CHAPTER 2

PESTICIDES AND THEIR USE FOR LIVESTOCK PEST MANAGEMENT

LEARNING OBJECTIVES:

After you finish studying this chapter, you should be able to:

- Differentiate between several pesticide chemistries registered for use on animals and the precautions necessary when handling or using them.
- Describe symptoms of animals when overexposed to different insecticide chemistries.
- Identify the factors to consider when choosing a formulation.
- Explain the various methods of pesticide applications and application equipment appropriate for animals and their environment.
- List the precautions necessary for safe pesticide applications on an animal or in its environment.
- Explain how and when pesticides may be incompatible.

PESTICIDES

Pesticides are substances or mixtures of substances intended to prevent, destroy, repel or manage pests. In addition, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) has extended the legal definition of a **pesticide** to include compounds intended for use as plant growth regulators, defoliants or desiccants, even though they are not normally used as pest management agents, and are usually not effective as such.

More specifically a pesticide may be defined as any chemical used to control pest populations directly or to prevent or reduce pest damage. Though the ending "cide" is derived from the Latin word cida, meaning "to kill," not all pesticides actually kill the target organism. For example, some fungicides may simply inhibit the growth of a fungus without killing it; attractants and repellents lure a pest to or divert it from a particular site.

The following chapters discuss a wide variety of insects, mites and ticks that afflict animals in agricultural settings. Activities or infestations by these pests can, in many cases, severely compromise the health and well-being of individual animals. Though insecticides (control insects) and acaricides (control arachnids) are not the only means for controlling or preventing these pests from becoming problems, they often play an important or even a key role. Sometimes, one must choose between insecticide applications and drug treatments to deal with insect pests that are true parasites.

Pesticides are a mixed blessing. For example, they contribute significantly to agricultural productivity and to improved public health by managing disease-carrying pests, but they can adversely affect people, nontarget organisms such as fish and wildlife, and the environment.

Before using insecticides, think about the components of an integrated pest management program (see Chapter 1). For insect, mite or tick pests of animals, this means developing management systems that employ the full range of physical and cultural methods available to manage the pests before insecticides are used. For example, in the case of filth fly (flies associated with poor sanitary conditions) problems in feed lot cattle areas, insecticides should not be used until good farm sanitation practices have been established. Removing manure and using good waste management practices help assure that flies will not reach levels that require insecticide use. Also,

purchasing animals from reputable breeders is a cultural preventive measure that may mean lice and mange mite infestations can be avoided or kept in check.

In another example, flea control for pet dogs or cats must include sanitation and control around the home to eliminate larval fleas and flea eggs. Fleas do occur in very clean houses, but sanitation is essential for a successful flea management program. Check the animal frequently, especially after it has been at a boarding or grooming facility or veterinarian's office. Other animals at these locations may spread fleas to non-infested animals. Typically, only after an infestation occurs should you consider insecticide use in the home or on the pet, and then only in conjunction with good sanitation practices. The exception may be when a pet has flea bite hypersensitivity. Treatment after a flea population has become established would be too late to avoid the animal's discomfort. In this case, insect growth inhibitor products may be effectively used to prevent a problem from becoming established.

In this chapter, you will learn about the types of pesticide chemistry, formulations, application methods and basic concepts of pest control on animals, and special concerns with pesticide use on and around animals. This knowledge will help you use pesticides safely and effectively. Refer to the *Pesticide Applicator Core Training Manual*, E-2195, Chapter 3, Pesticides, for a review of pesticide classification methods, formulations and chemistry.

CLASSES OF INSECTICIDES/ ACARICIDES USED IN LIVESTOCK PEST MANAGEMENT

Eleven chemical classes of insecticides and acaricides are used to control pests on or around animals.

1. **Chlorinated hydrocarbons**. This class includes lindane and methoxychlor. Lindane has become a restricted use pesticide for mange mites and lice.

Chlorinated hydrocarbons are easily absorbed through the skin and accumulate in the body. Overexposure can occur from excessive use. Common symptoms of animal chlorinated hydrocarbon poisoning may include hypersensitivity, spasms that begin with the eyelids and progress through the muscle masses toward the tail, loss of coordination, circling and abnormal posture, seizures, salivation, vomiting, coma and death. Continued low dose exposures can cause liver damage.

2. **Organophosphates (OP)**. An organophosphate is a synthetic organic pesticide containing carbon, hydrogen and phosphorus. If the product label bears chemical names containing "phosphoro" and recommendations to use atropine plus pralidoxime (2-PAM) as an antidote for poisoning, you can assume the product is an OP insecticide. Organophosphate compounds inhibit cholinesterase (see the Core manual, E-2195, Chapter 6, Pesticides and Human Health). Cholinesterase is a chemical catalyst (enzyme) found in mammals that helps regulate the activity of nerve impulses.

