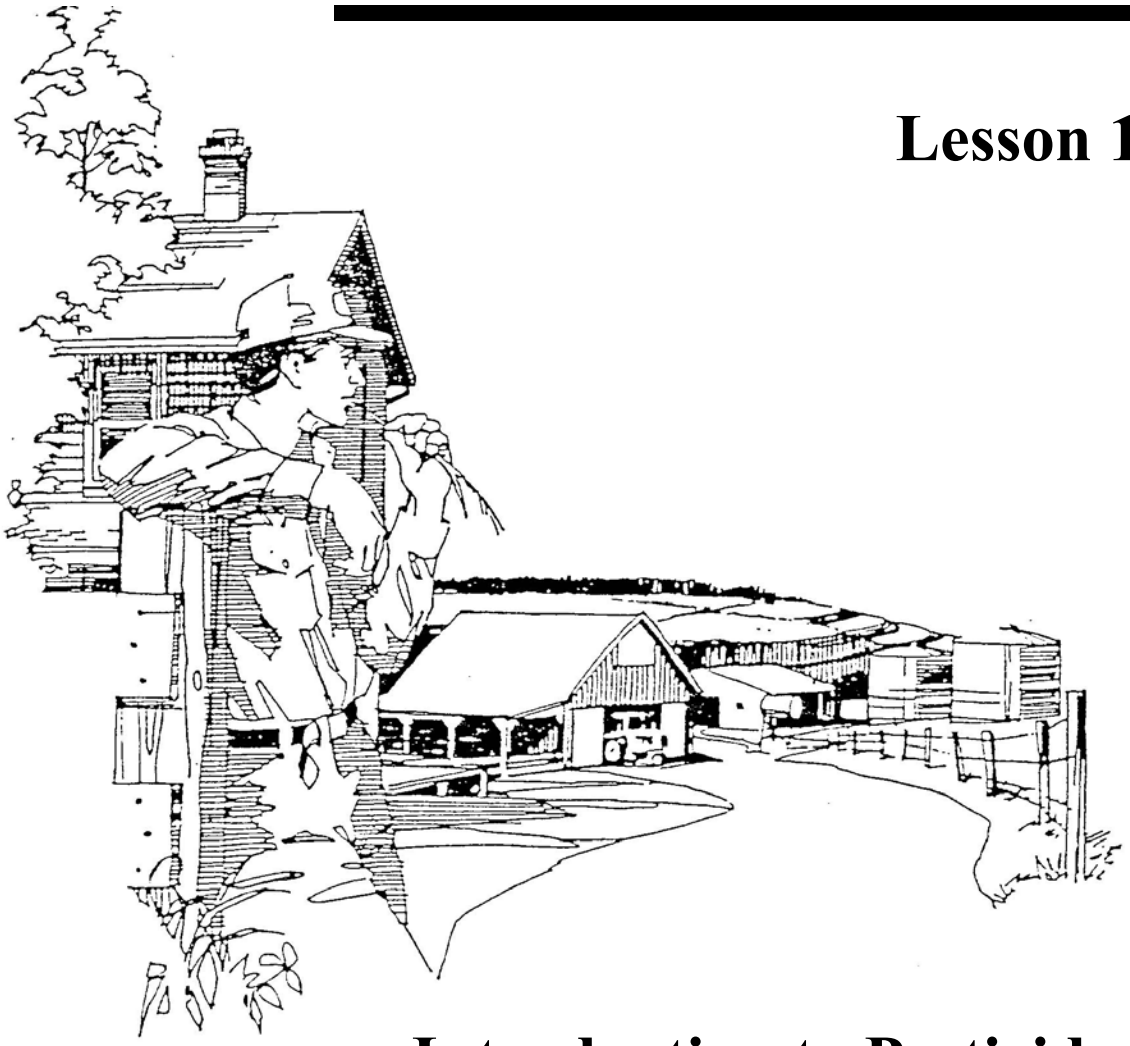
Pesticide Applicator Course for Agricultural Producers

Lesson 1



Introduction to Pesticides

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Lesson 1

Introduction to Pesticides

What You'll Learn!

The purpose of Lesson 1 is to make you aware of some of the terms and concepts you'll be using throughout the rest of the course. Specifically, the lesson covers the subjects of pesticide names, the classification of pesticides, and pesticide formulations.

