AGRICULTURAL ANIMAL PEST MANAGEMENT

Study Guide for Pesticide Application and Safety
Category 1.b.

Utah Department of Agriculture and Food
Division of Plant Industry
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STUDY GUIDE FOR AGRICULTURAL ANIMAL PEST MANAGEMENT

The educational material in this study guide is provided to assist pesticide applicators in preparing for the Agricultural Animal category examination. This guide does not include all of the information needed for the examination. Other topics that are covered on the examination include understanding and following pesticide label directions, emergency response, personal protective equipment (PPE), pesticide movement, mixing and handling pesticides, and additional application methods and equipment. Information on these and other topics can be found in the ***National Pesticide Applicator Certification Core Manual,*** published by the National Association of State Departments of Agriculture Research Foundation.

This book and the core manual can be obtained from the Utah Department of Agriculture and Food (UDAF). Please contact your local UDAF Compliance Specialist or the state office in Salt Lake City. The UDAF telephone number is 1.801.538.7185 and the web site for the UDAF Division of Plant Industry is <http://www.ag.state.ut.us/plantind/pest_app.html>.

The organizations involved in the preparation of this study guide were the Utah Department of Transportation, the Utah Department of Agriculture and Food, and Utah State University Extension. This study guide was originally based on one published by the Colorado Department of Agriculture. Materials for that guide were based on information developed by Extension personnel in the states of Colorado, California, Illinois, and Georgia.

The material and recommendations presented in this study guide are based on information believed to be correct. No endorsement, guarantee, or warranty of any kind, expressed or implied is made with respect to the information contained herein. When working with pesticides, follow the directions provided on the product label.

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I. INTRODUCTION

STUDY GUIDE

The agricultural animal pesticide study guide provides basic information that applicators of restricted use pesticides (RUPs) need to meet the minimum federal and state standards for certification and recertification. The standards are set by the U.S. Environmental Protection Agency (EPA) and the Utah Department of Agriculture and Food (UDAF) in line with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) as amended, and the Utah Pesticide Control Act.

Pesticide handlers who are licensed in the agricultural animal category include farmers with livestock or poultry, ranchers, feedlot owners and operators, and other individuals who treat living agricultural animals, including horses, with restricted use pesticides.

Agricultural animals are attacked by mites and ticks, insects, and animal predators. These various parasites and predators are of great economic importance to Utah agriculture and they cause losses amounting to millions of dollars annually. These pests affect agricultural productivity by causing death to animals, spreading disease agents, causing loss of blood, causing physical damage to animals or animal products, reducing weight gains, reducing milk and egg production, and in a number of other ways that lower the quality, value, and/or appearance of animals.

This study guide deals with some of the major pests of agricultural animals that are commonly controlled with pesticides and is not intended as a complete text on this important subject.

PESTICIDE PERSPECTIVE

Humans depend on living things to provide the essentials for survival. Destructive pests make the efficient production of these necessities very difficult. Other pest organisms constitute a threat to the health and comfort of people. Such pests must be managed to protect desirable plants and animals.

Plants or animals may be identified as a pest if they appear in unwanted places or their numbers are too great. For example, a weed is a plant growing where it is not wanted. In this context, a corn plant in a lawn is a weed and a rose in a cornfield is a weed. Some animals have been domesticated and provide humans with food and fiber. Other animals provide recreation through human interaction, but if these animals are destructive or carry diseases then they are pests.

There are beneficial birds that eat destructive insects and many provide aesthetic enjoyment. Other birds because of their population numbers and/or excessive noise are regarded as public nuisances. Some insects destroy crops or transmit diseases, while others pollinate plants or serve as parasites or predators of undesirable insects. In general, those plants or animals that conflict with the immediate or long term needs and desires of humans are regarded as pests.

Chemical pesticides are commonly used to control pests. The goal of a pesticide application is to effectively manage the pest without threatening the safety of humans and the environment. Instances of inappropriate use or over application have resulted in the banning or limited availability of some pesticides. In some instances past mistakes have resulted in the development of better pesticides that are safer to use.

Using pesticides often means the difference between profit and loss. The use of pesticides has become almost indispensable to modern agriculture and to the consumer of agricultural products who expects agricultural products to be readily available at the market.

There is no indication that pesticides will be eliminated and they continue to be the most effective defense against pests. It is important that researchers continue to investigate the effects of pesticides on humans and the environment. There are numerous well funded groups concerned about environmental protection that will continue to publicly resist the use and misuse of pesticides.

Where safety concerns occur relative to the use of a pesticide, the advantages must outweigh the disadvantages for a pesticide's continued use. Such decisions require objective evaluation. At present, the safest way to use a pesticide is to assure that applicators and handlers carefully adhere to label instructions and apply pesticides only when appropriate.

Concern about the environment has added considerable stimulus to the development of pest management techniques that reduce the need for pesticides. The challenge is to accomplish pesticide use reduction without lowering yields or quality. This goal has been accomplished in a few instances

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PESTICIDES AND THE ENVIRONMENT

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Both the beneficial and harmful effects of pesticides are determined by how pesticides and the environment react to each other. To be effective a pesticide must normally penetrate the pest, move or be transported to the site of action, and there disrupt or alter a vital function of the pest. The manner in which the pesticide affects the vital function is called its mode of action. Penetration, transport, and mode of action involve interactions between the pesticide and the pest.

Interactions are also involved in the metabolism, accumulation, and elimination of pesticides by the pest, as well as in the biodegradation and biological magnification of pesticides. In addition, the ability of pesticides to kill or otherwise alter one pest, while not affecting another, and/or the pest's ability to develop a resistance to pesticides are dependent on differences in the interaction between pesticides and pests.

***D**ichloro-**d**iphenyl-**t**richloroethane* or DDT as it is better known is one example of how pesticide perceptions have changed throughout the history of their use. DDT and other persistent chlorinated hydrocarbons formed the basis for much of today's public awareness and the legislative action that controls current pesticide use.