This class of pesticides includes a broad range of insecticides/acaricides such as chlorpyrifos, malathion, DDVP, ronnel, stiriphos and others. Organophosphates are effective against a wide range of insects including fleas and ticks. OPs are commercially available as ready-to-use insecticidal solutions, emulsifiable concentrates, dips, dusts, baits and flea collars.

These products range from acutely to mildly toxic to animals. The body has the ability to break these compounds down, usually in the first 24 hours. Though they are less likely to accumulate in the body than chlorinated hydrocarbons, organophosphates cannot be used in conjunction with one another because they can accumulate during a short period of time immediately following exposure. Find out whether the animal has been administered an oral, systemic OP. If so, do not treat with a topically applied OP. The two products can have a combined effect on cholinesterase activity.

Overexposure to OPs commonly causes such symptoms as increased salivation, inability to coordinate muscular movements (**ataxia**), frequent urination, vomiting, diarrhea, breathing difficulty (**dyspnea**), muscle weakness, tremors (shaking), convulsions, coma and death. The above symptoms are listed in order of severity. An animal may progress from mild symptoms to coma and death in a matter of minutes depending on the extent of the overexposure.

Onset of symptoms after excessive OP exposure usually occurs within hours but may be delayed up to two days. Severity and development of symptoms are influenced by the dosage and the route of exposure (dermal, oral, etc.). If poisoning from an OP is suspected, obtain immediate assistance from a veterinarian and provide them the label of the suspect insecticide. Atropine is the antidote for all levels of organophosphate poisonings.

A commonly reported organophosphate insecticide-related poisoning scenario among all animal types has been from dichlorvos (DDVP). Many

foggers contain DDVP in combination with other cholinesterase-inhibiting insecticides. Reading product labels and following all precautions and directions for use greatly reduces the chance of poisonings.

3. **Carbamates**. Carbamates are similar to organophosphates in activity—they inhibit cholinesterase. Carbaryl, propoxur and methomyl are carbamates. Animals have been the victims of carbamate poisoning by products labeled for use on sites other than on the animal. These include ant traps, products used for home insect control and agricultural products. Methomyl is particularly hazardous because of its inherent toxicity (LD_{50} of 17 mg/kg in test animals) and the apparent palatability of the sugar baits in which it is often formulated.

Carbamate poisoning is characterized by excessive salivation, tremors, vomiting, seizures, diarrhea and loss of muscle control. If you suspect carbamate poisoning, contact a veterinarian immediately. Be sure to provide the veterinarian with the label of the suspect insecticide. Atropine is the antidote. Victims of carbamate overexposure display similar symptoms as organophosphate poisonings, but they tend to recover, more completely and more rapidly. Carbamates may cause localized skin reactions on sensitive animals.

4. **Synthetic pyrethroids**. This class of insecticides/acaricides includes permethrin, resmethrin and allethrin. Often the formulations contain a **synergist** (something that enhances the effectiveness of the active ingredient) called piperonyl butoxide, or PBO. By itself, PBO is relatively nontoxic. The synthetic pyrethroids show properties of low mammalian toxicity but good activity against insects, ticks and mites. They do not appear to be readily absorbed through the skin.

Animals mildly affected by pyrethroids and those in the early stages of pyrethroid poisoning often display excessive salivation, vomiting, diarrhea, mild tremors, hyperexcitability or depression. These symptoms may be confused with symptoms of organophosphate or carbamate poisoning. More severely affected animals can have high fevers or lowered body temperature, difficulty breathing, severe tremors, disorientation and seizures. Death is due to respiratory failure. Generally, these signs begin within a few hours of exposure. In the case of excessive dermal exposure, bathe the animal using mild detergent and rinse repeatedly. Initial assessment of the animal's respiratory and cardiovascular condition is important. Further treatment requires veterinarian assistance.

5. **Botanicals**. Rotenone and pyrethrin are derived from plants. They may be synergized (increased activity) in certain formulations with PBO. With the exception of nicotine, plant-derived insecticides have shown low mammalian toxicity.

6. **Repellents**. Repellents, though not strictly insecticides, help prevent animal pest establishment. Diethyl-meta-toluamide (DEET), butoxypolypropylene glycol and dipropyl isocinchomeronate are repellents with activity against certain arthropods. Some formulations containing synthetic pyrethroids are repellents. There have been reported deaths of both cats and dogs after excessive exposure to DEET. The most common signs of poisoning include vomiting, tremors, ataxia and incoordination, hyperactivity, excessive salivation, depression, loss of appetite, seizures and breathing difficulty. Be watchful of possible overexposure symptoms when combining repellents with other pesticide treatments.

