g., malathion and methoxychlor) or break down quickly (e.g., pyrethrins).

Modes of Action



Systemic insecticides

- Are applied to the host plant and then move throughout it (e.g., dimethoate).
- Are effective when a pest eats or sucks on plant parts.
- Must be water soluble.
- Are non-selective.

Types of Insecticides

Suffocating

- Clog insect breathing systems or prevent eggs from hatching.

Types of Insecticides

Fumigants

- Control pests when they inhale poisonous gases or vapours.
- Are often limited to soil treatments in nursery production.
- May require provincial approval before use.

Types of Insecticides

Insect growth regulators

- Natural or synthetic products that mimic insect growth hormones.
- Disrupt insect life cycles and growth development.
- Are very species specific and selective.

Types of Insecticides

Silica Dusts or Gels

- Kill crawling insects by cutting the exoskeleton (e.g., diatomaceous earth).
- Have limited use in landscape applications.

Types of Insecticides

Sticky Glue and Pastes

- Capture insects when spread on hard surfaces or on traps.
- Provide a barrier for crawling / non-flying pests.
- Have limited use because they also capture beneficial insects.

Types of Insecticides

Microbials

- Tiny organisms (microorganisms) that are usually sprayed on foliage (e.g., B.t.).
- Slow acting because they must be eaten by the pest to be effective.

Types of Insecticides

Microbials

- Most effective in controlling early life (instar) stages of insect pests.
- Very species specific and selective.
- A wide variety of types are available.

Chose an Insecticide Based on Selectivity and Residual Activity

Selectivity

- **Selective insecticides** control only certain insects. Generally, they do not harm non-target insects.
- **Non-selective insecticides** control all insects. They will harm both target and non-target insects.

Choose an Insecticide Based on Selectivity and Residual Activity

Residual Activity

- Residual activity is the length of time a pesticide remains effective after application.
- Short residual products are best for IPM programs.

Factors that Can Influence the Effectiveness of an Insecticide

- **Timing of the Application** (Insects can be more vulnerable during certain life stages.)
- **Environmental Conditions** (Humidity, rain, and temperature can affect an insecticide.)
- **Pesticide Resistance** (If insecticides from the same family are used repeatedly, insects can build up resistance after a few generations.)

PEI Landscape Pesticide Applicator Training Course

Training Module 11 Application Technology

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Application Technology

Choosing proper pesticide application equipment and understanding how to use, and maintain it safely is necessary for effective pest management AND protection of the environment.

Application Technology

When selecting application equipment, choose a type that will:

- **Apply the proper amount of pesticide to the target.**
- **Give the maximum pest control.**
- **Minimize off-target drift.**
- **Be best suited for the size of the treatment site.**

Learning Objectives

- Completing this module will help you to:
- Identify types and parts of liquid and granular pesticide application equipment.
- Clean, and maintain different types of application equipment.
- Identify and interpret environmental factors before selecting application equipment.
- Undertake pesticide use calculations for different types of applicators.

Learning Objectives

Completing this module will help you to:

- Identify types and parts of liquid and granular pesticide application equipment.
- Clean, and maintain different types of application equipment.

Learning Objectives

Completing this module will help you to:

- Identify and interpret environmental factors before selecting application equipment.
- Undertake pesticide use calculations for different types of applicators.

Application Equipment

- Is the key component in transferring an active ingredient to the target.
- To be effective the equipment must be:
 - Appropriate for the job.
 - Set up and calibrated properly.
 - Used according to manufacturer specifications.

Application Equipment

- To be effective the equipment must be:
 - Maintained properly.
 - Designed to minimize applicator exposure.

Application Equipment

There are many different types available for pest control in turf management. Types can be divided into those that apply a liquid and those that apply a solid.



Liquid Applicators:

- Product is mixed in a tank and applied to the target through a nozzle as spray droplets.

Solid Applicators:

- Granules or dust move through openings in the spreading equipment.

Equipment for Liquid Formulations



Hand Operated Sprayers

- Use compressed air to apply a pesticide to a small area (a spot treatment).
- Risk of applicator exposure can be high.
- Pressure and output rate can vary.

Examples include hand held, backpack pressurized, aerosol cans and squirt-gun, and hand-pump sprayers.

Equipment for Liquid Formulations

Motorized / Mechanical

- Are used to apply a liquid pesticide mixture to a large area.
- Pressure is achieved using a power-driven pump.
- Product is delivered through nozzle(s).

Examples include power hose, boom, and air blast sprayers.

Liquid Applicators



Hose and Reel



Hand Held Wand

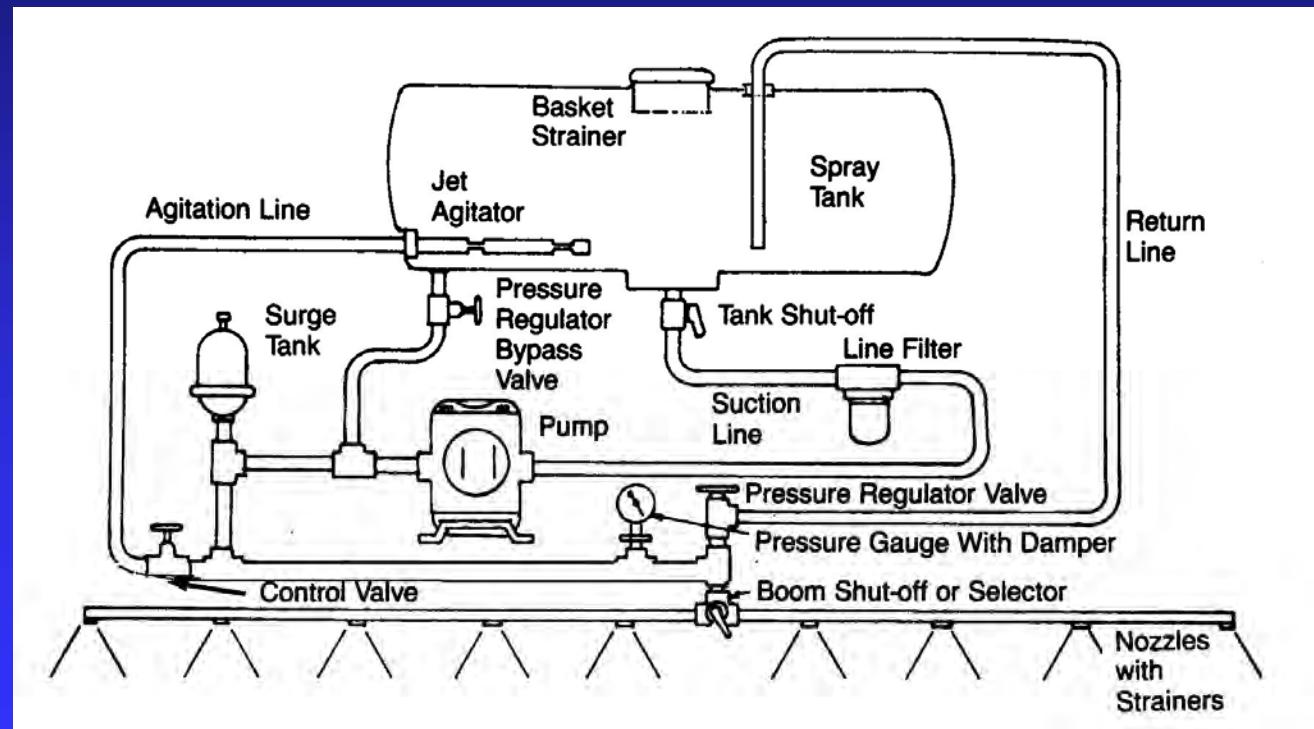


Walk Behind



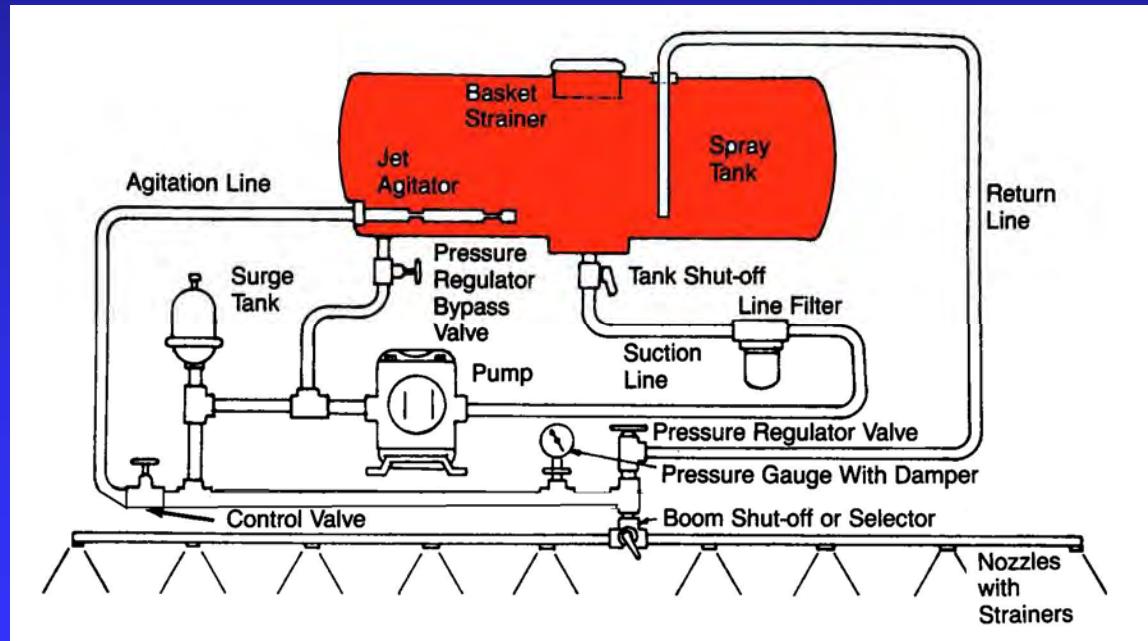
Towed Boom Sprayer

Basic Sprayer Components



Basic Sprayer Components

■ Tank



Basic Sprayer Components

Tank

- Made of a strong material that resists reaction and corrosion (fibreglass, stainless steel, or polyethylene).
- Shaped to promote agitation and be easy to fill and clean.