By the time you complete this lesson you should be able to:

- **define the terms pest, pesticide, adjuvant, and active ingredient;**
- **list three ways of naming pesticides;**
- **list at least three ways of classifying pesticides;**
- **identify the types of pesticides used to control insects, diseases, mites, weeds, rodents, and slugs;**
- **name the different kinds of pesticide formulations and the correct abbreviations for each;**
- **describe one disadvantage of each type of formulation;**
- **describe one advantage of each type of formulation;**
- **explain the function of different kinds of adjuvants.**

You'll need to know all these things to qualify for certification.

Pesticide Names

A pest is any kind of living organism causing undesirable effects. Pests include organisms in the following groups:

fungi	**rodents**
weeds	**slugs and snails**
insects	**birds**
mites	**certain forms of wildlife (e.g., moose, rabbits)**

Examples of pests include unwanted potatoes in a cabbage crop, rapeseed in rutabagas, and rust fly in carrots. Some plants or animals may be desirable in one location and a pest in another.

A pesticide is any kind of material that is used to kill, control or manage pests. Pesticides include products used to manage the growth of plants (e.g., growth regulators).

There are three ways of naming pesticides:

- **by trade name**
- **by common name**
- **by chemical name**

Trade names refer to the names given to pesticide products by their manufacturers. They appear prominently on pesticide labels with the first letter or all letters capitalized. The product will usually be a mixture containing one or more active ingredients and several additives. Active ingredients are the chemicals which control the target pests. Additives are the ingredients included in a mixture to make the product safer, more effective, more convenient to handle, or easier to apply.

Common names refer to the names of the active ingredients in pesticide products. They appear on pesticide labels in lower-case letters, usually next to the word "Guarantee." The same active ingredient can be made into several different pesticide products.

Chemical names refer to the names of the chemical structures of the active ingredients in pesticide products. They do not usually appear on pesticide labels. Chemical names are not used in this course.

Below are several examples of pesticide products listed by their trade, common, and chemical names.

Trade Name	Common Name of Active Ingredient	Chemical Name of Active Ingredient
Round-up	glyphosate	N-(phosphonomethyl) (glycine)
Cygon 480, Lagon 2E, and Chipman Hopper-Spray EC	dimethoate	O,O-Dimethyl S-L (N-methyl-carbamoylmethyl) phosphoro-dithioate

Exercise 1.1

Take out a production guide that you commonly use in your pest management program. Turn to the contents page. Find the page listing the trade and common names of pesticide products.

As you look through the list you'll likely recognize the pesticides you commonly use in your own pest control practices.

In the space provided below, list three pesticides you regularly use, first by common name and then by trade name. An example has been provided.

Common Name	**Trade Name**
e.g., diazinon	**Basudin**
_____	_____
_____	_____
_____	_____

Once you've completed this exercise, please continue with the lesson.

Grouping Pesticides

Pesticides can be grouped in a number of different ways. Most commonly, they are grouped according to:

- **their target (the pests they control)**
- **their mode of action (the way they control the pest)**
- **their chemical structure**
- **their method of application**
- **the timing of their application**

The first three ways of grouping pesticides are explained in the following sections.

Grouping by Target

Pesticides are often grouped according to the pest they control. Here are some examples of pesticide groups classified by target pests.