7. **Lime sulfur** (calcium polysulfide). Sulfur and lime-sulfur are two of the oldest insecticides. Lime-sulfur is an inorganic chemical option for lice control. Lime-sulfur may cause the animal irritation, discomfort or blistering, but it rarely causes death. If overexposure is suspected, bathe the animal to remove any residues and rinse repeatedly with clean water.

8. **Mineral oil**. Mineral oil is useful as a barrier against biting flies in ears of horses. It is also a diluent in some ear mite treatments that contain carbaryl.

9. **Amitraz**. Amitraz is a formamidine chemical with insecticidal and acaricidal properties.

10. **Insect growth regulators and hormone mimics**. This class of insecticides prevents immature insects from developing to the adult stage. Methoprene is formulated as a spray for flea control (eggs on animals, larvae in the environment). These chemicals simulate the activity of juvenile hormone, the hormone in insects that maintains immature characteristics in insects.

11. **Ivermectins**. The ivermectin/avermectin group of insecticides are labeled as drugs, and they often come into use for pest control on animals. Because they are drugs, most of them must be obtained and administered by a veterinarian for companion animal use. There are some over-the-counter formulations for horses available.

FORMULATIONS USED TO MANAGE ANIMAL PESTS

It is important to choose the formulation that is best for a particular job based on its effectiveness, cost, practicality, and relative safety to you, the animal being treated and the environment.

Insecticide and acaricide formulations vary widely and must be chosen to fit the particular situation. A high-pressure hydraulic sprayer is inappropriate for applying a flea shampoo to a sheep, to give one extreme example. Under certain conditions, the application method requires a particular formulation. Sometimes the formulation and application method are described by the same word (e.g., shampoo). Formulations used for animal pest management include:

1. **Ready to use (RTU)**. Ready-to-use formulations require no mixing or combining with other ingredients or diluents. They usually come in a container that serves as the application device, such as an aerosol can, pour-on bottle, roll-on, spot-on or spray bottle. These formulations tend to be the most expensive options because they are convenient and packaged for application. Because of their convenience and effectiveness, these formulations are being used instead of spray treatments to various sized animals. Ready-to-use products may include ointments or gels that help prevent fly bites.

2. **Wettable powders (WP)**. Wettable powders must be mixed with water before application. They are concentrates in solid, powdered form and can be sprayed after mixing.

3. **Emulsifiable concentrates (EC)**. Emulsifiable concentrates are liquids that must be mixed with water before application. They can be sprayed after mixing or sponged on the animal.

4. **Shampoo**. A shampoo is a formulation of insecticide and other ingredients that is applied to an animal's wet haircoat and worked into a lather. Label directions may indicate a length of time that the shampoo must remain on the animal to achieve effective pest control before being thoroughly rinsed. Shampoos should be pH balanced and labeled for use on the pet to be treated. Industrial shampoos and dish detergents are not acceptable products for use on small animals. Exercise all caution when applying pesticide products to debilitated animals (animals weakened by injury, illness or some other stress). These animals should be referred to a veterinarian for close observation during and after application.

5. **Dust**. A dust is a ready-to-use dry formulation. Protect the animal's and the applicator's eyes from the dust. Applicators must wear appropriate personal protective equipment to protect exposed skin, the respiratory tract and eyes.

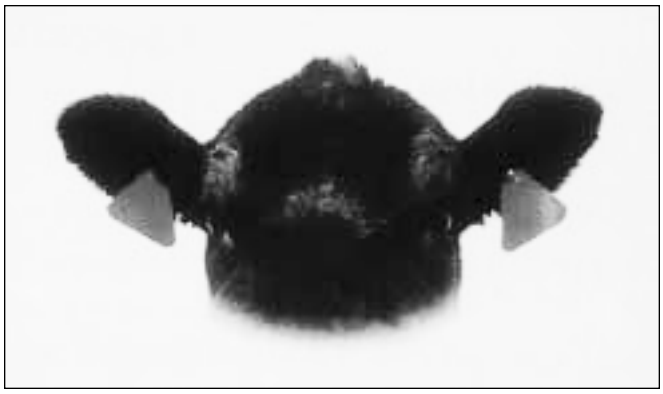
6. **Feed additive** or **bolus**. These formulations are mixed into salt blocks, with feed or, in the case of a bolus, fed directly to an animal.

Some insecticides are formulated into salt blocks.

7. **Ear tags, plastic strips** and **medallions**. Some insecticides and acaricides are formulated with plastics, such as ear tags and medallions, that are fixed to an animal and left attached for a time. Plastic straps, for instance, containing an insecticide can be fixed to horse halters for biting fly control. In these formulations, the insecticide moves from the plastic to the hair or coat of the animal.

8. **Pastes, liquids, powders, tablets/pellets** and **injectables**. These formulations are given orally or injected into animals to control internal parasites. Some products have restrictions, are regulated as drugs by the FDA, and may be purchased and administered only by licensed veterinarians.