Basic Sprayer Components

Tank

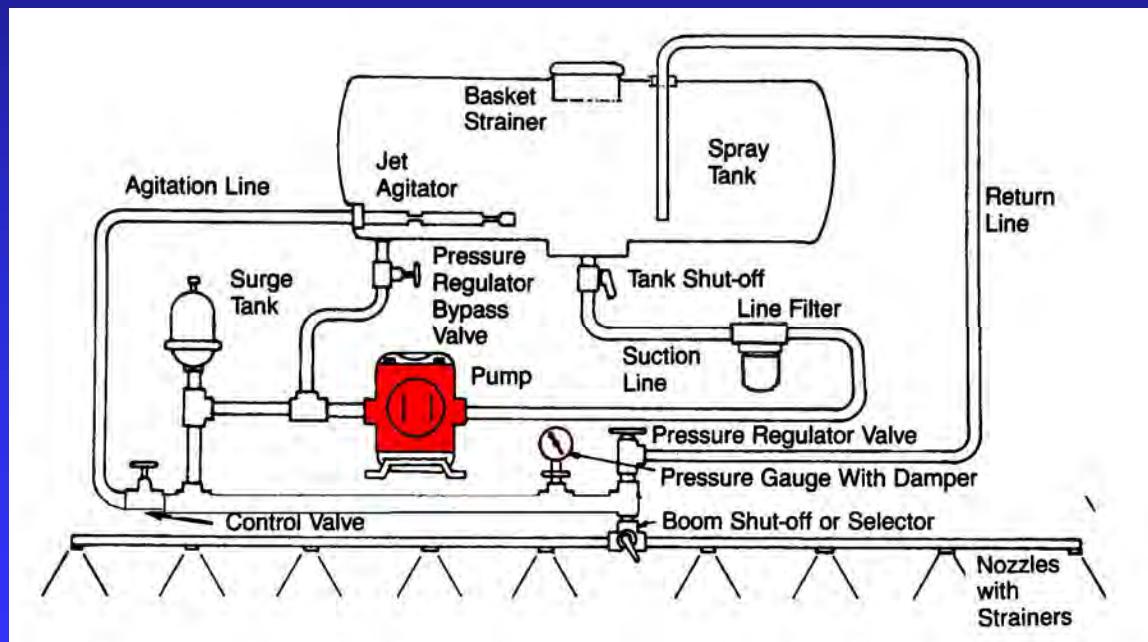
- Baffled to prevent liquid pesticide from sloshing.
- Sized to suit the sprayer boom width and output.

Spray tank



Basic Sprayer Components

■ Pump

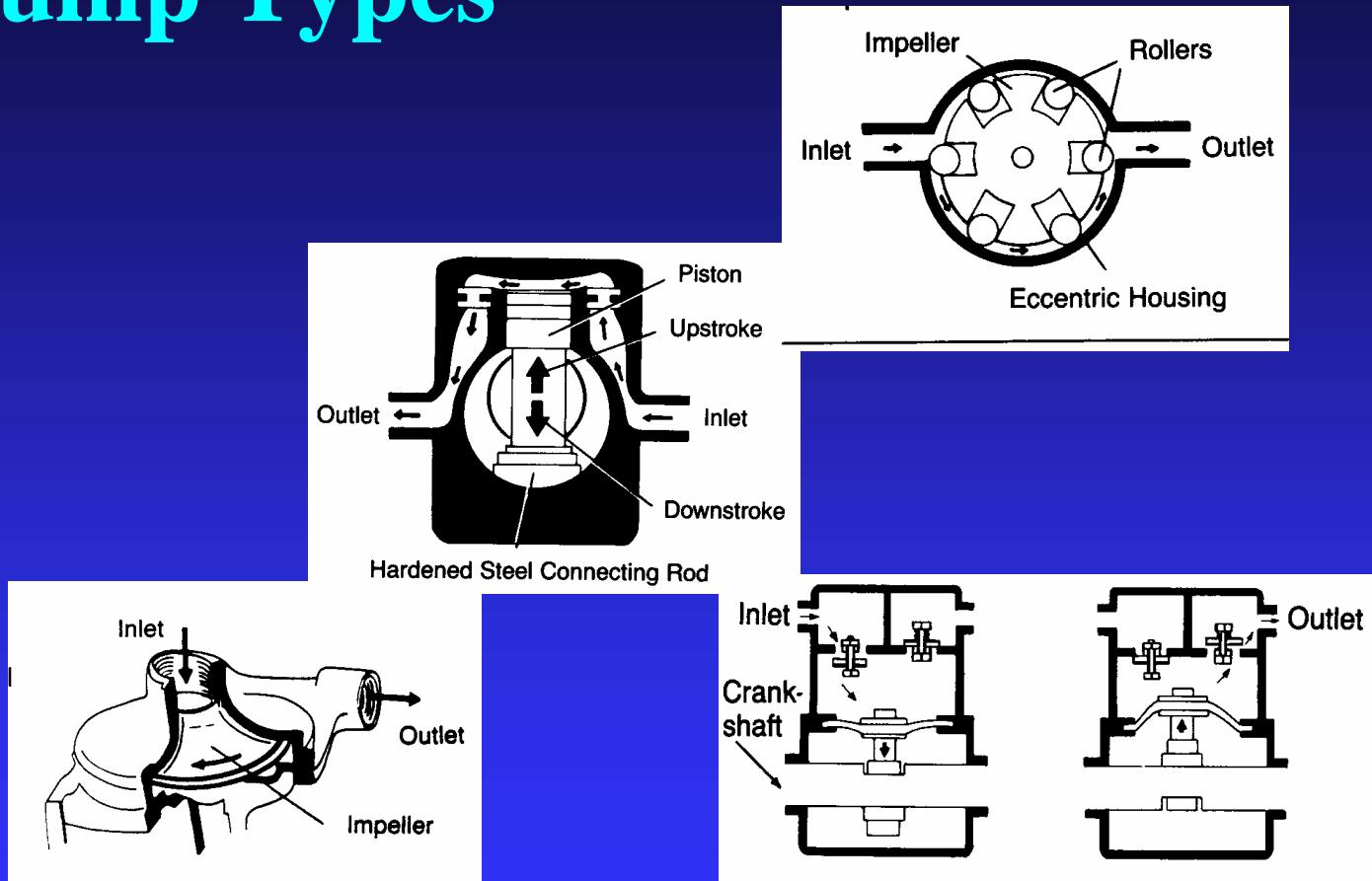


Basic Sprayer Components

Pump

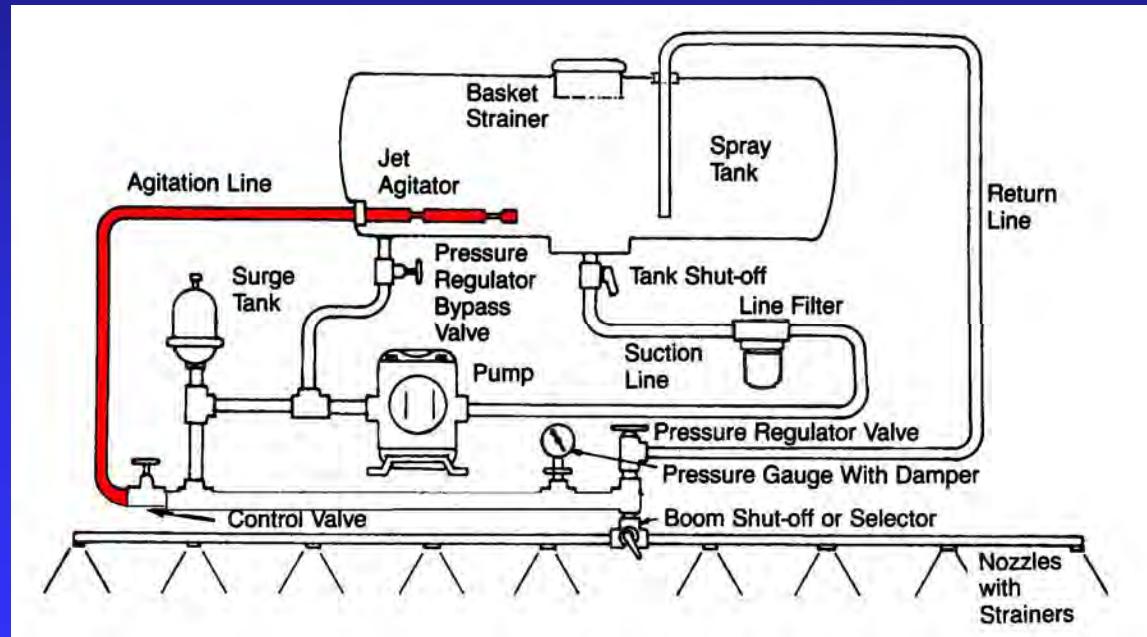
- Creates a flow of spray mixture from the tank to the nozzle.
- Uses a power takeoff (PTO) drive or 12V electric power.
- Should be large enough to move the required volume of pesticide mixture to the nozzle(s) at an even pressure and provide enough agitation to keep the spray and carrier mixed.