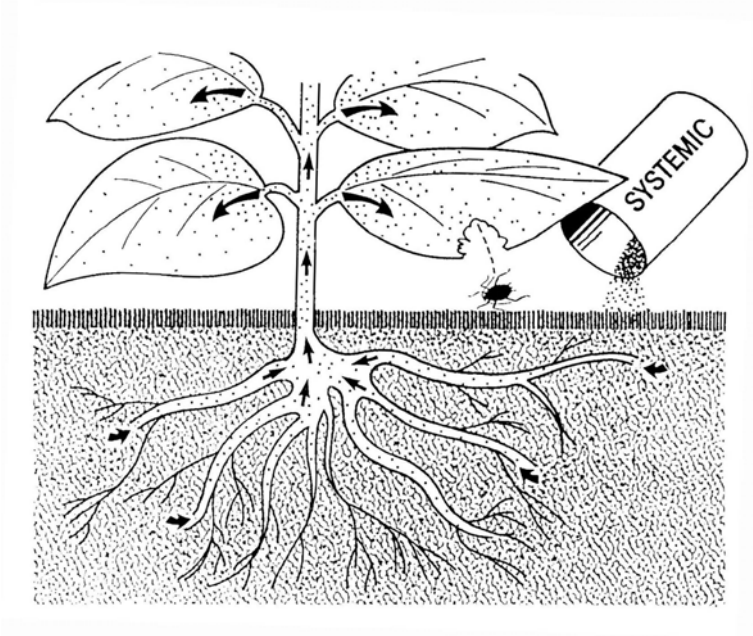
Pesticide	Target	Example
Fungicide	fungi (molds, mildews)	benomyl
Herbicide	weeds	2,4-D
Insecticide	insects	diazinon
Miticide or Acaricide	mites	propargite
Nematicide	nematodes (roundworms and hookworms)	oxamyl
Rodenticide	rodents	warfarin
Molluscicide	slugs and snails	metaldehyde
Avicide	birds	avitrol

Grouping by Mode of Action

Pesticides can also be grouped according to their mode of action - the way they enter or affect the target pest. Two examples of pesticide groups in this type of classification are contact pesticides and systemic pesticides.

Contact pesticides control their targets by direct contact. For example, weeds are killed when enough of their surface area has been covered with a contact herbicide. Insects may be killed when sprayed directly or when they crawl across surfaces sprayed with contact insecticides.

Systemic pesticides control their targets by being translocated in treated plants. Translocation is the process whereby a systemic pesticide moves through a treated plant. For example, some weeds receiving only partial spray coverage will be killed as a systemic herbicide moves within the plant to untreated areas of leaves, stems, or roots. Some insects may be killed as they feed on the juices which carry systemic insecticides through a plant.



Some systemic insecticides are transported through treated animals. For example, a systemic insecticide may be poured on the backs of beef cattle in order to control fly larvae within the body.

You'll learn more about contact and systemic pesticides in Lesson 10.

Grouping by Chemical Structure

A third way of grouping pesticides is by their chemical structure. Pesticides in the same chemical class or family have similar chemical structure and usually have a similar mode of action as well as similar poisoning symptoms, persistence, first aid, clean-up and safety guidelines.

Four chemical families are:

Chemical Family	Example
organophosphates	malathion
carbamates	carbofuran
triazines	atrazine
phenoxys	2,4-D

It is important to know if the pesticide you are using is an organophosphate or carbamate. This information will allow you to measure your exposure to such pesticides using a cholinesterase test. Refer to Lesson 5, Poisoning and First Aid, for more information.

Your production guide and other reference material may indicate which pesticides are organophosphates or carbamates.

Quiz 1.1

Below are a number of statements, each containing at least one blank. Fill in the blanks with the correct answers. The first statement has been completed for you.

1. **Three ways of naming pesticides are by trade name, by common name and by chemical name.**

2. **The common name of a pesticide refers to the _____ in the product.**

3. **Three ways of grouping pesticides are according to _____, _____, and _____.**

4. **A _____ is a pesticide used to control nematodes.**

5. **A miticide is used to control _____.**

6. **One way of grouping pesticides is according to the way they control pests. This is known as grouping by _____.**

7. **Contact pesticides control pests by _____.**

8. **Pesticides that are translocated in treated plants are known as _____.**

After completing the quiz, check your answers against those provided in the Answer Key at the end of the lesson. How did you do? Did you complete all or most of the statements correctly? If so, congratulations! If not, go back and review the section(s) covering what you need to know. Once you've completed your review, proceed to the next section of Lesson 1.

Pesticide Formulations

Pesticides are manufactured as formulations. A pesticide formulation is a mixture of active ingredients with other substances. These substances include carriers and adjuvants.

As you'll recall from earlier in this lesson, the active ingredient in a pesticide formulation is the chemical which actually does the job of controlling the pest. Active ingredients may be used to make different formulations. The type of formulation depends on the chemical structure of the active ingredient and its intended use.

Carriers are materials mixed with an active ingredient to make the product safer to handle, easier to apply or better suited for storage. Materials used as carriers include water, oil, solvents, talc, clay, walnut shells, or corn cob bits.