9. **Baits**. Baits are either commercially prepared as dry granules or made as mixes of insecticides, sweeteners and water, as discussed in "Methods of Application" below.



Some pesticides are formulated into plastic ear tags that are attached to the animal. The pesticide in this formulation moves from the plastic to the hair or coat of the animal.

METHODS OF APPLICATION AND APPLICATION EQUIPMENT

The methods of application of insecticides/acaricides to animals or the animals' environment depend on the target pest, the formulation chosen and the number of animals or size of area to be treated. Sometimes the limiting factor will be the availability of application equipment or suitable facilities and helpers. For example, ear tags must be applied to individual cattle while they are in a head chute (used to isolate and immobilize the head temporarily). Applicators must wear all the protective equipment required on the pesticide label. Labels list minimum requirements. The applicator should use common sense and protect body areas that may be at risk of exposure. Waterproof aprons, gloves, boots and goggles are always a wise choice.

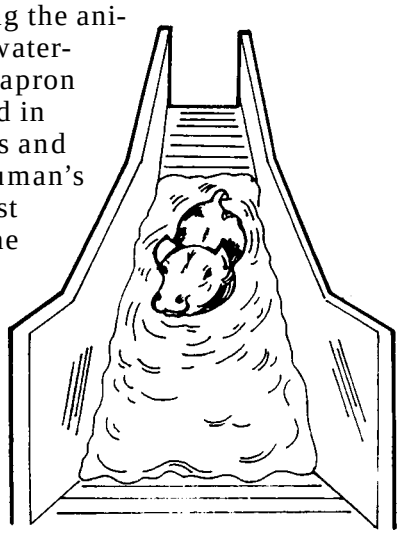
On premises, feedlots, housing barns, corrals, milk parlors, manure piles, poultry houses and other animal agricultural environments, several different methods of applying insecticides may be appropriate. Many involve using spray equipment or specialized tools for handling animals.

Always wear the appropriate personal protection equipment when making a pesticide application.

Dipping Vats

Dips are a method of applying insecticides to animals. Dipping vats are large tanks (vats) of liquid pesticide solutions used to treat livestock for external parasites. Portable dipping vats are usually trailer-mounted tanks with a set of folding ramps and railings. Livestock animals may be drawn through or placed in a vat of insecticide diluted to the correct label rate for the given animal size and species, and immersed to wet the entire body. Dips have been commonly used for sheep and cattle.

Dips may also be pour-on products that do not require total immersion of the animal. The product is poured on a specific region of the animal, such as along the backbone. Pour-ons are taking place of the dipping vat method of application because of convenience, lower worker exposure and the ability to treat the animal at the same time it is being vaccinated or handled for other reasons.



The person dipping the animal should wear a water- and chemical-proof apron and gloves. As noted in Chapter 6, Pesticides and Human Health, a human's groin area is the most absorptive part of the body and should be completely protected from pesticide exposure. Goggles can prevent splashing solution from entering the eyes. Always wear the minimum amount of personal protective equipment required on the label. It's okay to wear more.

Spray-dip Machines

Spray-dip machines have been used to treat livestock for external parasites. A spray-dip machine usually consists of a trailer-mounted chute with solid walls and gates at each end. The chute is located above a shallow tank and is equipped with several rows of large nozzles mounted so that they direct the spray mixture to thoroughly cover each animal. A large centrifugal pump supplies the pesticide to the nozzles. Surplus and runoff spray falls back into the tank, where it is filtered and recycled to the nozzles.

Face and Back Rubbers and Dust Bags

Some pesticides are applied through back rubbers. When the animal rubs against the apparatus the pesticide is transferred to their hair coat.

Some insecticides are applied to livestock for control of external parasites by self-applicator devices such as face and back rubbers, cables, ropes and dust bags. Back rubbers, cables and ropes are soaked with insecticide mixed with oil and hung over entrances and exits where the animals must pass. When the animal rubs against the device, the pesticide is transferred to the animal's face, back, sides or legs.

Dust bags filled with dust formulations are hung in similar areas for direct contact with passing animals. Animals can be dusted with the use of the shaker in which the product is packaged. The eyes of the animal and the applicator should be protected from dusts.

Dust Boxes

Dust boxes are used mainly in raised wire battery-type cages for laying hens or other poultry. These boxes contain a pesticide dust used to control poultry pests, usually mites. Birds wallow in the boxes and pick up the dust on their feathers and skin. Dust boxes may also be used when 20 to 30 birds are in pens on the floor.