Pump Types



Basic Sprayer Components

■ Agitator

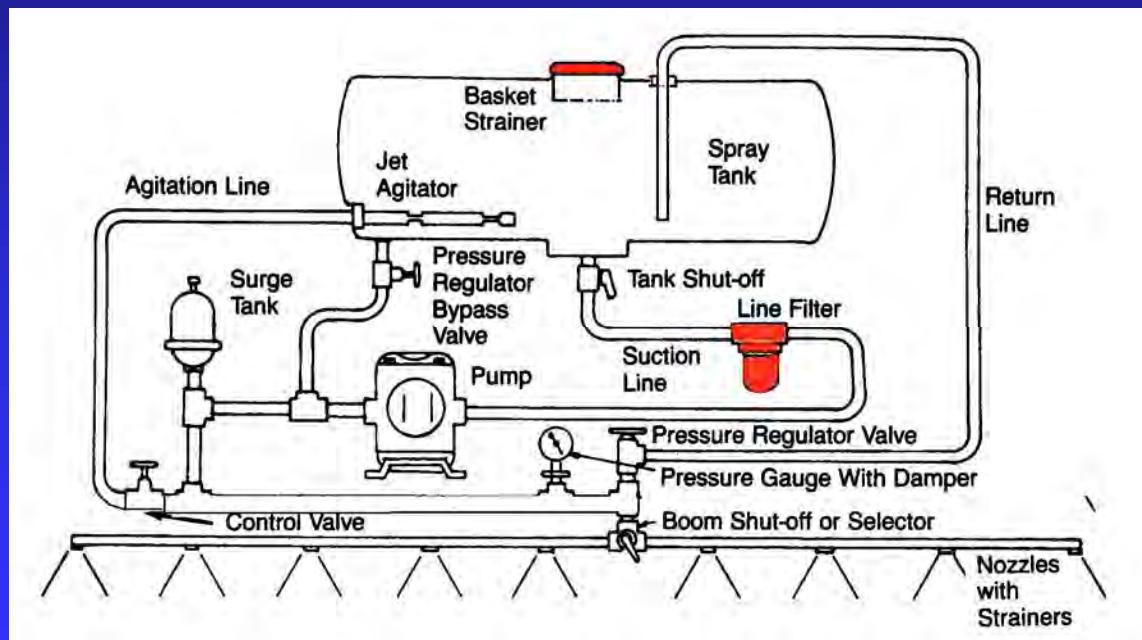


Agitator

- Mixes the formulated pesticide and the carrier (often water).
- Prevents suspended pesticide particles from settling out.
- Amount of agitation needed depends on the type of formulation.
- Types include mechanical & hydraulic.

Basic Sprayer Components

■ Filters or Strainers

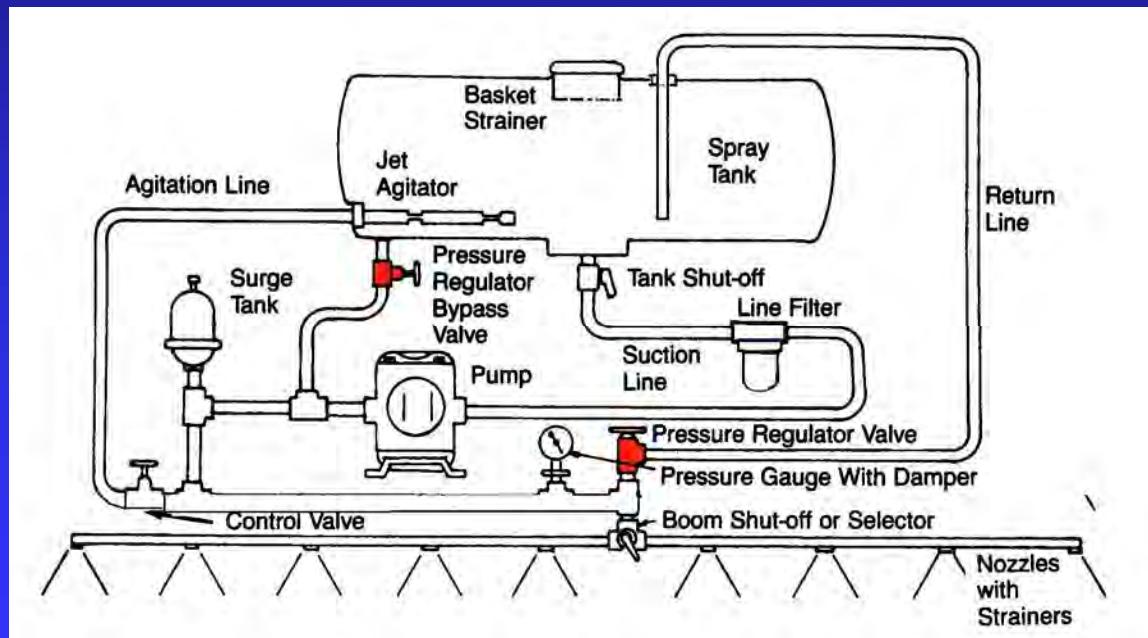


Filters or Strainers

- Prevent debris or particles in the spray mixture from breaking the pump or plugging the nozzles.
- Can be installed in different places.
- Need to be checked regularly.
- Strainers should not be removed as they protect the nozzle from wear.

Basic Sprayer Components

■ Pressure Regulator Valve

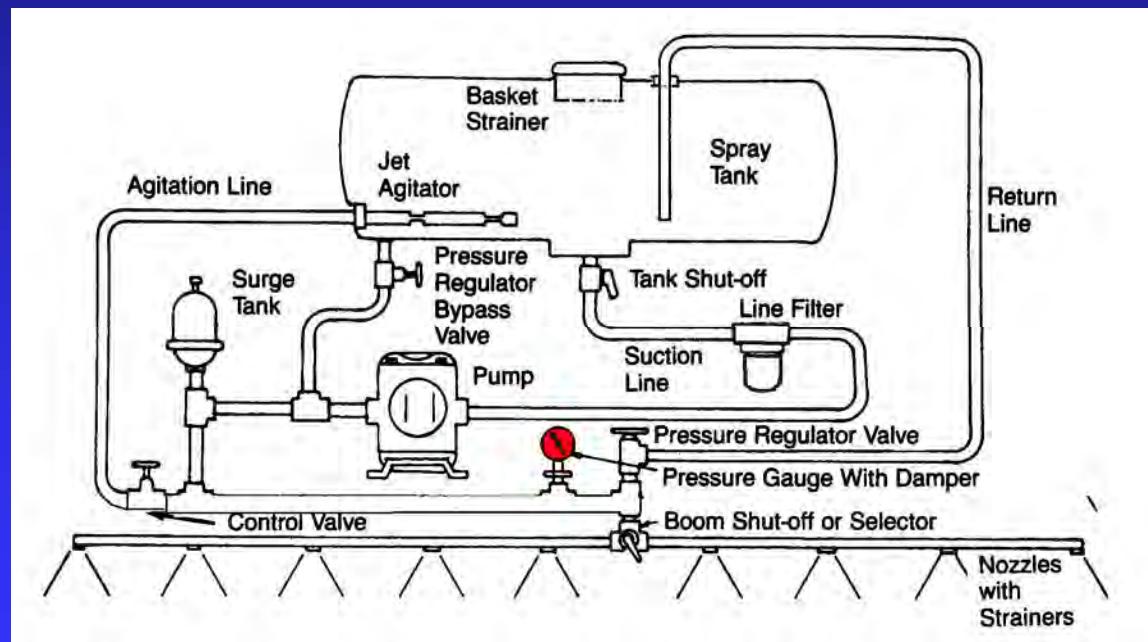


Pressure Regulator Valve

- Controls the output rate on most sprayers.
- Protects pump seals, hoses, and other parts from damage due to too much pressure.
- Pressure range and flow capacity of the regulator should match those of the pump.
- Pressure is measured by the pressure gauge.

Basic Sprayer Components

■ Pressure Gauge



Pressure Gauge

- Measures the sprayer's operating pressure.
- Set at a desired, initial pressure.
- Measurement can be changed by changing the setting on the pressure regulator valve.
- Best place to measure the sprayer's pressure is close to the nozzles.