DDT was the most well known organic insecticide and most widely used chemical for the control mosquitoes responsible for malaria, typhus, and other insect borne diseases. Today it is banned from use in the US. It is still manufactured and continues to be used to battle mosquitoes in other parts of the world.

PESTICIDE MONITORING

Pesticides are monitored in the environment by the EPA, FDA, and USDA. The monitoring program includes fish, shellfish, wildlife, water, soil, food, and humans. In addition to the federal program, considerable monitoring is also done by state agencies, scientists from universities, and the chemical industry.

Extensive monitoring indicates that only a limited number of pesticides are generally found in environmental samples such as soil, water, air, and wildlife. However, articles written about pesticides in the environment often generalize about their occurrence, giving the false impression that all pesticides are involved.

Careful reading of these articles will usually reveal that they are based on studies involving DDT or another of the more persistent chlorinated hydrocarbon insecticides. The only samples that commonly contain pesticides are food crops that have been treated with these materials. These generally occur at levels below tolerance limits set

by EPA. Pesticide monitoring studies must be interpreted carefully, especially when dealing with amounts in parts per billion or parts per trillion.
The use of gas liquid chromatography and mass spectrometry has made possible the detection of extremely small amounts of some chemicals. However, identification of these chemicals is by no means certain unless confirmatory techniques are employed. This may be very hard and perhaps impossible at such low levels unless large samples are used. Also, at these levels it may not be possible to rule out accidental contamination of the sample, either at the time of collection, during storage, or in the analytical process.

The importance of confirming the identity of pesticides was illustrated recently when two chlorinated hydrocarbon insecticides, dieldrin and heptachlor, were apparently discovered in soil that had been collected and sealed in jars between 1909 and 1911, long before these chemicals had even been synthesized. Efforts to confirm the identity of these chemicals proved they were not pesticides but apparently naturally occurring constituents of the soil.

There is also evidence that polychlorinated biphenyls (PCBs) have been erroneously reported as DDT in environmental samples. Apparently PCBs, which were used in a variety of products ranging from plastics to industrial coolants, are widespread in the environment and can easily be mistaken for DDT if proper analytical procedures are not followed.

PESTICIDES IN WATER

Pesticides may enter water in several ways, including fallout from the atmosphere, drift from nearby applications, and movement from treated land by means of soil particles or runoff water. They may also be applied directly to water, either purposely or accidentally. Although quantitative information on the importance of these sources of contamination is limited, it seems likely that treated soil is the principal factor involved.

Most pesticides found in the environment are often bound tightly to soil particles or organic matter in the soil and are not readily soluble in water. These particles can move long distances by wind and water, so it is not surprising that pesticides are sometimes found far removed from the site of application. Although agricultural lands contribute to pesticide contamination of water, some of this pollution originates from urban areas where pesticides are used in the home and garden.

Some of the contamination of the Great Lakes with DDT has been traced to city sewers. Pesticide contamination in the Red Cedar River in Michigan is reported to come mostly from waste water treatment plants, even though the river runs through areas of extensive agricultural development.

The pesticides most often found in water were some of the chlorinated hydrocarbon insecticides including dieldrin, endrin, heptachlor, lindane, BHC, and chlordane. Herbicides such as atrazine, alacore, prometon, and simazine are now the most common type of pesticide found in water.

PESTICIDES IN SOIL

Soils are important in determining what happens to a pesticide after application. Even though some pesticide volatilizes before reaching the soil or is intercepted by plants, a large portion eventually reaches the soil. As previously discussed, soil can serve as a reservoir from which pesticides may move to other areas by water or wind erosion.

Pesticides may also escape by evaporation from the soil surface into the atmosphere. Soil organisms may serve to transport pesticides from one area to another, usually because they serve as a food source for animals or birds.

The fact that soils and organisms in soils are largely responsible for the breakdown or inactivation of pesticides is of great importance. This neutralization of pesticides varies with soil type and climate and is in part the determining factor as to whether a particular pesticide should be used in a given area. Aside from purely environmental concerns, if a pesticide persists too long in soil, it may also damage future crops.
Most pesticides do not move readily in soil because they are bound to soil particles, especially clay and organic matter. Consequently, they are usually found in the top few inches of soil. In rare instances some have been found at depths of several feet.

PESTICIDES IN WILDLIFE

It is not surprising to learn that pesticides found in wildlife are generally the same ones found in soil and water. Wildlife consume the food derived directly or indirectly from soil and water, and in some instances, pesticides will accumulate in wildlife at concentrations ranging up to thousands of times more than in soil and water. This process is bio-magnification and is known to occur with persistent chemicals that are readily soluble in fat. One of the best examples is DDT.

Dieldrin and heptachlor have also been implicated in biomagnification, but other chlorinated hydrocarbon insecticides have not. Some of the highest residues of the chlorinated hydrocarbon insecticides have been found in birds of prey such as hawks and eagles. Fish eating birds are especially likely to contain residues of these insecticides. As might be expected, the insecticides most commonly found are DDT and dieldrin. These chemicals have been associated with lowered reproduction in several species of these birds. In fact, this is the principal reason that the use of DDT and dieldrin were severely restricted in the United States and other countries of the world.

The presence of pesticides in seed eating birds is generally much less than in birds of prey, and to date, there is little reason to believe there has been any effect on their reproduction. Birds have been killed by direct application of pesticides and by eating food contaminated with pesticides. This is not a general occurrence and, so far as is known, has not caused population declines that would threaten the existence of a species of seed eating bird.

PESTICIDES IN FOOD

Pesticides in food are monitored and controlled by two federal agencies, the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA). Some state agencies are also involved in these activities.

EPA has the responsibility of establishing tolerances for pesticides in food. FDA monitors pesticides in foods that are prepared for the table. This is commonly referred to as a "market-basket" or "total-diet" studies.