Bait Application Equipment

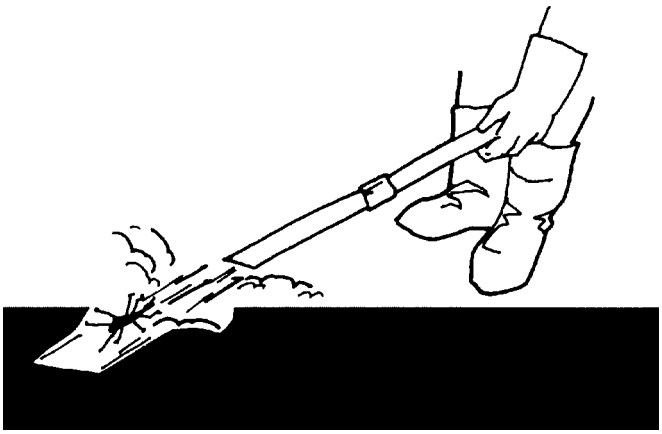
Bait stations hold pesticide-treated food that attracts target pests. They are used for insect control around poultry and livestock housing and for vertebrate control around crops, commodities and agricultural buildings.

An insecticidal **bait** can be purchased ready to use (generally dry, as granules) or can be mixed. Baits can be established at bait stations that lure the pest toward the insecticide source. Some fly baits contain attractants to draw flies in, such as muscamone. Some fly baits are made by mixing sugar, corn syrup or molasses with water and insecticide and then applied as a slurry with a brush to surfaces in confined settings. Caution: Do not apply this sweet mixture where animals can lick it from treated surfaces. This includes companion animals that may frequent the same areas.

Applications to the Animal's Surroundings

A **premise spray** is an insecticide application that will persist on the surfaces in an animal's living area for a period of time. The length of residual depends on the insecticide used rather than the method of application. Pest insects, such as filth flies or fleas, contact these surfaces, encounter the insecticide and die. The spray is intended to offer a few days to a few weeks of control. Remove all livestock before applying a residual spray. Avoid exposing hay bales or other feed to pesticides and cover all drinking cups. Do not apply a residual spray in a milkroom.

An **area spray** or **space spray** does not involve an insecticide with long residual qualities. Instead, the spray, aerosol or fog kills the insects in the area at the time of the application. Thus, a space spray is much more temporary than a premise spray.



A space spray may involve **ultra-low volume** equipment—small droplets of insecticide are sprayed at a low rate of application into the space. An example would be the use of a fogger in a milking parlor.

Hand-held, electrically operated mist foggers are satisfactory for space applications of insecticides. They are used primarily for fly control (knockdown). Mist foggers produce a coarse mist, deliver 4 to 5 gallons of spray mixture per hour and project a horizontal airblast 15 to 20 feet.

These sprayers are not to be confused with thermal foggers that generate an insecticidal smoke by heating the spray mixture.

Pesticide dosage depends upon the length of time the spray mist is directed toward the animal or area. To calibrate a fogger, first determine the maximum number of ounces of insecticide released per minute then calculate the time in seconds necessary to apply the proper dosage.

In general, use and care for a mist foggers as you would a sprayer. They do require several special precautions, however:

- Be sure that the pesticides used in the aerosol and fog generators are registered for that use.
- Keep the pesticides on the target.
- Because aerosol and fog formulations are easily affected by weather conditions during application, follow special use instructions.
- The operator, other people and animals should stay out of the fog or smoke cloud.

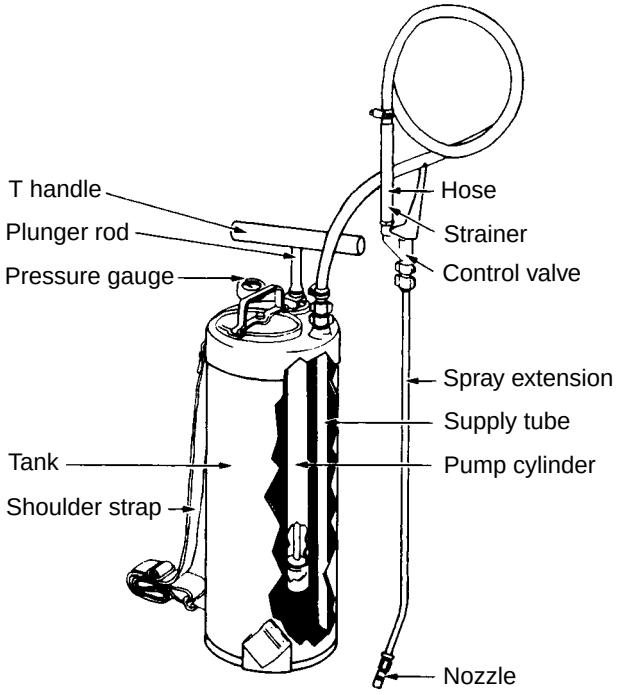
Applying insecticides or acaricides onto animals can be done in a variety of ways. Coarse sprays are applied directly to animals. With hand-pumped or mechanically pressurized equipment, a coarse spray of the label rate of insecticide is applied to the animals. Certain coarse sprays, for example those used for control of mange mites on swine or lice on cattle, must have sufficient pressure to thoroughly penetrate the hair and wet the skin.