Plumbing

Pipes and Hoses

- Should be chemical resistant and checked regularly for wear or kinks.
- Inside diameter should be the same as the pump inlet openings.

Plumbing

Pipes and Hoses

- Capable of handling the maximum pressure and maximum output used and a pressure surge.
- Any restrictions (e.g., kinked hose, undersize, clog) can cause a drop in pressure.

Basic Sprayer Components

Nozzles are a key component of the spray system because they:

- Metre the amount of spray delivered.
- Break (atomize) liquid into droplets.
- Spread droplets in a given pattern.

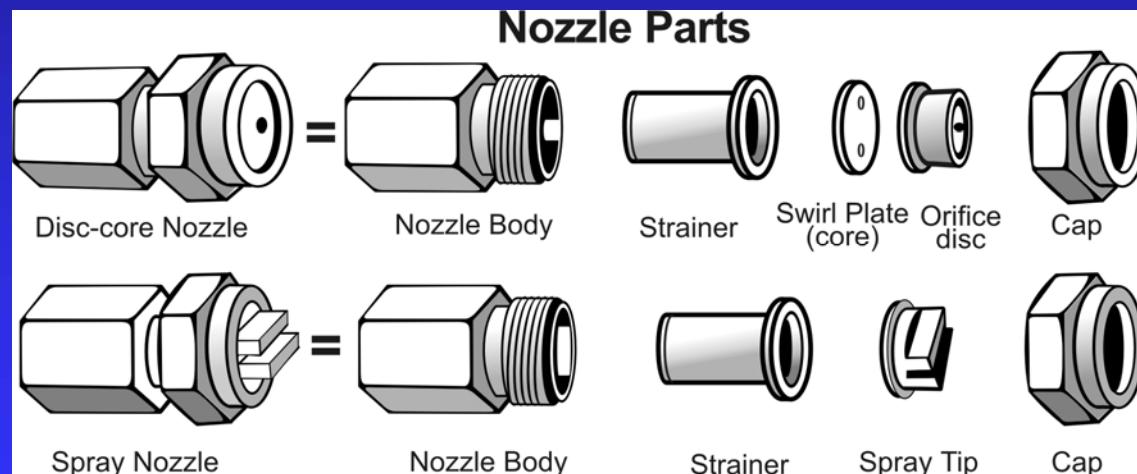
Basic Sprayer Components

Nozzles are a key component of the spray system because they:

- Each sprayer nozzle is designed to do a specific job with a particular type of pesticide formulation.
- Nozzle types vary by output capacity, spray pattern, and operating pressure.

Basic Sprayer Components

■ Nozzles Parts



Basic Sprayer Components

Nozzles Parts

- Nozzle body holds the strainer and tip in place.
- Strainer (screen) filters out debris and prevents the opening from becoming clogged. (To work properly, a screen should have a mesh size smaller than the nozzle opening.)
- Cap is used to secure the strainer and the tip to the body.

Basic Sprayer Components

Nozzles Parts

- Tips create the pesticide spray pattern by breaking the liquid into droplets.
 - Are defined by their spray pattern. Common tips used in landscape applications are the flat fan and hollow cone.
 - Are made from various materials and are often inter-changed.

Nozzle Tip Types

Brass	Poor wear life; susceptible to corrosion (more so when used with fertilizers)
Polymer	Good wear life and resistance; orifice can be damaged if not properly cleaned
Stainless steel	Good wear life; excellent chemical resistance; durable orifice
Hardened stainless steel	Very good wear life; good durability and chemical resistance
Ceramic	Superior wear life; highly resistant to abrasive and corrosive chemicals

Nozzle Spray Patterns

Full or Solid Cone Nozzles



- Used where dense foliage requires a penetrating spray.
- Most often used to apply fungicides or insecticides to foliage when the plants must be fully covered with product.

Nozzle Spray Patterns

Hollow Cone Nozzles



- Used when spraying at high pressures.
- Often used for wettable powders, flowables, and suspensions.
- Tend to produce a finer, more uniform spray than solid cone nozzles.

Nozzle Spray Patterns

Even Flat Fan Nozzles



- Form a narrow, oval pattern with a sharp cut-off at the edge.
- Used for applying herbicides with a multi-nozzle boom.
- Boom height and nozzle spray angles affect the width of the area treated.

Worn Nozzle Tips

As a nozzle tip wears, the opening changes. This alters the application rate.

Worn nozzles can:

- Produce a poor spray pattern.
- Waste chemicals and money.
- Result in poor pest control.
- Produce higher pesticide application rates.

Nozzle Replacement

Replace a nozzle if the flow varies more than ten percent (10 %) from the manufacturer's specifications or five percent (5 %) from the sprayer's average nozzle output.

Nozzle Performance Characteristics

Each sprayer nozzle is designed to do a specific job with a particular type of pesticide formulation. Nozzles come with a wide range of performance characteristics, including:

- Spray Angle
- Volume
- Nozzle Output
- Droplet Size

Nozzle Performance Characteristics

Spray Angle

- Is the measurement (in degrees) of the spray pattern formed by a single nozzle at a given pressure.
- Wider nozzle angles provide a more even pesticide application with lower boom heights.
- Refer to nozzle manufacturer guidelines on required overlap for even application.

Nozzle Performance Characteristics

Volume

- Is the amount of spray to be applied per unit of area.
- Is often shown on the label of a pesticide as a range (apply 300 to 500 litres per hectare).

Nozzle Performance Characteristics

Nozzle Output

- Depends on the size of the nozzle opening and the spray pressure.
- Output increases as pressure increases.
- Pressure must be increased four times to double the nozzle output.

Nozzle Performance Characteristics

Droplet Size

- Is the size of a particle of liquid (measured in microns) that is formed as the spray mix is forced through the nozzle.
- Nozzles can form a range of droplet sizes, from very small to large.
- More droplets become fine (small) as the spray pressure increases.

Nozzle Performance Characteristics

Droplet Size

- Pesticide coverage tends to be better (and cheaper) when using smaller droplets.
- Unfortunately, spray drift is more likely to occur with small droplets.
- Evaporation and wind can move the smaller spray droplets away from the target (vapour drift).

Drift Control

- Drift can also be reduced by placing a cone or shroud around the spray wand.
- This addition also gives better coverage of the target.
- Boom-type spray wands can be enclosed in a shroud or windfoil.

Granular Application Equipment

Granular application equipment is used to spread dry pellets or granules of pesticide.

Components of granular application equipment include:

- **Storage Hopper**
- **Metering Mechanism**
- **Distribution System**



Granular Application Equipment

Storage Hopper

- Comes in a number of shapes, sizes, and materials and holds the granular pesticide.
- Should be graduated, strong, resist corrosion, shaped to help the granules flow, and be easy to fill and clean.

Granular Application Equipment

Storage Hopper

- Agitators and coarse screens can be installed to prevent blockage and to keep out clumps of product, debris, or pieces of the pesticide container.

Granular Application Equipment

Metering Mechanism

- Releases the required amount of product from the hopper at the desired rate.
- Can be gravity-flow or positive mechanical metering.

Metering System

Gravity Flow

- Have manually adjusted openings below the hopper.
- Often have agitators to help give a steady flow of granules to the openings. Openings at the bottom of the hopper can be adjusted in size to change the flow rate of the granules.

Metering System

Gravity Flow

- Application rate affected by granule size, ground speed, humidity, slowing down at turns, & wind.

Metering System



Positive Mechanical

- Use an auger or feed roller to regulate the flow of granules.
- A ground driven wheel or motor powers the auger.

Metering System



Positive Mechanical

- Considered to be more accurate than gravity type.

Distribution System

Moves the granules from the equipment to the site. Distribution system types include:

- Broadcast Application Equipment
- Banding Application Equipment.



Distribution System

Broadcast Application Equipment

- Applies granules over the entire surface using either:
 - A wide hopper with closely spaced, gravity-flow openings.
 - A single flow opening with a mechanical spreader.

Distribution System

Broadcast Application Equipment

- A pneumatic delivery system (granules are blown from the metering system through a boom to outlets. A powerful fan produces a stream of high-speed air to carry the granules.)

Distribution System

Banding Application Equipment

- Applies granules in narrow bands that often line up with crop rows.
- Untreated areas are left between the rows (thus, banding helps reduce pesticide use).
- Uses either a spreader to distribute granules across a desired band width, or small drop tubes or soil openers to place granules under the soil.

Wick Applicators

- Used to apply a liquid herbicide directly to weeds.
- Herbicide is poured into a long pipe. It then seeps out of the pipe and is absorbed by the wicking material.
- Non-selective herbicide is wiped onto weeds.
- Typically used where drift could be a problem.

Wick Applicators



Roller



Wick Stick



Equipment Maintenance

Care of Application Equipment

- Involves regular cleaning, inspection, repair, and preventative maintenance; and proper storage.
- Read the pesticide label for cleaning instruction.
- Read the equipment operating manual for instruction for proper cleaning, maintenance, repair, and storage.

Equipment Maintenance

Before working on application equipment:

- **First put on personal protective equipment.**
- Remove and dispose of excess pesticide and/or wash water in a place and manner that will not harm the environment.