Adjuvants are added to pesticide formulations to increase their effectiveness. They are described later on in this lesson.

Types of Formulations

There are three main types of pesticide formulations: solids, liquids, and gases. Many pesticides are available in different types of formulations. Furthermore, solids, liquids, and gases can take several different forms. For example, solids include dust or powder, granules, and soluble powder, to name but a few.

The specific formulation of many pesticides is indicated by an abbreviation on the product label. Some of the most commonly used abbreviations are found in the following box.

D or DU	**Dust**
DF	**Dry flowable**
G or GR	**Granules**
P	**Pellets**
SG	**Soluble granules**
SP	**Soluble powder**
WP or W	**Wettable powder**
A	**Aerosol**
EC or E	**Emulsifiable concentrate**
F	**Flowable**
SC	**Sprayable concentrate**
SN	**Solution**

Advantages and Disadvantages of Formulations

On the next two pages of this lesson you'll find a chart listing some of the most commonly used pesticide formulations. The chart also describes each formulation, lists advantages and disadvantages, and suggests a typical use. After studying the chart, go on to Exercise 1.2. When selecting a formulation you should consider the following factors:

- **effectiveness**
- **risk to applicator**
- **potential exposure to non-target organisms**
- **possible target injury**
- **appropriate protective clothing and equipment**
- **cost of different formulations**

SUMMARY OF PESTICIDE FORMULATIONS				
Name	**Description**	**Advantages**	**Disadvantages**	**Typical Use**
SOLIDS:				
Dust (D or DU)	**Finely ground dry particles with a low concentration of a.i.* mixed in a carrier such as talc.**	**Ready to use.**	**Easily drifts to non-target areas. Very visible on plants. Easily inhaled.**	**Spot treatment for plants. Animal powder. Seed treatment.**
Granules (G or GR)	**Granular particles of dry carrier such as clay containing a low concentration of a.i.**	**Ready to use. Drift minimal.**	**Some dust produced during handling may be inhaled. May be eaten by birds.**	**Soil treatment for insect or weed control.**
Pellets (P)	**Like granules, but formed into spheres or cylinders.**	**Same as granules.**	**Some dust produced during handling may be inhaled.**	**Soil treatment for weed control.**
Bait	**A mixture of a.i. and edible carriers. Made as a pellet, meal, or liquid.**	**Easy to apply by hand.**	**Could be eaten by children, pets or wildlife.**	**Baits for insects, rodents, or slugs.**
Soluble Powder (SP)	**A dry powder which dissolves in water to make a spray solution. Higher concentration of a.i. than dust or granules.**	**Reasonable cost. Slower skin absorption than EC's. No agitation required after mixing.**	**Hazardous to applicator if dust inhaled.**	**Sprays mostly used for weed control.**
Wettable Powder (WP or W)	**Dry powder which forms a suspension in spray mix. Higher concentration of a.i. than dust or granules.**	**May cost less than liquids. Slower skin absorption than EC's.**	**Hazardous if inhaled. Dusty. Requires pre-mixing and constant agitation. Abrasive. Increases wear in nozzles and pumps. May clog screens and filters.**	**Sprays for insects, disease, and weed control.**
Dry flowable (DF)	**Like wettable powder but formulated as dry granules which form a suspension in spray mix. * a.i. = active ingredient**	**Less dusty than WP. Easier to pour and mix than WP. Less inhalation hazard.**	**Requires constant agitation. Abrasive. Increases wear on nozzles and pumps.**	**Sprays for insect, disease and weed control.**

SUMMARY OF PESTICIDE FORMULATIONS (continued)				
Name	**Description**	**Advantages**	**Disadvantages**	**Typical Use**
Liquids:				
Emulsifiable concentrate (EC or E)	**Contains a.i. petroleum solvent, and emulsifiers so it can be mixed with water.**	**High concentration of a.i. means less product to transport and store. Easily mixed. Non abrasive.**	**High concentration of a.i. increases mixing hazard. May cause leaf burn. May be easily absorbed through skin. May be flammable.**	**Sprays for insect, disease, and weed control.**
Flowable (F)	**Finely ground particles suspended in a liquid carrier. Forms suspension in spray mix like WP.**	**No dust. No pre-mix required.**	**Particles settle out during storage so needs agitation before pouring. spray mix needs constant agitation. abrasive.**	**Sprays for insect, disease, and weed control.**
Solution (SN)	**A.I. comes in a liquid. Forms a solution in spray mix.**	**High concentration of a.i. means less product to transport and store. Easily mixed. Non-abrasive.**	**High concentration of a.i. increases mixing hazard.**	**Sprays for weed control.**
Gases:				
Fumigants	**Volatile liquids or solids which release toxic gas when applied.**	**Toxic to many types and stages of pests. Good penetration of structures and soils under proper conditions.**	**Highly toxic. Treated area must be well sealed for good control.**	**Greenhouses, mushroom houses, granaries. Pre-plant soil treatment for hard-to-control pests. Fumigation of granaries and greenhouses.**