Hand Sprayers

Hand sprayers are often used to apply small quantities of pesticides. They can be used in structures or outside for spot treatments or in hard-to-reach areas. Most operate on compressed air supplied by a hand pump.

Compressed air sprayer — This is usually a hand-carried sprayer that operates under pressure created by a self-contained manual pump. The air in the tank is compressed by the pump. The compressed air forces liquid pesticide through the hose and nozzle whenever the control valve is opened. Capacity is usually 1/2 gallon to 3 gallons.

Bucket or trombone sprayer — These sprayers involve a double-action hydraulic pump operated with a push-pull motion. The pesticide is sucked into the cylinder and pushed out through the hose and nozzle with the return stroke. Pressures up to 150 psi can be generated. The separate tank often consists of a bucket with a capacity of 5 gallons or less.



Hand Can Sprayer

Backpack (knapsack) sprayer — One type of backpack sprayer is a compressed air sprayer with a harness that allows it to be carried on the operator's back. Some of these sprayers can generate pressures of 100 pounds per square inch (psi) or more. Capacity of these types of backpack sprayers is usually 5 gallons or less.

Wheelbarrow sprayer — Wheelbarrow sprayers are similar to backpack sprayers but have a larger tank and longer hose line. The tank is mounted on a wheeled cart for easy transport. The capacity of these sprayers is usually less than 25 gallons.

Small Motorized Sprayers

Some small sprayers have all the components of larger field sprayers but usually are not self-propelled. They may be mounted on wheels so they can be pulled manually, mounted on a small trailer for pulling behind a small tractor, or skid-mounted for carrying on a small truck. They may be low-pressure or high-pressure, according to the pump and other components with which they are equipped. Standard equipment includes a hose and an adjustable nozzle on a handgun. Some models have multi-nozzle booms.

Advantages:

- Larger capacity than hand sprayers.
- Low- and high-pressure capability.
- Built-in hydraulic agitation.
- Small enough for limited spaces.

Limitations:

- Not suitable for large jobs.

Estate sprayers — These sprayers are mounted on a two-wheel cart with handles for pushing. Trailer hitches are available for towing the units. Spray material is hydraulically agitated. Some models have 15- to 30-gallon tanks. Pumps deliver 1 1/2 to 3 gallons per minute at pressures up to 250 psi. Larger models have 50-gallon tanks and pumps that deliver 3 to 4 gallons per minute at pressures up to 400 psi. Power is supplied by an air-cooled engine of up to 5 horsepower.

Power backpack sprayer — This backpack-type sprayer has a small gasoline powered engine. The engine drives the pump, which forces the liquid pesticide from the tank through a hose and one or more nozzles. The engine also drives air blowers, which help propel the spray droplets. This model can generate high pressure and is best suited for low-volume applications of dilute or concentrated pesticide.

Power wheelbarrow sprayer — This sprayer, like the manually operated wheelbarrow sprayer, has a tank mounted on a wheel for easy transport. It may deliver up to 3 gallons per minute and can develop pressures up to 250 psi. The 1 1/2 to 3-horsepower engine is usually air-cooled. The tank size ranges from 12 to 18 gallons. The spray mixture may be either mechanically or hydraulically agitated.

Large Power-driven Sprayers (High Pressure)

These sprayers are used to spray through dense foliage or thick animal hair and into areas where high-pressure sprays are necessary for adequate penetration and reach. Often called hydraulic sprayers, they are equipped to deliver large volumes of spray — usually 20 to 500 gallons per acre — under pressures ranging from 150 to 400 psi or more. Piston pumps are used and provide outputs up to 60 gallons or more per minute. Large tanks (500 to 1,000 gallons) are required because of the high application rate per area. Mechanical agitators are usually standard equipment, but hydraulic agitators may be used. High-pressure sprayers may be equipped with a hose and single handgun nozzle for use in spraying animals.

Advantages:

- Provide good penetration and coverage of animal hair.
- Usually well built and long lasting if given proper care.

Limitations:

- Large amounts of water, power and fuel needed.
- High pressure may produce fine droplets that drift easily.

Pour-ons and Spot-ons

Pour-ons and spot-ons are high-concentrate, low-volume formulations applied directly to animals. They offer a quick and simple method of applying insecticides to livestock. The solutions, either an oil or emulsion formulation, are applied with a calibrated dipper along the back of the animal at an even rate. Pour-ons were originally developed for application of systemic insecticides for cattle grub control but are being used for some non-systemic formulations. Because of convenience, reduced applicator exposure and their efficacy, these types of applications are the becoming the most frequently used application method, replacing the dipping vat and spraying methods.