Equipment Maintenance

Before working on application equipment:

- Read the product label or contact the PEI Department of Environment, Energy and Forestry for direction on product disposal.

Equipment Maintenance

Proper care of pesticide application equipment can save you time and money. It can also reduce hazards and the cost of accidents and breakdowns.

Equipment Maintenance

- Screens should be kept clear of residue and debris.
- Replace screens as required with a size that correctly matches the nozzles used.
- Sprayer valves and pressure gauges should be checked regularly.

Equipment Maintenance

- Check hoses and fittings for cracks, leaks, or wear. Replace those that show signs of excess wear or holes. Tighten fittings as required.
- Nozzles should be calibrated at least twice a year. Check and clean nozzles regularly. Replace worn or damaged nozzles.

Equipment Maintenance

- Check pumps for valve or piston wear.
- Regularly clear out granules from the hopper to prevent lumping.
- Check and grease all moving parts before using

Preventative Maintenance

Should be done on a regular basis throughout the year. To keep application equipment working well:

- Overhaul the pump annually.
- Check all tires for proper inflation. Air pressure will affect the size of the tires, alter the application rate, and cause uneven pesticide application. Over-inflated tires cause bouncing.

Preventative Maintenance

- Store the equipment under cover.
- Drain and rinse tanks and clean-out hoppers when they are not in use.
- Clean the entire system as required.
- Use gaskets and washers made of a pesticide-resistant material, such as teflon.

Cleaning Equipment

- Cleaning removes any accumulated residue in the tank (or hopper), hoses, and nozzles.
- Leftover residue can mix with new product, alter the effect of the second pesticide, and damage turf or ornamentals.

Cleaning Equipment

- **Clean equipment before:**
 - Using it for the first time.
 - Using a different pesticide (extra care when changing from a herbicide to an insecticide).
 - Storing it during the off-season.

Steps for Cleaning a Sprayer

- Put on personal protective equipment (PPE).
- Wash the outside of the tank with soap (or mild detergent) and water.
- Remove nozzle tips and screens, and clean them using a strong detergent and water. Use a soft brush.

Steps for Cleaning a Sprayer

- Partly fill the spray tank with clean water.
- Flush this water through the booms for at least ten minutes before draining. Boom sections should be flushed one at a time.
- Repeat the rinse cycle if residue can still be seen.
- Fill the tank nearly full with clean water.

Steps for Cleaning a Sprayer

- Add a cleaning agent and then agitate and circulate this mix through the system for at least 15 minutes.
- Spray out and drain completely.
- Repeat the wash cycle.
- Rinse twice with clean water and drain.
- Wash PPE and hands.

Steps for Winter Storage of a Sprayer

- Clean using ‘Steps for Cleaning a Sprayer’.
- If equipment is to be stored where it might freeze, drain it and then rinse with alcohol to prevent residue from freezing and cracking or damaging the tank, hoses, and pump.
- Flush pumps and hoses with antifreeze.
- Remove, clean, and store nozzles in a warm, dry place to avoid damage from freezing.

Steps for Cleaning Granular Application Equipment

- Equipment should be cleaned after each use.
- Put on personal protective equipment (PPE).
- Remove all pesticide from the device.
- Clean the inside of the hopper.
- Clean and oil the flow-control slides or valves.
(Wipe off excess oil.)
- Wash PPE and hands.

Steps for Storing Granular Application Equipment

- Clean using ‘Steps for Cleaning Granular Application Equipment’.
- Protect plastic parts from direct sunlight during storage. This will extend their life.
- Use sandpaper or a wire brush to clean rusted parts. Paint the cleaned parts.
- Coat the inside of the hopper and metering system with oil to prevent rust and corrosion.
- Oil or grease the bearings.

Protecting Human Health and the Environment

Follow these guidelines to minimize hazard to human health and the environment when cleaning pesticide application equipment:

- Never use a piece of wire, nail, or metal object to clean nozzle tips. These can damage the opening, distort the spray pattern, and increase nozzle output.

- Use a toothbrush or soft material to clean nozzle tips.
- Wear protective clothing and equipment (PPE) when cleaning sprayers and measuring containers.
- Follow label directions or contact the regulatory authority for direction for the disposal of un-used product.

- Clean application equipment away from waterways, ditches, wells, or other water sources.
- Comply with provincial regulations for distances of equipment from bodies of water.
- Clean up puddles of rinse or wash water. These can be hazardous to children, pets, or wildlife.

- Never blow out nozzle tips using your mouth.
- Wash hands and PPE after handling application equipment.
- Clean up spilled granules to prevent soil contamination and intake by birds and wildlife.

PEI Landscape Pesticide Applicator Training Course

Training Module 12, Part 1 Emergency Response

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Learning Objectives

There is risk of exposure any time a person comes into contact with a pesticide. Anyone who handles or might be exposed to a pesticide must be prepared to respond to an accidental poisoning, burn, spill, or fire.

- Completing this module will help you to:
- Assess the hazards of a pesticide spill or fire, and apply emergency measures.
- Secure pesticides and minimize theft.

Emergencies Involving Pesticides

You can plan for pesticide emergencies by:

- Knowing all the areas of risk.
- Knowing how to respond to different incidents.
- Taking the necessary steps to reduce risk.
- Having the right information on hand.
- Contacting the proper authorities.

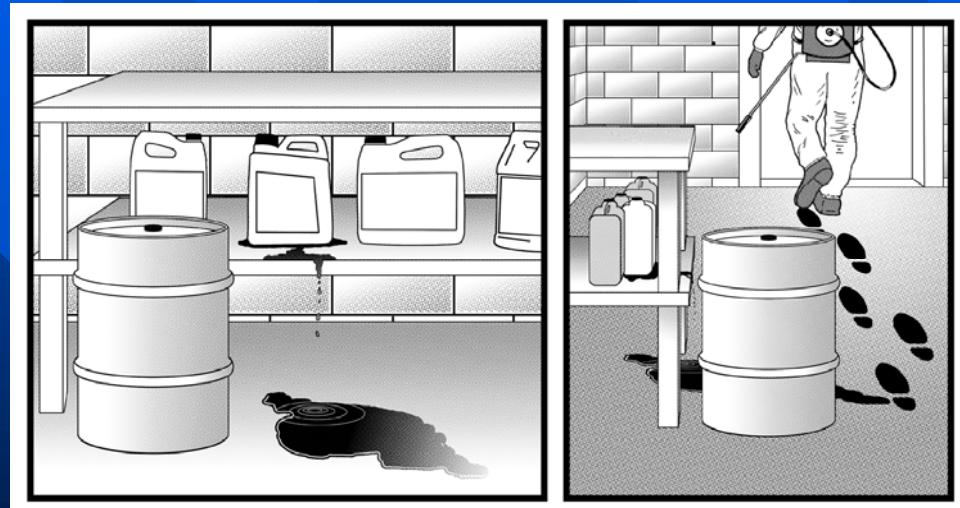
Pesticide Spill Emergencies

- A pesticide spill can occur when a product is being transported, stored, or handled at the application site.
- A pesticide spill can poison people, animals, and plants.
- If not properly cleaned up and decontaminated, a pesticide spill can contaminate soil, water, and vehicles.

Pesticide Spill Emergencies

Three steps are involved when addressing a pesticide spill:

- Prevention
- Preparation
- Response



Preventing Spills

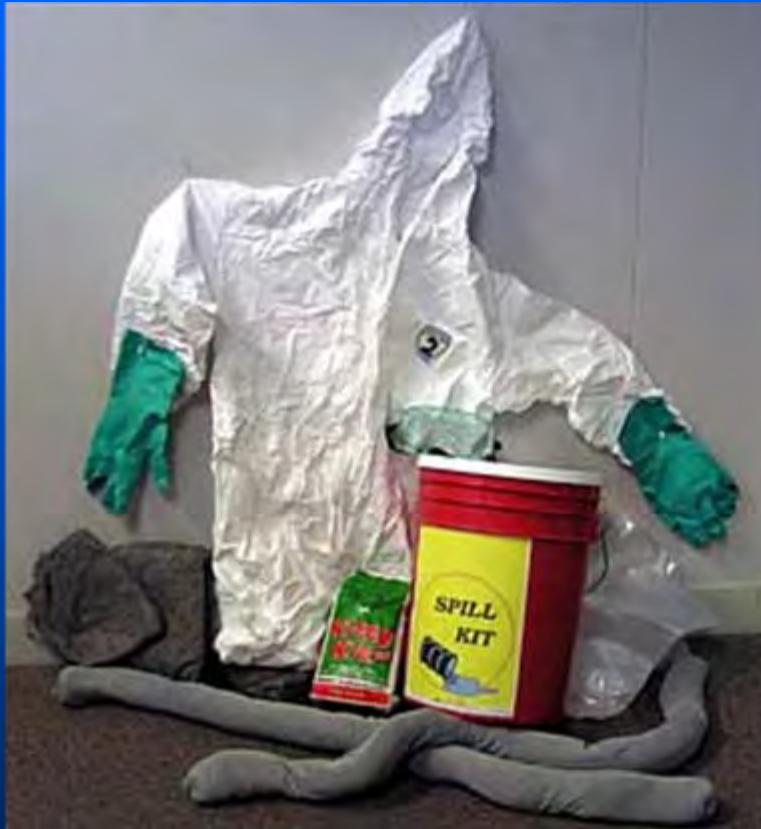
You can reduce the chance of a pesticide spill, and the resulting risk, by following these guidelines:

- Regularly check pesticide containers for leaks, holes, and other signs of stress.
- Store pesticides in a proper storage facility.
- Keep pesticide containers on pallets and off the ground. Do not over stack containers.