FDA determines the amount of pesticides in foods shipped in interstate commerce. It has authority to seize shipments that contain pesticide residues above tolerance levels and to initiate legal proceedings against the shipper.

FDA examines foods for contaminants other than pesticides, including such things as rodent hair, fecal pellets, and insect parts. Tolerances are established for these contaminants in food as well as pesticides. While consumers might be surprised to learn that a certain number of fecal pellets or insect legs are permitted in foods, perhaps they can take some comfort in knowing that current standards are much stricter than they were 20 or 30 years ago.

Pesticides have been largely responsible for these strict standards, and ironically, these standards are now a serious obstacle to the reduction of pesticide usage in certain situations. To the farmer, the use of pesticides may mean much more than simply increasing yield. If the quality of his crop is lowered by pest damage, he may not be able to market it at any price.

Every year, FDA determines the amount of pesticide chemicals in processed and raw agricultural products that are shipped interstate. This is a surveillance and regulatory program designed for the enforcement of tolerances set by EPA. Samples are collected throughout the year at producing, shipping, and destination points.

ENVIRONMENTAL CONCERNS

As we learn more about the behavior of pesticides in the environment, we find it necessary to devise more sensitive and discerning techniques to determine what their total impact will be. Invariably, man's innovations begin without a complete understanding of their consequences, such as the development of cars, airplanes, and the atomic bomb. Pesticides are no exception. The best we can do is to use all available knowledge, make allowances for unknown factors, and carefully estimate benefits and risks.

It is not possible to prove that a pesticide can be used without risk because proving a negative is generally impossible. Past experience and current EPA testing requirements give considerable assurance that risks will be minimal. During the past ten years, the time required to meet federal testing requirements has nearly doubled. There has also been a notable reduction in the appearance of new pesticides on the market and increased emphasis on finding ways to reduce the need for these chemicals.

The concern about the effects of pesticides on the environment is an extremely controversial issue debated by scientists, politicians, and the general public. One of the main reasons for this is that it is very hard to prove that a chemical is or is not harmful, especially when it is present in small amounts and its effects cannot be clearly demonstrated outside the laboratory.

PESTICIDE MANAGEMENT FOR AGRICULTURAL ANIMALS

The use of pesticides to control the pests that attack agricultural animals is a method of protecting the animals from harmful insects and other pests that can injure or kill the animal, reduce the animal's value, and/or the value or quantity of the animal's byproducts. Pesticides are used to prevent pest activity, control the spread of infectious pests, and reduce the transfer of pests between animals. When agricultural animals are treated with pesticides, special care is necessary to prevent adverse effects to other animals and humans. Pesticides labeled for use on agricultural animals include detailed guidelines to protect the animals being treated, other non pest animals that come in contact with the pesticide, the environment, and humans. The pesticide label includes specific instructions such as when, where, and how a pesticide should be applied and to which animals, the animals' appropriate age and size, the animals' required health condition, and production purpose of the agricultural animals. Failure to follow the label guidelines is both illegal and hazardous.

PESTICIDES AND PESTS

Pesticides include a variety of chemical products designed for the management of pests. The term pesticide refers to products such as herbicides and insecticides that are used to kill or control harmful organisms such as insects, weeds, or microorganisms. The following list includes numerous pesticides and the pests controlled.

Acaricide: mites and ticks
Adulticide: adult pests
Algicide: algae
Aphicide: aphids
Attractant: insects and vertebrates
Avicide: birds
Bactericide: bacteria
Defoliant: foliage removal
Desiccant: water removal from plant foliage
Disinfectant: microorganisms
Fumigant: insects, rodents, and weeds
Fungicide: fungi and other plant pathogens
Germicide: germs
Growth regulator: insects and plants
Herbicide: weeds
Hormone: insects and plants
Insecticide: insects
Larvicide: larval pests
Miticide: mites
Molluscicide: snails and slugs
Nematicide: nematodes
Ovicide: eggs
Pediculicide: lice
Pheromone: insects
Piscicide: fish
Predacide: predators
Repellent: insects and vertebrates
Rodenticide: rodents
Sanitizer: microorganisms
Silvicide: trees and woody vegetation
Slimicide: slime molds
Sterilant: microorganisms
Wood preservative: fungi and insects

PRECAUTIONARY STATEMENT

Pesticides offer both benefits and risks. Benefits can be maximized and risks minimized by reading and following the labeling. Pay close attention to the directions for use and the precautionary statements. The information on pesticide labels contains both instructions and limitations. Pesticide labels are legal documents and it is a violation of both federal and state laws to use a pesticide inconsistent with its labeling. The pesticide applicator is legally responsible for proper use. Read and follow the label instructions.

II. COMMON LIVESTOCK PESTS

PESTS OF CATTLE

The economically important livestock in Utah include beef and dairy cattle, sheep, goats, swine, and horses. The common pests of Utah's livestock are described in this chapter and the following chapters. The information presented in this study guide identifies the common agricultural animal pests that are managed with pesticide treatments and is not intended to serve as a complete reference for livestock care. In many instances a veterinarian or other trained professional should be contacted when animals are injured or sick. When selecting the appropriate pesticide to manage a pest, the pesticide label is the primary source for information.

The common pests of both beef and dairy cattle include various flies, gnats, lice, ticks, mites, birds, and both predator and non predator wild animals. Many of these pests and the methods of controlling such pests with pesticides are discussed in this chapter. A general discussion of bird and animal pest is provided at the end of this chapter.

FLIES

Many of the important pests of agricultural animals are flies. The pest damage from flies may range from a simple annoyance to painful biting and bloodsucking parasitism. While all cattle are negatively affected by flies, confined cattle have a more difficult time evading this pest. Some of the Utah fly species that must be managed with insecticides are discussed in this chapter. In this first section on stable flies the three traditional methods of controlling flies with spray pesticides is discussed in detail. In many cases these pesticide application methods are applicable to other insect pests.