Like the pour-on method, spot-ons allow for the direct application of a measured amount of insecticide to the back of the animal. Spot-ons are applied as concentrates so considerably less material is needed. Because of the toxicity of the products, spot-ons are typically applied by a veterinarian. These products may require that the animal be completely dried after application before it contacts humans or other animals.

Wipes are also used as direct applications to animals—cloths or sponges are saturated with the pesticide and used to wipe the animal. With pour-ons, spot-ons and wipes, the rate of application is determined by the size and weight of the animal.

The ease of using pour-on formulations is contributing to this becoming the most common application technique.

Ear tags, plastic strips, collars and **medallions**, though technically formulations as described above, are also methods of application. These formulations come ready to use and are applied by fastening them to the animal or, in the case of plastic strips, in the animals environment. They offer long-term release of insecticide or acaricide onto the animal.

Feeding insecticides to animals can be accomplished with feed additives or boluses, salt blocks, or drugs prescribed by or obtained from veterinarians. Of course, only those insecticides labeled for oral delivery can be provided in this manner. Some of the insecticides control pests on the animal while others are intended to pass through the digestive systems of the animal to be deposited in manure for fly maggot control.

PESTICIDE USE AROUND ANIMALS

Pesticide use on animals or in their environment must be done with the safety of the animals and the applicator in mind. Remember that insecticides and acaricides are toxic not only to the target pest but also to the animals at certain doses. Thus, the dose-response relationship of the insecticide and the targeted animal must be considered. The accurate weight of the animal must be determined to dilute and apply the appropriate rate of pesticide.

Many insecticides are labeled with restrictions and are not to be used on animals of certain ages (especially young ones), in certain reproductive states (pregnancy, nursing), or on certain breeds. Also, use extreme caution or avoid using pesticides on animals just before or just after surgery. The product may interact with the anesthesia.

Apply all insecticides with extreme care. Never apply insecticides to the eyes, nostrils or mouth. When treating animals using a spray, the applicator should wear appropriate protective gear and shield his/her eyes and those of the animal. It is standard practice to apply an ophthalmic (eye) ointment to protect small animals' eyes before dipping, spraying or shampooing. Ointments must be labelled for use in the eye. Petroleum jellies are not an acceptable substitute for ophthalmic ointment. Be sure not to contaminate ointments. Handle carefully and wash your hands between animal treatments.

Insecticides must be applied at the rates and with the application methods described on the label. Labels also usually state to avoid testicle and vulva areas as well as mammary gland areas if the animal is nursing young.

When applying certain insecticides or acaricides on animals, the intent is to create a residual of systemic insecticide in the body tissues of the animal. These insecticides are used in ways that do not differ greatly from the way drugs are used for animal health. In such cases, there may be dose limits established in relation to the weight of the animal. Thus, only a certain amount of insecticide per unit of body weight can be applied at any one time. Accurately determining the animal's body weight is critical for issuing the correct dosage.

When using systemic insecticides or some other insecticides on animals used for meat or dairy products, restrictions often apply with regard to when slaughtering can occur or how long dairy animals should be held from milking. These restrictions are called treatment-slaughter intervals and milk withholding times. These restrictions are listed on the label. No residual insecticide should occur in meat or milk when these label restrictions are followed.

Many kinds of pesticides are commercially available. Though different products may have the same active ingredient, the formulations can vary greatly. The result may be that one product is safe for animal applications and others are deadly. **Use only products specifically labeled for use on animals or in animal surroundings**. Consult with experts such as veterinarians, licensed veterinary technicians, Extension specialists or product representatives for help in selecting the best product for your situation. The experts can provide you with information to help make your decision and support your action in the most economical manner. When selecting an insecticide, the label is a primary source of information. Labels often include package inserts. If the label does not allow the use or method of application you intend to use on the animal, then that insecticide formulation cannot be used. When several product choices are available, consider the type of and percent of active ingredient, formulation, equipment required to make the application, any treatment-slaughter or milk withholding intervals and requirements for retreatment.

In general, observe the following guidelines for insecticide use on or around animals:

1. Use only products labeled for use on animals or in animal environments.

2. Do not exceed label dosages; measure carefully and know the animals's exact weight.

3. Read labels before using and follow all instructions.

4. Provide adequate ventilation while using pesticides (remove animals from buildings if it is an area or premise spray).

5. Prevent drift or drainage to adjacent cropland, yards, woodlots, lakes or ponds. (Some insecticides may severely harm fish and wildlife.)

6. Avoid treatment of animals that are sick, overheated or stressed (such as after shipping, surgery or heartworm treatment, or recently weaned).

7. If available, use a dust formulation instead of sprays on outdoor animals on cold winter days.

8. Avoid contaminating feed (feeders and/or feed in storage) and water (including waterers, wells and reservoirs). See Chapter 8, Safe Pesticide Handling, in the Core manual, E-2195.