Preventing Spills

- Take extra care when mixing, handling, or moving pesticide containers or loaded application equipment.
- Regularly inspect and maintain application equipment, and never leave it unattended when filling.
- Make sure that workers are trained to handle pesticides properly.

Preparing for Accidental Spill Emergencies



To prepare for a
pesticide spill
emergency:

- Keep personal protective equipment (PPE) on hand.

- Keep a spill kit on hand, including:
 - Absorbent material
 - A sealable container to hold contaminated waste.
 - A shovel to contain and pick up contaminated material.

Preparing for Accidental Spill Emergencies

- Keep copies of the MSDS's and the following emergency phone numbers handy:
 - Local Dept. of Environment.
 - Fire, police, and ambulance service.
 - Poison control centre.
 - Canutec (613 996 6666)
- Know what to do if a spill occurs.

Responding to a Spill

If a pesticide spill occurs, you must respond quickly and properly. To put your Emergency Response Plan into action:

- Assess the hazards.
- Take steps to protect yourself and others from exposure to spilled pesticide.
- Put on proper personal protective equipment.
- Remove any victims. Call 911 if required.

Responding to a Spill

- If the spill is in a storage area, ventilate.
- Keep people and animals away from the spill area.
- Follow personal safety practices (e.g., do not smoke, eat, or drink during cleanup activity).
- Check the pesticide label and MSDS for instruction on containing the spill.
- Cover a liquid spill with absorbent material (vermiculite or pet litter).

Responding to a Spill

- Clean up the spill quickly, but use care.
- Never try to wash away a spill using water.
- If cleanup guidelines are not given on the label, sweep or shovel contaminated absorbent material into a container lined with a heavy-duty plastic bag.
- Seal the container and label with information on the spilled pesticide (trade name, PCP Act number, date of spill).

Responding to a Spill

- Locate the manufacturer's emergency phone number and call for more information (your local pesticide vendor may be able to help with this).
- Follow product disposal guidelines. These may be given on the product label or MSDS.
- If a pesticide spill occurs, you must contact the:
PEI Environmental Emergencies

24-hour toll-free number 1-800-565-1633

Pesticide Spill

- Any amount of spilled pesticide can pose a hazard.
- A spill of **less than 20L or 20Kg** of concentrated product or less than 200L of pesticide mix is considered to **be a small spill**.
- An amount larger than this is considered to be a **large spill**.
- Large spills are more likely to impact people or pets, or to contaminate property or the environment.

Steps for Cleaning up a Pesticide Spill

- Put on proper PPE.
- Contain or reduce further spillage. If possible, pump large spills into drums.
- Cover a liquid spill with absorbent material.
- Shovel contaminated soil and absorbent material into a lined container.

Steps for Cleaning up a Pesticide Spill

- Seal and label the container (product name, *PCP Act* number, amount of product, and date).
- Contact provincial regulatory authorities for proper disposal procedures.
- Decontaminate area according to the label or MSDS.

Never flush the area with large amounts of water.

Decontaminating the Spill Area

Pesticide residue left after cleanup can remain active. This residue can further contaminate soil, water, or hard surfaces.

To decontaminate soil:

- Refer to the product MSDS and label. These may provide information for dealing with minor pesticide spills during mixing, loading, transporting, or application.
- Contact the pesticide manufacturer or the PEI Department of Environment, Energy and Forestry for information on decontaminating soil.

Decontaminating the Spill Area

To decontaminate hard surfaces:

- Use a small amount of wash water. Use only enough to extract the pesticide. Do not dilute it.
- Contain the wash water to the contaminated area.
- Work the wash water and degradation agent into the spill area with a coarse brush or broom. Only use bleach when called for on the label.

Decontaminating the Spill Area

To decontaminate hard surfaces:

- **Absorb excess liquid with more absorbent material (e.g., pet litter or vermiculite).**
- **Sweep the used absorbent material into a waste container.**

Decontaminating the Spill Area

- Seal the waste container, label it (date, *PCP Act* number, and trade name of the spilled pesticide), and store until you are able to properly dispose of it.
- If you are unsure of how to dispose of the contaminated material, contact the PEI Department of Environment, Energy and Forestry.

After Cleaning up Spill



Prepare warm soapy water.



Remove and wash PPE



Remove gloves last.

Decontamination of Cleanup Equipment and PPE

- Equipment and PPE used to clean up a pesticide spill must be decontaminated after use.
- Before removing PPE, wash any equipment used in the cleanup (e.g., broom, shovel) with soap and water.

Decontamination of Cleanup Equipment and PPE

- Remove and wash goggles, respirator, boots, and coveralls using soap and water.
- Wash gloves before taking them off.
- Remove gloves last and wash hands and face.

Proper Glove Removal



Avoid exposure by not touching contaminated glove surfaces.

Personal Hygiene

There is always a chance of exposure, even when wearing PPE.

- Shower and change immediately if clothing becomes heavily contaminated. Do not wait to finish the cleanup activity.
- Wash hands and face with warm soapy water before eating, smoking, drinking, or changing into street clothes.
- Take a full shower as soon as possible.

Personal Hygiene

- If any person involved in the spill or cleanup activity begins to feel sick (e.g., nausea, headache, etc.), take him/her to the nearest hospital at once. Take along:
 - A clean pesticide label (if possible).
 - The PCP Act number.
 - All medical treatment information on the label or MSDS.

Pesticide Fire Emergencies

Fires involving pesticides can pose a special danger because:

- Many pesticides are flammable; a few are even explosive.



Flammable

TDG Safety Marks



Explosive

Pesticide Fire Emergencies

- Some pesticides produce highly toxic fumes when burned.
- Fumes from a pesticide fire can poison people (e.g., firefighters), animals, or plants.
- Runoff water from fighting the fire, which can contain pesticide residue, has the potential to contaminate soil, wells, and other water sources.

Pesticide Fire Emergencies

Three steps are involved when addressing a pesticide fire:

- Prevention
- Preparation
- Response



Preventing Fires

You can help to avoid a fire by following these guidelines:

- Do not use an open flame (welding, burning, cutting) in a pesticide storage facility.
- Follow national and local fire, building, and electrical codes when locating and constructing a storage facility.
- Prevent unauthorized access to a storage facility by securing doors and windows.
- Do not smoke in, or around, a storage facility.

Preparing for a Fire Emergency

Prepare an Emergency Response Plan for dealing with fires. The plan should include the following fire control guidelines:

- Keep a list and the Material Safety Data Sheet of all stored pesticides.
- Keep these references within easy access, but away from the storage facility.

Preparing for a Fire Emergency

- Encourage the fire department to visit the site before a fire occurs, or provide them with the list and the exact location of all stored pesticides (site plan).

Preparing for Fire Emergencies

- Post “danger” or “warning” signs at all points of access to a pesticide storage facility.
- Keep emergency telephone numbers nearby.
- Keep a fire extinguisher, approved for fighting chemical fires, near the storage area.
- Have a step-by-step plan to respond to fire. This should tell how to respond, who is to perform each task, and how to contain any runoff water.

Responding to Fire

An Emergency Response Plan should be put to work as soon as an incident occurs.
You should:

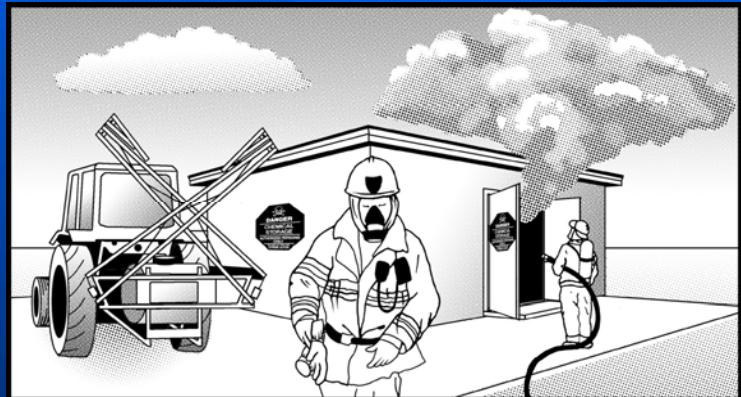
- Get away from the fire.**
- Dial 911 at once to notify the fire department.**
- Confirm that all workers and family members are safe.**

Responding to Fire

An Emergency Response Plan should be put to work as soon as an incident occurs.
You should:

- Keep people and animals upwind and away from the fire. This will help to protect them from toxic fumes, runoff, and explosions.**

Responding to Fire



- Make sure that firefighters know that the structure on fire contains pesticides or application equipment.
- Give firefighters a list of all pesticides in the facility.