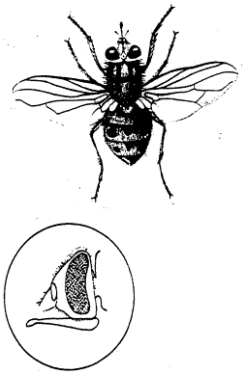
Stable Fly

Stable flies are the most important insect pest on feeder and dairy cattle in the summer in Utah. They feed by piercing the skin and sucking blood. The bite of the stable fly is painful and cattle try to dislodge flies by foot stamping, tail switching, and ducking their heads toward their front legs. Stable flies stay on cattle long enough to get a blood meal and then they seek a shaded place on a fences, walls, other cool surfaces, or within vegetation to digest the meal.

When stable flies are abundant, cattle will bunch together trying to evade the biting flies or seek water to stand in to avoid the fly harassment. Heavy stable fly populations may cause cattle to go off feed and present a health

hazard during time periods with excessively high temperatures. Weight gain reductions of one-quarter pound per day and decreased milk production of 30 to 40 percent have been reported because of attacks from stable flies.

The stable fly is dark gray and its abdomen has dark irregular spots. The stable fly's mouth parts, known as proboscises, protrude like a bayonet to the front of the head. Both male and female stable flies bite and feed on blood. These pests are very persistent and prefer animal hosts, but will bite humans. Stable flies are attracted to active cattle, but will feed on inactive animals. These flies commonly attack the ears and legs of cattle.



Stable fly adult and enlarged side view of head

The stable fly larvae are typically whitish fly maggots and the pupae are chestnut brown about one-fourth inch in length. This stable fly's complete life cycle from egg to adult averages about 24 days in Utah during hot weather. The female stable fly deposits eggs in spoiled or fermenting organic matter mixed with animal manure and dirt.

The most common breeding sites of stable flies are in feedlots or dairy lots. The female fly lives 20 to 30 days and lays 200 to 400 eggs during her lifetime. This fly will produce several generations each year. In warmer climates, the stable fly may breed year round. Stable fly maggot and pupae commonly overwinter in manure mixed with straw or other plant matter.

Stable Fly Control

Sanitation should be the first step in fly control and it is very important for stable fly control. In a feedlot or dairy operation, manure should be removed daily. Cleaning operations should target the elimination of the wet materials such as manure or feed materials and other organic matter on the ground that provides the habitat for stable fly reproduction. Clean up activities should target those areas around watering systems, feed sites, and fences, gates, and structures. If regular sanitation practices are not followed then pesticide applications are very likely to fail in controlling flies.

The three tradition insecticide spray methods for fly control include the treatment of facilities and structures with residual sprays, spraying an area to control flies that are present, and directly spraying cattle. Residual sprays are applied to surfaces, objects, and vegetation where flies are likely to land and absorb the insecticide. Residual insecticide sprays will last up to three weeks unless rain, sunlight, and/or temperature reduce the effectiveness. Residual sprays are cost effective when the areas requiring treatment are not too large and conditions allow for safe applications without contamination of feed and water sources. Smaller dairies and feed lots are examples of such sites. Spraying of residual insecticides must be repeated several times during the fly season and cattle should be removed from the area while spraying occurs. Insecticide label directions will provide detailed instructions for applications around cattle.

Insecticide area sprays are short term solutions that effective control flies that come in contact with the spray. This fly treatment technique involves the release of a low concentration of insecticide as a fine mist. Area sprays work well when stable fly activity is low and flies are collected in swarms. Area spraying is used to control existing adult stable fly populations and may have to be applied two or three times

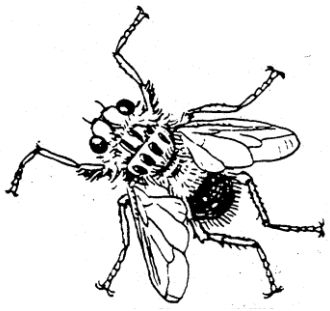
per week. Area spraying is sometimes followed by a residual spray application to control the newly emerging, next generation female stable flies before they can lay their eggs.

Insecticide sprays applied directly to cattle is a another stable fly control technique. Direct spray applications are used in many situations, but it works well when cattle travel between stable or corral locations and pastures. Stable flies will attack cattle when they visit confinement areas for water or feed and follow them back to the pastures. Direct spray applications must be repeated at four to seven day intervals because cattle that pass through tall vegetation or lay down will wipe off the insecticide. Directed sprays should target the legs, flanks, and underlines of cattle. Stables and corral areas will still require regular cleaning because the stable flies can reproduce in the confinement areas and travel to pastures to feed on cattle.

Other methods of fly control include insecticide treatments with pass through feed additives, pour ons, and injectable animal drugs. These management methods for cattle pests are discussed in more detail within the control sections for the other pests identified in this chapter.