Exercise 1.2

In your own pest control practices you probably use a number of different pesticide formulations.

Beside the numbers below, list three formulations you use regularly. In the spaces provided below each name, write down the advantages and disadvantages of the formulation. Use the chart on the preceding pages to help you complete the exercise.

1._____

Advantages:

_____

_____

_____

Disadvantages:

_____

_____

_____

2._____

Advantages:

_____

_____

_____

Disadvantages:

_____

_____

_____

3._____

Advantages:

_____

_____

_____

Disadvantages:

_____

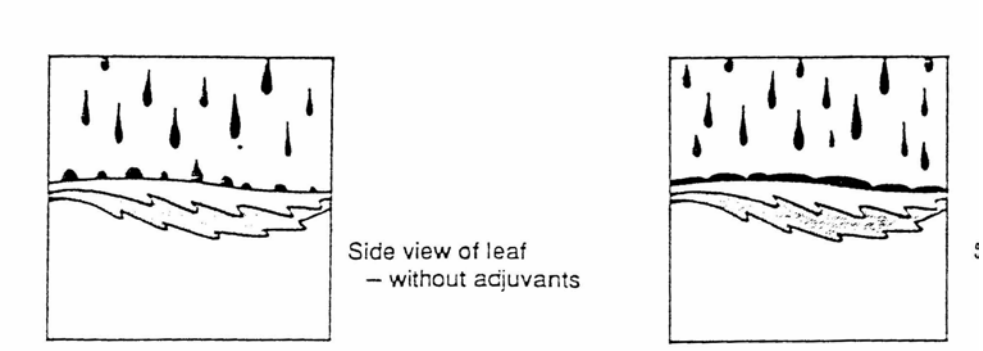
_____

_____

Once you've completed this exercise, please continue with the lesson.

Adjuvants

Adjuvants are added to pesticides in order to increase their effectiveness. They may help the pesticide spread more evenly to cover leaves or better penetrate the outer layer of a plant or insect. Adjuvants may also help the pesticide stick to a plant in such a way that it can be contacted by an insect.



Adjuvants may be included in the formulation by the manufacturer or added to the spray tank by the applicator. ***Never add adjuvants unless the product label specifically tells you to do so.***

Here is a list of some of the different kinds of adjuvants and what they do.

Adjuvants	Function
Wetting agents	**cause solutions or suspensions to make better contact with treated surfaces.**
Spreaders	**assist in the even distribution of the spray solution over the target.**
Stickers	**help the pesticide to stay on the plants or other surface.**
Thickeners	**reduce pesticide drift to other areas by increasing droplet size.**
Drift reducers	**reduce pesticide drift.**
Anti-foaming agents	**reduce foaming of spray mixtures that require vigorous agitation.**

Compatibility of Pesticides

Sometimes applicators mix two pesticides together to reduce application time. This should only be attempted if it is listed on the label. Label rates of individual pesticides may be different from rates for tank mixed product. The applicator assumes all risks associated with off-label tank mixes. This includes tank mixing pesticides and liquid fertilizers. Mixing of products not listed on the label result in the following problems:

- **loss of effectiveness of product**
- **crop damage**
- **settling out of solids**

Quiz 1.2

Below are a number of statements, each containing a single blank. Complete each statement by filling in the blank with the letter of the most appropriate answer from the Answer Box on the next page. The first statement has been completed for you.