Responding to Fire

- If required, make dams or dikes to contain runoff water and to prevent it from getting into waterways, wells, and other environmentally sensitive areas.
- Report all fires involving pesticides to the:

PEI Environmental Emergency
24-hour toll-free number
1-800-565-1633

Pesticide Theft

In the case of pesticide theft, the owner of the stolen product can be held liable for any related accident involving the pesticide. To help prevent pesticide theft:

- Lock the storage facility and use a security system.
- Ensure adequate outdoor lighting.

Pesticide Theft

- Limit access to the pesticide storage facility at all times.
- Secure pesticides when transporting them.
- Never leave application equipment unattended.
- Stolen pesticides can be tracked using the supplier's batch or lot numbers.

Pesticide Theft

- If a theft of pesticide occurs, contact the police, PEI Department of Environment, Energy and Forestry, your insurance company, and your pesticide supplier at once.

PEI Landscape Pesticide Applicator Training Course

Training Module 12, Part 2 Emergency Response

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Learning Objectives

There is a risk of exposure any time a person comes into contact with a pesticide. Anyone who handles, or might be exposed to, a pesticide must be prepared to respond to an accidental poisoning, burn, spill, or fire.

Learning Objectives

Completing this module will help you to:

- Prepare and use an emergency response plan.
- Assess pesticide emergencies and apply first aid.
- Respond to the variety of emergencies that can occur.

Emergency Response Plan

An incident can occur quickly and without warning. An Emergency Response Plan can reduce the impact of a pesticide emergency on human health and the environment. A good plan should identify the steps needed to deal with:

- **Fire.**
- **Incidents causing personal injury.**
- **Spills or incidents during transport.**
- **Vapour and/or odour release.**

Emergency Response Plan

An Emergency Response Plan will include a:

- **List of contacts and emergency response numbers.**
- **List of emergency assistance resources.**
- **Site map for the office and storage area.**
- **Accurate pesticide inventory.**
- **Step-by-step outline of emergency procedures.**
- **Record of emergency equipment and supplies.**

Telephone List

List the name and 24-hour telephone numbers for:

- **Fire, police, and medical assistance (911).**
- **Owner, managers, and key staff (home and office).**
- **The provincial 24-hour environmental emergency line (1-800-565-1633).**

Telephone List

List the name and 24-hour telephone numbers for:

- All provincial authorities who must be called in case of an emergency.
- Neighbours.
- Your insurance agency.

Update and review your plan annually.

Emergency Telephone List

- An emergency contact list should be posted near any telephone located in a pesticide handling, mixing, or storage area.

EMERGENCY PHONE NUMBERS

Doctor _____

Fire _____

Police _____

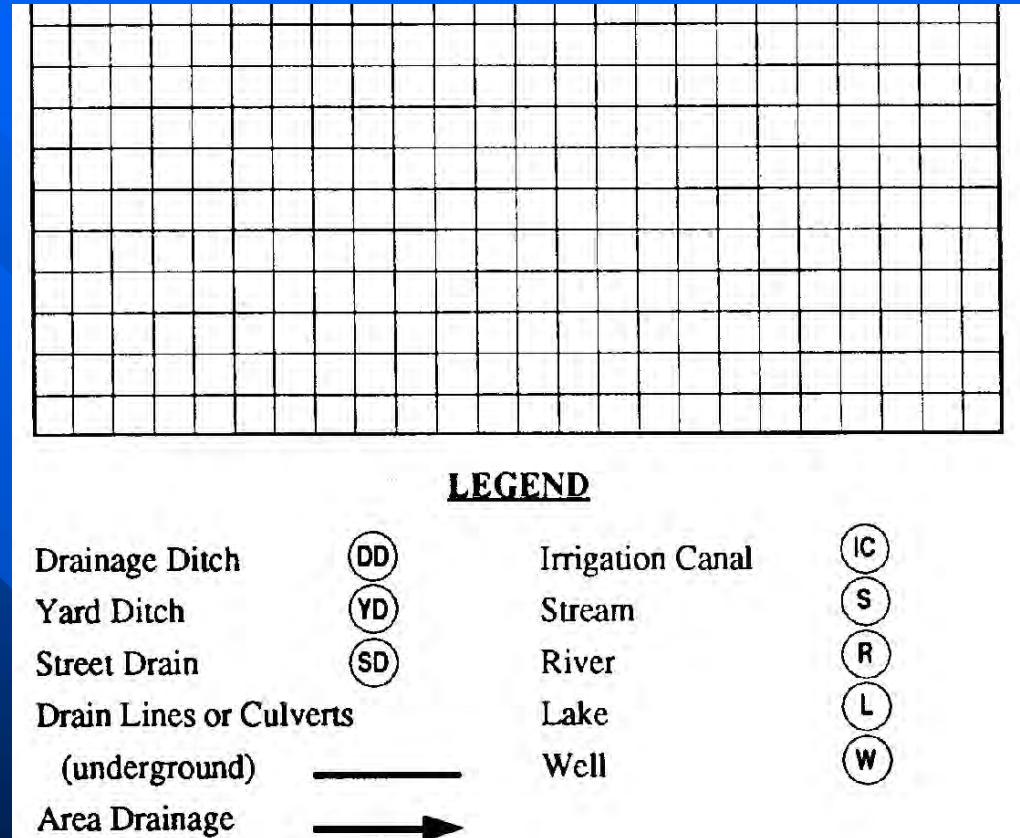
Ambulance _____

Poison Control Centre _____

Environmental Emergencies _____

Site Map

Prepare a map locating the pesticide storage structure and all surrounding features.



Emergency Response Plan

An Emergency Response Plan will only work if equipment and supplies are on hand, and staff are ready to respond.

- Review the plan annually to ensure all workers are familiar with the location of, and information contained in, the plan.
- Copies of the plan should be stored in different places, including the cab of each vehicle.
- Update the plan annually.

First Aid

First Aid:

- Is the means to help stabilize a sick or injured person until medical help arrives.
- Can prevent further injury and save lives.
- Cannot take the place of medical help.
- Should be learned by all staff.

First Aid Procedures for Pesticide Exposure

- Those who work with pesticides should be prepared to deal with chemical-related emergencies.
- Staff should be trained to administer general first aid procedures for pesticide poisoning, respiratory exposure, exposure to the eye and skin, and pesticide ingestion.

Pesticide Labels and Information on First Aid

- Principal source of first aid information is the pesticide label.
- Read the first aid section of the label before handling any pesticide.
- If someone is working with you, review first aid information with him or her.

First Aid Kit

- Your emergency supply inventory should include a well-stocked and maintained first aid kit.
- A list of materials for a first aid kit is provided in Chapter 9, page 192 of the Core Manual.
- Keep a first aid kit in the pesticide storage facility, office, and close to any area where pesticides are handled (ideally, in each vehicle).
- Check provincial regulations for details regarding the type and contents of kit required.

Pesticide Poisoning Response

People who work with pesticides should know the (mild, moderate, or severe) symptoms of a pesticide poisoning. They should also know proper first aid techniques.

- **Assess the danger**
- **Do not enter a dangerous situation.**
- **Protect yourself from injury before giving treatment to another person.**

Pesticide Poisoning Response

- Put on protective clothing and equipment.
- Remove the victim from the contaminated area.
(Move only if a spinal cord injury is not suspected.)
- Call, or have a bystander call, an ambulance and/or the Poison Control Centre.
- Check the victim's breathing and pulse. If he/she is not breathing, give artificial respiration. **(Wear a mask with a one-way valve.)**

Pesticide Poisoning Response

- Remove any contaminated clothing.
- Wash any skin exposed to the pesticide with soap and plenty of warm water.
- Keep the patient quiet, warm, and comfortable and reassure them to minimize shock.

Pesticide Poisoning Response

- If possible, supply emergency and medical responders with:
 - Information on the pesticide involved (e.g., *PCP Act* number, trade name, concentration).
 - Duration, route, and amount of exposure.
 - Relevant medical history of the victim.

First Aid and Routes of Exposure

First aid to be undertaken will depend on the pesticide's route of entry. A pesticide can enter the body:

- By breathing it into the lungs (respiratory).
- Through the eyes (ocular exposure).
- Through the skin (dermal exposure).
- By swallowing it (ingestion).

Refer to Chapter 9, pages 193–195), of the *Core Manual* for first aid procedures for addressing each of these routes of exposure.

Treatment for Respiratory Exposure

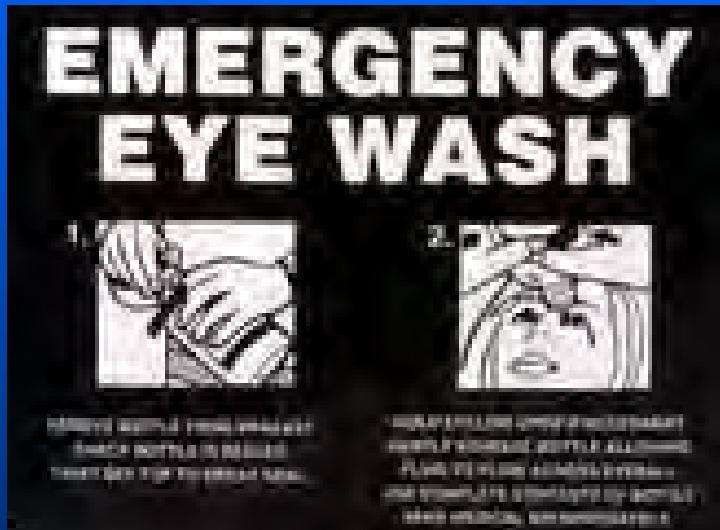
Vapours and fine droplets can be breathed into the lungs and cause respiratory exposure. When this happens to another person, act quickly and:

- Call for medical assistance.
- Reduce your risk by putting on proper PPE.
- Move the patient to fresh air.
- If needed, apply first aid and treat for shock.
- Attend to the patient until assistance arrives.