Heel Fly

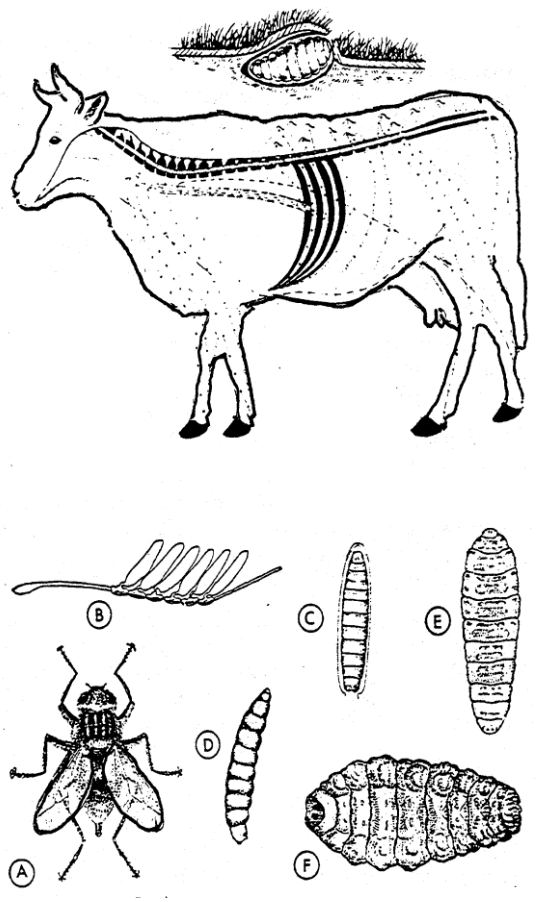
There are two species of heel flies, also known as cattle grubs, in Utah. They include the common cattle grub, *Hypoderma lineatum* and the northern cattle grub, *Hypoderma bovis*. The life cycles of these two species are similar except that the northern grub's life cycle occurs one to two months after the common grub.



Heel fly

Heel flies annoy cattle in their attempts to lay eggs. To evade flies, cattle seek shade or water to stand in and excessive fly activity can frighten cattle. If fly attacks interfere with cattle grazing it can result in decreased milk production and/or below normal weight gains. Further losses occur when cattle run through fences or into other objects. Slaughter losses result from the necessity to trim grub damaged areas from the carcass and from the decreased value of hides with grub exit holes.

The adult heel fly does not feed and usually lives less than a week. The heel fly prefers to attach eggs to hairs on lower parts of the body, hence the term heel fly. Flies will deposit five to 15 eggs on the hair coat of the host bovine. Heel fly eggs hatch in three to six days and the tiny larvae bore through the skin to reach the connective tissues between the muscles. During the next eight months the larvae migrate in several directions throughout the animal's body.



A. Adult heel fly female
B. Eggs attached to hair coat
C. Larva
D. Larva in gullet of cow
E. Larva beneath hide of back
F. Larva exits back and falls to ground

When the heel fly larvae reach the back of their bovine host they cut a breathing hole through the skin and remain in that location just beneath the hide for 35 to 90 days before becoming mature grubs. After becoming fully mature, the grubs squeeze through the breathing holes, drop to the ground, and pupate in loose soil or other debris.

After about four to five weeks, the adult heel flies emerge. There is only one generation of heel fly per year. When planning to treat cattle that have come from out of state, remember that the timing of the life cycle varies in different parts of the country. Insecticide treatments should occur after heel fly season but not later than eight to 12 weeks before the anticipated first appearance of grubs in the animals back. Insecticide applications can also be made after all of the grubs have migrated to the animal's back.

Heel Fly Control

There are a number of effective insecticides and methods of application to manage heel flies. The various pest control methods for cattle grubs include feed additives, sprays, dips, pour-ons, and injectable animal drugs. Nearly all of these insecticides are aimed at managing the immature flies that are also known as warbles.

When treating cattle for heel flies, there are several important considerations. Systemic insecticides should not be used on lactating dairy animals and applicators must strictly observe the withdrawal periods between treatment and slaughter or freshening. Sick or stressed calves under three months of age should not be treated with insecticides unless the insecticide label specifies that it can be used on young animals.

Insecticides can negatively interact with other chemicals, other pesticides, and/or other medications. Insecticide treatments when an animal is on medication, has been drenched, or has been exposed to other chemicals are not recommended and care should be taken to prevent hazardous interactions. Pesticide applicators should pay special attention to warning statements on labels regarding application rates, condition of animals to be treated, treatment in conjunction with other medications, and the recommended duration for treatments.

Black Flies

There are many species in the black fly, *Simultidae* family and they are among the smallest of the biting flies that attack livestock. These flies are sometimes called buffalo gnats because of their humped back appearance. The black fly name may be a misnomer because some species that attack livestock are often tan or yellowish in color.

The four life stages of the black fly are egg, larva, pupa, and adult. The duration of the life stages varies considerably with the different species. Several hundred eggs may be deposited on or in water by the adult female. Larval and pupal black flies spend their lives in the running water of rivers, canals. or streams. These aquatic stages are attached to objects such as stones, logs, and submerged vegetation. After adult flies emergence they are capable of flying great distances.

Female black flies are attracted in large swarms to host animals. They get into the nose, eyes, ears, and mouth of cattle and they feed either on exposed areas of skin or deep within the hair coat. They pierce the skin and suck oozing blood. Strong anticoagulants in the black fly saliva prevent coagulation of the blood for some time following the bite. A large painful welt may develop at the site of the black fly bite and cattle with numerous bite can become weak from blood loss. Significant losses in weight and/or milk production have been reported during black fly outbreaks.

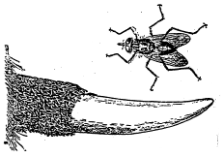
Black Fly Control

The management of black flies is identical to insecticide application for other type of flies discussed in this chapter.

Horn Flies

Horn flies are about half the size of common house flies and get their name because they gather around the base of the horns. Horn flies also feed on the backs, shoulders, withers, and bellies of cattle. Horn flies are bloodsuckers with piercing and sucking mouthparts and they may feed 20 to 30 times per day.

Populations of several thousand horn flies may be present on one bovine. When large numbers of flies attack, the cattle bunch and spend most of the time fighting flies. Cattle will stand in water or seek shade trying to get relief. Horn flies stay on cattle most of the time, crawling and feeding in the hairs on the back, sides, or belly. The eggs are very small and white or dark brown. The larvae are typical small fly maggots, and the pupae are small, brown, and seed-like.