1. **A pesticide formulation is __j__.**

2. **Pesticide formulations contain a substance which is mixed with active ingredients to make the product safer to handle, easier to apply or better suited for storage. These substances are called _____.**

3. **The abbreviation DF represents a type of formulation called _____.**

4. **The abbreviations EC or E represent a type of formulation called _____.**

5. **A formulation consisting of a mixture of active ingredients and edible carriers is known as _____.**

6. **A flowable formulation can be described as _____.**

7. **Wettable powders are typically used as _____.**

8. **One advantage of granular formulations is that they are _____.**

9. **One advantage of fumigant formulations is that they are _____.**

10. **One disadvantage of emulsifiable concentrate formulations is that _____.**

11. **An adjuvant is _____.**

12. **A thickener is an adjuvant which _____.**

13. **Adjuvants which reduce pesticide drift are called _____.**

14. **Adjuvants which assist in the even distribution of the spray solution over the target are called _____.**

15. **_____ are mixtures of different pesticides blended in the same spray tank.**

16. **Mixing of non-compatible pesticides can result in _____, _____ _____ and _____.**

Answer Box

a) stickers

b) reduces pesticide drift to other areas by increasing droplet size

c) sprays for insect, disease, and weed control

d) toxic to many types and stages of pests

e) tank mixes

f) bait

g) very visible on surfaces

h) a substance included in a pesticide formulation in order to increase its effectiveness

i) anti-foaming agents

j) a mixture of active ingredients with other substances

k) settling out of solids

l) spreaders

m) carriers

n) a dry material similar to dust or granules except it is soluble in water

o) drift reducers

p) crop damage

q) causes solutions or suspensions to make better contact with treated surfaces

r) the high concentration of active ingredients increases mixing hazard

s) loss of effectiveness

t) finely ground particles suspended in a liquid carrier

u) emulsifiable concentrate

v) soil treatment for insect or vegetation control

w) dry flowable

x) ready to use

Now check your answers against the Answer Key at the end of the lesson. If most of your answers are right you are ready to move on to Lesson 2. If not, go back and review the material and try again.

Looking Ahead

In Lesson 1 you have learned some terms and definitions which you will be using in the rest of the course. You have also learned different ways of naming and classifying pesticides. Lesson 2 explains the label on the pesticide container, and tells you how to use the information on it.

Answer Key

Quiz 1.1

1. **Three ways of naming pesticides are by trade name, by common name, and by chemical name.**

2. **The common name of a pesticide refers to the active ingredient in the product.**

3. **Three ways of grouping pesticides are according to their target, their mode of action, and chemical structure.**

4. **A nematicide is a pesticide used to control nematodes.**

5. **A miticide is used to control mites.**

6. **One way of grouping pesticides is according to the way they control pests. This is known as grouping by mode of action.**

7. **Contact pesticides control pests by direct contact.**

8. **Pesticides that are translocated in treated plants are known as systemic pesticides.**

Quiz 1.2

1. **A pesticide formulation is j) a mixture of active ingredients with other substances.**

2. **Pesticide formulations contain a substance which is mixed with active ingredients to make the product safer to handle, easier to apply, or better suited for storage. These substances are called m) carriers.**

3. **The abbreviation DF represents a type of formulation called s) dry flowable.**

4. **The abbreviations EC or E represent a type of formulation called e) emulsifiable concentrate.**

5. **A formulation consisting of a mixture of active ingredients and edible carriers is known as f) bait.**

6. A flowable formulation can be described as t) finely ground particles suspended in a liquid carrier.

7. Wettable powders are typically used as c) sprays for insect, disease, and weed control.

8. One advantage of granular formulations is that they are k) ready to use.

9. One advantage of fumigant formulations is that they are d) toxic to many types and stages of pests.

10. One disadvantage of emulsifiable concentrate formulations is that r) the high concentration of active ingredients increases mixing hazard.

11. An adjuvant is h) a substance included in a pesticide formulation in order to increase its effectiveness.

12. A thickener is an adjuvant which b)reduces pesticide drift to other areas by increasing droplet size.

13. Adjuvants which reduce pesticide drift are called o) drift reducers.

14. Adjuvants which assist in the even distribution of the spray solution over the target are called l) spreaders.

15. Tank mixes are mixtures of different pesticides blended in the same spray tank.

16. Mixing of non-compatible pesticides can result in crop damage, settling out of solids and loss of effectiveness.