9. Use all appropriate personal protective equipment during applications of any pesticide.

10. Do not add new insecticides to old, previously used dipping water. Start with fresh water.

11. Avoid using pesticides when an animal has been, will be or is anesthetized.

12. Keep records of pesticide applications. See Chapter two, Laws and Regulations, in the Core manual, E-2195.

13. Always store and dispose of pesticide containers according to label directions.

COMPATIBILITY of PESTICIDES

In some situations, applicators may attempt to manage more than one pest with a single application by combining pesticides. Such a practice can create problems, sometimes more serious and costly than applying the chemicals alone. Product mixing requires extensive knowledge of pesticide formulations, timing of application and application techniques.

The important issue is to determine the compatibility of the products involved. In simple terms, we are concerned about whether the mixtures can be used in combination without reducing the safety and effectiveness of the compounds. Before combining any pesticides, check labels, product information sheets, company representatives or Extension agents for information on compatibility of the products in question.

Below are important areas of incompatibility to consider before attempting to mix products.

Host Tolerance

As mentioned, problems can arise when more than one organophosphate is applied to an animal at any one time, or when a residual is still present from a previously applied dose. Never use more than one OP insecticide on an animal. The combined effects of the OPs may cause irreversible damage to the animal or even kill it. Also, some animals are more sensitive to certain products than others. Always read the label before applying a pesticide on an animal.

Physical Incompatibility

Physical incompatibility occurs when two or more pesticides are mixed together and the result is an unsprayable mixture because of excessive foaming, curdling or a gummy deposit. Hard water and cold water also can cause some physical incompatibilities.

Chemical Incompatibility

This type of incompatibility occurs when mixing pesticides reduces or destroys the effectiveness of one or all of the compounds. This happens frequently when materials with a high pH are added to the mixture. Chemical incompatibility is not evident in the spray tank but becomes apparent when the application fails to control the target pest adequately.

Timing Incompatibility

Pesticides must be applied when the pest is at a vulnerable stage of development. With many insects, diseases or weeds, this may be a relatively short period. Timing is important when using two or more chemicals to manage more than one pest. Failing to apply the mixture at the correct time in the pests' life cycles renders the mixture ineffective.

This has been a brief summary of pesticide compatibility problems. Remember, never assume that pesticides can be mixed together unless the combination is specifically indicated on a product label. If recommendations for use are not given on the label, the products in the mix must be applied at a rate not to exceed the label directions for use of any component product applied alone for the same purpose. Many product labels have toll-free numbers. Call with any questions you may have before using a product.

Chapter 2 – Review Questions

Write the answers to the following questions and then check your answers with those in the back of this manual.

1. A pesticide is a chemical that:
   a. manages only insects and vertebrates.
   b. directly controls pest populations.
   c. prevents or reduces pest damage.
   d. only a certified applicator may apply.
   e. b and c.

2. Pesticides with chlorinated hydrocarbon chemistry are not recommended for use on animals. (True or False)

3. If a product label bears chemical names containing "phosphoro" and recommends the use of atropine plus 2-PAM as an antidote for poisoning, you can assume the product is a(n):
   a. Chlorinated hydrocarbon.
   b. Organophosphate.
   c. Pyrethroid.
   d. Carbamate.
   e. Insect growth regulator.

4. What are the symptoms that an animal may exhibit as a result of overexposure to an organophosphate pesticide?

5. Which two types of pesticide chemistry inhibit cholinesterase? What types of pests do these pesticides control?

6. If an animal is overexposed, it can be killed by pesticide products even though the products are labeled for use on animals. (True or False)

7. If an animal is dermally overexposed to a synthetic pyrethroid, what action should you take?
   a. Bathe the animal with mild detergent and rinse it repeatedly.
   b. Give the animal atropine.
   c. Give the animal atropine plus 2-PAM.
   d. Keep it cool and give it water.

8. Protectants are pesticides applied to manage pests by rendering them incapable of normal reproduction. (True or False)

9. What might you use for protection against biting flies on the ears of horses that can also serve as a diluent for ear mite treatments?
   a. Lime sulfur
   b. Amitraz
   c. Ivermectin
   d. Mineral oil

10. Which of the following are synthetic organic pesticides?

    a. Chlorinated hydrocarbons.

    b. Organophosphates.

    c. Carbamates.

    d. Synthetic pyrethroids.

    e. All of the above.

11. Some insecticides are formulated as feed additives and are given to the animal as part of their food rations. (True or False)

12. Explain the difference between a premise spray and an area or space spray.

13. Which of the following are self-application techniques used for livestock treatments?

    a. Back rubbers.

    b. Dips.

    c. Ear tags.

    d. Spot-ons.

14. When choosing among several insecticide products, what are some of the things that must be considered?

15. List three types of pesticide incompatibility, and give a brief definition of each.

    1.

    2.

    3.