Horn fly

Horn flies over-winter in Utah as pupae in or beneath cattle droppings. In late April or May adults emerge and begin their life cycle. The female horn fly deposits eggs in fresh cattle droppings. The larvae complete development in the manure and move below the droppings into the soil to pupate. The complete life cycle of the horn fly, egg to adult, may be completed in 10 to 20 days during hot weather. Under favorable conditions, many generations are produced in a single season.

Horn flies cause annoyance and pain to cattle, they interfere with feeding, and transmit disease. During the grazing season, yearling cattle free from horn flies gain from 15 to 50 pounds more than heavily infested animals. Grazing dairy cattle infested with horn flies may have as much as a 20 percent decrease in milk production, but this is less of an economical impact than the reductions in beef cattle weight gains.

Horn Fly Control

Throughout the day and night adult horn flies spend most of the time resting on cattle and feed intermittently. This allows horn flies to be easily controlled with residual insecticides applied to the backs of cattle. Horn fly problems are primarily limited to pasture and range situations and are not significant in feedlot operations.

Horn fly treatment in Utah should begin in about May or when fly counts reach 25 to 50

per animal and continue treatments at specified intervals throughout the fly season. Sprays are effective in controlling horn flies on cattle, but they require frequent reapplication. Insecticides applied with self administering back rubbers offer a convenient method to control cattle horn flies and also help control other flies.

Other methods of controlling horn flies include the use of ready to use dust insecticides hung four to six inched below the top line height of cattle in heavy cloth or burlap bags. When these bags are located in the vicinity of mineral or salting stations or at similar such locations frequented by cattle they allow for self administered horn fly treatments. Dust bags should not be placed where they will contaminate water or feed and should they be protected from rain and other moisture.

Insecticide impregnated ear tags, placed in the ears of cattle may also be used to control horn flies. The type of insecticide used in the ear tag should be changed annually to reduce the likelihood that flies develop a pesticide resistance. Feed additives with a fly larvacide can also be used to control horn fly larvae, but again daily consumption and appropriate bovine doses are necessary.

Face Fly

The face fly, *Musca autumnalis*, is an important, non biting nuisance fly that negatively affects cattle. It is believed that the face fly transmits pink eye and even contributes to cattle blindness. This face fly looks much like the house fly and it is very difficult to distinguish between the two adult flies.

The persistence of face flies in congregating around the eyes and nose of cattle helps distinguish face flies from house flies in the field. Face fly larvae, known as maggots, are yellowish and the pupae are white. The life cycle of the face fly is nearly identical to the house fly except the female face fly lays more eggs, up to 1500 eggs in her lifespan. Face fly larvae can only develop in cow manure.

Face flies are present in the field throughout the summer. Peak population occurs in late July or August. Face flies are most prevalent along waterways, in areas with 30 inches or more of rainfall, in canyons where the canyon floors have trees and shaded vegetation, and on irrigated pastures. An open range with sparse vegetation will typically allow cattle manure to dry out before fly larvae have completed development.

Face fly

Face flies swarm around the heads of cattle, lighting in and around the nostrils, muzzle, and eyes. They cause profuse tear formation and feed on the mucous from the eyes, nose, and mouth. They also feed on blood oozing from insect bites or open cuts. Irritation resulting from face fly infestations may cause cattle to huddle or seek shade and refuse feed. The protective and evasive actions of cattle in attempts to avoid face flies causes reduced milk production and/or weight gain.

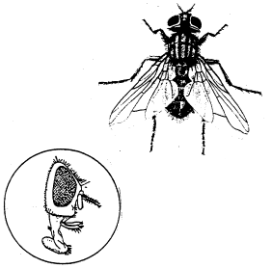
Face Fly Control

The control of face flies is problematic because they congregate on the faces of cattle making the application of spray insecticides difficult. Also, face flies spend so much time away from cattle that spray insecticides with less residual control may prove ineffective. Other than treatments by hand, the most successful control for face flies is from self administered dust or oil insecticides located where cattle have to be treated daily. The success of self treatment insecticide depends on location and regular maintenance. Placement of treatment sites should result in almost daily contact with these insecticides during the face fly season.

Insecticide impregnated ear tags, placed in the ears of cattle may also be used to control face flies. The type of insecticide used in the ear tag should be changed annually to reduce the likelihood that flies develop a pesticide resistance. Feed additives with a fly larvacide can also be used to control face fly larvae, but again daily consumption and appropriate bovine doses are necessary.

House Flies

House flies are about the same size as stable flies. They develop in manure or other areas of high organic matter that remain moist for several days. House flies cannot bite because they have sponging mouthparts. The underside of their abdomen is white to yellow rather than the gray color of stable flies.



Adult house fly and enlarged side view of head

The female house fly lays about 100 eggs in manure or other organic material. The eggs hatch within 24 hours and the larvae, known as maggots, are fully mature in 5 to 10 days. The mature maggots then move to drier areas and pupate. The length of time for the pupal stage varies, taking less time in warmer weather. The adult house fly emerges and mates immediately. The development stage of the house fly requires eight to 20 days, depending on the conditions. Two or more generations per month may be produced during warm weather. The house fly can overwinter as maggots or pupae, and adult flies can survive in heated buildings.

House fly populations increase in the spring and summer, then reach the maximum in late summer or early fall. House flies primarily cause problems around feedlots, but are of minor importance under range situations. House flies are not directly injurious to livestock but are annoying to the animals and are responsible for high bacteria counts. They are a nuisance to the homeowner. The tremendous numbers produced around feedlots may create a fly problem for several miles around.

House Fly Control

Sanitation is very important for house fly control. Cattle manure must be removed regularly and confinement facilities kept clean and dry. Applications of residual insecticide sprays will temporarily reduce fly populations, but the label must allow for applications to cattle or cattle should be removed during applications.

Insecticide baits are sometimes useful in supplementing other fly control measures. Such baits are available as dry and/or wet mixtures for use on surfaces where flies congregate. Cattle feed additives or supplements with pass through insecticides are also available for fly control. Pass through insecticides act as larvicides and function by passing through the bovine's digestive system to kill fly larvae in the manure. In order for this management practice to control fly larvae in manure, cattle must ingest the proper amount of larvicide daily.