Exposure to the Eye

- Pesticides can splash into the eye during loading or overhead application.
- Product is then quickly adsorbed into the blood stream, causing poisoning.
- Some products are also very corrosive and can cause long-term damage to the eye.
- The label information will provide a warning.

Treatment



If a pesticide enters the eye:

- Hold the eyelid open and rinse with plenty of water for at least 15 minutes.
- Follow the first aid instruction on the label.
- Call for medical assistance or take the patient to the hospital.

Exposure to the Skin

The skin, in particular the hands, is the most likely site for pesticide exposure. Exposure to the skin can occur from:

- Touching contaminated containers or application equipment.
- Splashing product on the face when mixing or loading.
- Rubbing against treated vegetation.

Treatment for Dermal Exposure

Steps for treatment:

- Remove the patient's contaminated clothing.
- Drench the contaminated area with cold water.
- Call for medical assistance if there is extensive exposure, the product is corrosive, or the patient becomes unconscious.
- Wash the patient's skin and hair with soap and water. Clean under the fingernails if this area is contaminated.
- Give first aid until medical help arrives.

Treatment for Chemical Burns

Some products are very corrosive and can burn the skin on contact. Should this happen:

- Call for medical assistance.
- Remove contaminated clothing and drench the affected area with plenty of cold water.
- Do not apply anything to the burned area.
- Give first aid, as required.

Treatment for Ingestion

Accidental ingestion most often occurs as a result of someone placing a pesticide in a container other than the original (e.g., pop can, coffee cup). When this happens:

- Act quickly and call for medical assistance.
- Read and follow label directions for poisoning.
- First aid directions will state whether to induce vomiting or not induce vomiting.
- Provide first aid until medical help arrives.
- **Never give anything by mouth to an unconscious patient.**

Inducing Vomiting

Only induce vomiting if:

- The patient is conscious.
- The label clearly states “induce vomiting”.
- You are instructed to do so by the Poison Control Center or medical personnel.

Follow up to an Exposure

- Anyone poisoned (dermal, inhalation, ocular, or ingestion) by a pesticide should have a full medical assessment.
- Family members should be advised to watch the victim for recurring symptoms of poisoning. Ensure that they are aware of the acute toxic symptoms as noted on the label.
- **REMEMBER: First aid is never a substitute for professional medical treatment.**

PEI Landscape Pesticide Applicator Training Course

Training Module 13 Professionalism

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Learning Objectives

Completing this module will help you to:

- **Develop a more professional image for dealing with the public.**
- **Understand the importance of good public relations.**

Professionalism

Pesticide applicators must develop and maintain a positive relationship when dealing with the public.

- As an applicator in the turf management industry, you should understand that chemical pesticides are an important tool in the Integrated Pest Management ‘toolbox’.

Professionalism

- **Urban pesticide use continues to have a high profile, and the actions of landscape applicators are constantly under the watchful eyes of concerned citizens.**
- **You also need to recognize that because pesticides are often applied in densely populated, urban areas, exposure and risk to human health can be high.**

Professionalism

- The challenge for turf managers is to professionally balance the concerns of the public, while meeting the needs of their clients.
- Work professionally to balance your IPM skills with your clients' needs and with public concerns.

As a professional, you must work with skill and integrity. Key factors that display professionalism include:

- Knowledge of your job.
- Attitude, image, and work habits (how you conduct yourself on the job).
- Communication with clients, staff, and the public about your work

Knowledge

As a pesticide applicator, you must be familiar with:

- **Federal, provincial, and municipal laws that govern pesticide use in your province and community.**
- **Interactions between the pest, the host, and the environment.**

- Applicator training programs and provincial certification requirements for transporting, storing, handling, mixing, applying, and disposing of a pesticide.

As a pesticide applicator, you must understand:

- **How to select, use, and take care of pesticide application and personal protective equipment.**
- **Public concerns regarding pesticide use, human health, and the environment.**
- **How to respond quickly and properly to a pesticide-related emergency, spill, or fire.**

As a pesticide applicator, you must understand:

- How to obtain needed information on pesticide use (e.g., resource experts, publications, and trade organizations).
- Current information on pest control options. (This includes Integrated Pest Management.)
- The benefits and risks associated with various pest control methods.

Knowledge

Pesticides and their legal use change over time.

- It is important to keep up-to-date on changing pesticide laws, pest control products, application techniques and equipment, and public concerns.
- Keep current by attending seminars; talking to pesticide/equipment sales representatives; taking courses; and reading journals, papers, and other relevant publications.

Attitude and Work Habits

A professional attitude will help you to:

- **Protect yourself and the environment when working with pesticides.**
- **Reduce pesticide use by practising IPM. (Never perform whole lawn treatments when spot treatments will do.)**
- **Respect public concerns regarding pesticide use.**

Attitude and Work Habits

A professional attitude will help you to:

- **Respond quickly and properly to pesticide spills, other emergencies, and public inquiries.**
- **Make ‘educated’ and sound recommendations.**

Attitude and Work Habits

Practice professional work habits.

- **Apply pesticides according to label directions.**
- **Notify people who could be affected by an upcoming pesticide application (e.g., nearby residents, neighbours with known health issues, etc.).**
- **Avoid a pesticide application that might affect bystanders.**

Attitude and Work Habits

- Practice integrated pest management (IPM).
- Apply a pesticide only when the weather allows.
- Keep detailed pesticide application records.
- Practise safety at all times.
- Keep an up-to-date inventory of stored pesticides.
- Notify your local fire department of the location of any pesticide storage site.

Attitude and Work Habits

- Keep pesticide application equipment clean and in good working order.
- Use and maintain application equipment and vehicles in a safe and proper manner.
- Develop an emergency response plan to quickly and effectively respond to a pesticide spill or fire.
- Do follow-up inspections of all treatments.
- Immediately clean up any spilled pesticide.

Communication

- **Communication is key to a well-informed public.**
- **Public concern about pesticide use is steadily increasing. This is especially noticeable in the lawn care business as applications generally take place in urban areas.**

Communication

- Good communication can prevent misunderstandings and loss of public support.
- It is the responsibility of pesticide applicators to educate members of the public on IPM and their role in improving turf health.

Communication

To communicate effectively:

- Be honest, polite, and cooperative.
- Provide timely and accurate information.
- Respect public health and environmental concerns.
- Listen to public concerns and respect the viewpoints of others.

Communication

- Take part in industry-led communication efforts (e.g., mail-outs, forums, presentations).
- Provide solid facts and avoid less-than-honest statements.
- Develop client information brochures that are based on fact and science.
- Educate your clients regarding their role in a good IPM turf management program.

Legal Requirements

- There are legal requirements for buying, handling, and applying many pesticides.
- Federal, provincial, and municipal laws are designed to protect public health and the environment from pesticide misuse.
- These same laws can also work to protect an applicator.
- As a professional, you should be familiar with provincial legislation and municipal by-laws.

Reducing Bystander Exposure

Applying a pesticide in a residential area increases the risk of exposure to the public. To reduce exposure:

- Notify nearby property owners (legal requirement in PEI).
- Post the area at all access points (legal requirement in PEI).

- Apply a pesticide when traffic flow is reduced.
- Restrict access when treating public areas.

Communication with the Client

Prevent indirect exposure to humans or pets by advising your clients:

- When and where application is to take place.
- To remove toys and pet dishes.
- To cover all outdoor items (e.g., sandboxes, wading pools, play areas.)
- To keep children and pets out of treated areas until a liquid pesticide has dried or granules have dissolved.

Communication with the Client

You can demonstrate professionalism by:

- Determining client expectations. (What is an acceptable number of weeds?)
- Telling clients what an IPM program involves.
- Telling clients how they can be part of the IPM program (e.g., mulch mowing, proper watering and fertilizing, mechanical weeding, etc.).

Complaints

Public complaints and concerns regarding the use of pesticides are common. To reduce these complaints comply with provincial regulations by:

- **Notifying owners/residents of nearby properties before using a pesticide.**
- **Complying with label directions and provincial regulations (e.g., wind speeds, posting, etc.,).**
- **Using pesticides only as a last option.**

Complaints

**When you become aware of a complaint
it is in your best interest to:**

- Respond quickly and properly.
- Visit the affected area with the person who made the complaint and openly discuss their concerns.

Remember that you may be legally and financially liable for property (e.g., gardens, ornamentals, belongings) damaged as a result of an improper application of a pesticide.

Public Relations

A good relationship with the public will help to promote support for the turf management industry. To promote good public relations:

- Establish professional memberships.
- Practise good communication.
- Do hands-on work with the public and the media.
- Keep and freely share pesticide application records.