A fly sanitation program must include areas around cattle confinement to prevent fly breeding in untreated media. Fly larvicides do not control adult flies so other methods must be used for complete control. Biological control of flies includes parasitic wasps that kill fly larvae.

GNATS

Gnats, also referred to as sand flies, are small biting flies that are an annoyance and cause irritation. If a gnat swarm is large enough they may cause an animal to feel as if it is suffocating. Gnats are a vector for blue tongue because they feed on the blood and transmit the disease from infected cattle to other animals.

Gnats reproduce in wet or aquatic habitats where the females lay the eggs in masses of 25 to 300 in the water. They may over-winter as eggs or larvae and the larvae have an eel like appearance.

Gnat Control

Gnats are very difficult to control. Periodic insecticide spraying of confinement areas and/or livestock provides temporary relief. Elimination of standing water and moisture will reduce the prime locations that allow for gnat reproduction.

LICE

Lice are considered to be serious insect pests of livestock. Heavy louse populations result in lowered milk production, loss of flesh, stunted growth, general un-thriftiness, and anemia. Chronic or carrier cows may abort due to louse induced anemia. Lice are typically more of problem during winter months and these extended times of cold temperatures, louse infested cattle are more susceptible to respiratory diseases.

Fall calves, yearlings, older unthrifty cattle, and early spring calves will typically have the heaviest infestations of lice. Heavily infested cattle are usually in poor physical condition, with rough patchy hair coats that have a dirty appearance. Heavy cattle lice infestations may cause bluish colored patches to appear on the head, neck, brisket, and shoulders of cattle. Lice may be seen climbing about on the animals facial hairs. Cattle scratch and rub against objects and remove hair in an attempt to relieve itching. Heavy lice infestations can cause a substantial monetary loss in cattle unless they are controlled.

Cattle biting louse

There are four different species of parasitic lice that are important to cattle producers in temperate areas of the United States. The three sucking lice species include the short nosed cattle louse, the long nosed cattle louse, and the little blue cattle louse. The single biting louse species is the cattle biting or chewing louse.

All four lice species have similar life cycles. The eggs are attached to the hairs and in a severe infestation are obvious. The duration of the egg stage varies, but eggs usually hatch after one to two weeks. The nymphal lice are very small and there are three nymphal instars that last between two to three weeks before maturing to adulthood. Adult lice may live about two weeks and produce one to two eggs per day. Lice infestations decline during summer months and become more severe during cold weather.

Short and long nosed lice

Louse Control

Control of lice depends on early recognition and thorough treatment. Insecticides can be used to treat cattle and warm fall days are a good time to apply spray insecticides for the control of lice. Back rubbers and dust bags with insecticides can also be used to allow self treatment by cattle.

Several insecticides are available in pour on formulations and such treatments are preferred for midwinter applications because they can be applied without wetting the animals. Injectable lice treatments are effective for bloodsucking lice.

TICKS

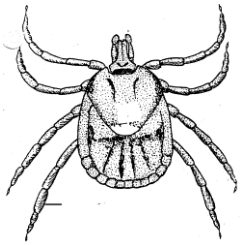
Ticks are arachnids and they are obligatory parasites that require blood meals in order to develop. Male, female, and immature ticks feed on blood. Ticks feed by driving their mouthparts into the skin of the host. Their feeding causes wounds and removes large quantities of blood.

Ticks have four developmental stages that include the egg, larva, nymph, and adult. The larvae, nymphs, and adults can be differentiated according to size. Larval ticks possess six legs, whereas adults and nymphs have eight.

To lay eggs the fully engorged females drop off the host and lay eggs on the ground. The larvae hatch and climb vegetation to contact passing animals. They molt into nymphs and then into adults, staying on the host the whole time. Ticks can cause anemia and they can be a vector for diseases transmitted to humans such as Lyme disease and Rocky Mountain spotted fever.

Rocky Mountain Wood Ticks

The Rocky Mountain wood tick attacks cattle and is a significant pest. The toxins secreted by the female tick can paralyze many animals, including cattle, man, sheep, and horses. The initial symptoms of tick induced paralysis in cattle are weakness and staggers. In a few hours, the animal is incapable of standing and finally death ensues. Animals can be saved by removing the offending ticks. Recovery may be rapid, within an hour, or it may take a couple of days. When recovery does not occur within this time, it is an indication that some ticks may have been overlooked during the removal.



Tick

Rock Mountain Wood Tick Control

Thorough coverage by an insecticide spray or dip is necessary to control the Rocky Mountain wood tick. Several different insecticides are approved for this purpose.

Spinose Ear Ticks

The spinose ear tick inhabits the ears of cattle during the larval and nymphal stages of the tick's life cycle. The adult spinose ear tick lives on the ground away from the host. This tick causes injury by puncturing the skin within the ear and sucking blood. Wounds may become infected, causing a condition known as ear canker. Sometimes tick infestations become severe enough to completely close the ear passage. Cattle infested with this tick may shake heads and rub ears and animal weight loss and un-thriftiness can result.

Spinose Ear Tick Control

Insecticides in dust or oil solution formulations must be applied into the ears of infected animals or insecticide impregnated ear tags may be used.

MITES

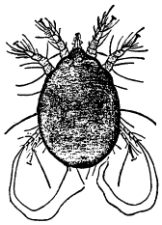
According to the United States Department of Agriculture (USDA), cattle mange is legally defined as any skin condition of man or animals associated with a mite and scabies is a mange condition that is especially serious, debilitating, and reportable. Mites are tiny arachnids and are the causative organisms for scabies. There are three varieties of mite infestations that cause scabies and they include psoroptic or common scabies, sarcoptic scabies, and chorioptic scabies.

Mites are more of a problem during the winter and they cause a thickening of the animal's skin and loss of condition. Infected animals rub and scratch and exhibit weight loss, un-thriftiness, and hide damage. Correct identification of mites requires that they be scraped from an infected area on the host animal and microscopic examination for

identification. Mites are very small and barely visible to the naked eye. When scabies mites are detected, the infested cattle are required by law to be quarantined and treated.

Psoroptic Scabies

Psoroptic scabies is caused by the *Psoroptic ovis* mite and is a parasite that spreads quickly and easily among cattle of all ages, classes, and conditions. Psoroptic scabies is by far the most injurious form of cattle scabies and requires immediate quarantine and control measures when found. *Psoroptes ovis* is host specific to a degree and it only lives on sheep, cattle, horses, and American bighorn sheep, but it prefers the domesticated sheep to other animals. The entire life cycle of this mite is spent on the host.



Female psoroptic mite

Sarcoptic Scabies

Sarcoptic scabies is another form of scabies caused by the *Sarcoptic scabiei* mite. This parasite is found on cattle, sheep, swine, horses, household pets, wild carnivores, monkeys, and man. When sarcoptic mites establish themselves on cattle they usually congregate where the hair is thin and the skin tender. The first lesions are often found above the scrotum or udder and on the inner surfaces of the thighs. If the disease is not controlled it may cover the entire body. Affected areas lose hair and become covered with heavy crusts or scabs. New generations of mites require about two weeks to complete the cycle from egg to egg. Sarcoptic, like psoroptic scabies is a disease subject to quarantine and control measures wherever found.

Female sarcoptic mite

Chorioptic Scabies

Chorioptic scabies is caused by the *Chorioptes bovis* mite. Chorioptic mites have strong host preferences and normally are only found on cattle, horses, sheep, and goats.

In some host species, the chorioptes mite prefers the feet and lower hind legs as the sites for infestation. These mites live in colonies on the surface of the animal's skin. Chorioptic scabies is the most common type of mange in cattle. Disease symptoms include skin lesions that usually develop in the animal's tail region and spread to other parts of the body. If the lesions start on the feet or legs, it is diagnosed as leg mange.

Cattle with chorioptic scabies may also develop lesions on the scrotum, udder, under the flanks, or on the legs. Chorioptic scabies is a reportable disease and the state veterinarian is notified. Quarantine and control measures are at the discretion of state animal health agencies.

Chorioptic mite

Mite Transfer between Hosts

Scabies mites are single host parasites and they normally live, mate, deposit eggs, and die on the same host. Mites may drop off or be rubbed off the skin and hair coat of the infested host and establish themselves on a new host. All of the forms of scabies are

highly contagious diseases and extreme care must be exercised to prevent dissemination. Cattle scabies may be transferred to a new host by contact with infected animals, equipment, or facilities.

Cattle Scabies Control

Because scabies infestations are considered contagious diseases their existence must be reported to appropriate federal and state agencies. Scabies control measures must be supervised by federal or state designated officers.

State and federal animal health agencies cooperate very closely and effectively in the detection, quarantine, and control of scabies. When scabies infested animals or herds remain within state confines only the office of the state veterinarian concerned is responsible for the necessary regulatory procedures. When two or more states are involved in a scabies outbreak, where infested animals are moved across any state boundaries or when livestock are brought into the U.S. from outside the country, the Animal and Plant Health Inspection Service (APHIS) of the USDA determines the course of action to be followed.

PESTS OF SHEEP AND GOATS

A number of insects and related pests are problems to Utah sheep and goat producers. Many of the pest discussed in the cattle section of this chapter also attack sheep and goats. That information will not be repeated in this section, but reference should be made to the earlier sections on cattle.

FLIES

Several of the pest flies for sheep and goats are also pest for cattle. Refer to the sections on cattle pests for information related to house flies, black flies, stable flies, and horn flies.

Bot Flies

The sheep bot fly, *Oestrus ovis*, is a common pest of sheep and goats. The persistence of the adult flies in depositing larvae in the nostrils excites the animals and interferes with handling and grazing. The larval stages of this fly are referred to as head grubs and they live as parasites within the nasal passages and frontal sinuses. Head grubs irritate the membrane linings of the nasal cavities and predispose the sheep to bacterial infection. The resultant nasal discharge leads to the symptoms of snotty nose in sheep.

Bot fly adult

Bot Fly Control

There are several drugs that may be used to control head grubs. These grubs are the larvae of the bot fly. Some of these animal drugs may be administered orally and others are injectable.

Blow Flies

Blow flies are also known as wool maggots or fleece worms. The larvae of many species of blow fly invade wounds of livestock. Other species of blow flies may parasitize sheep and goats without infesting a wound. The larvae of these flies are called wool maggots or fleece worms. The adult blow fly of this species is about the same size as the house fly and dark bluish green in color, with a metallic luster. The larvae look like typical fly maggots.

Blow fly

The factors surrounding the egg laying that result in wool maggots are not completely understood. The strike as it is referred to is commonly associated with bacterial activity in the wool. Such sites can be the result of contaminated urine, feces, sweat, or other maggot infestations. Blow fly maggots may live in the fleece or they may attack the skin and produce lesions. The lesions and the maggots irritate the animals. The sheep and goats become restless, stamp their feet, constantly wag their tails, and bite at the infected site. Sheep and goats with blow fly maggots may not feed properly and with continued deterioration can die in a few days.

Blow Fly Control

Much can be done to avoid maggot infestation of animals through flock management. Soiling of fleece should be avoided and if the breech area becomes saturated with urine and feces during the blowfly season, wool should be clipped from the crotch area.

In order to avoid wounds that may become maggot infested sheep and goats should be handled gently and with safe chutes and corrals. Lambing and shearing early in the spring, prior to the blowfly season, are advisable. Insecticides are used for prevention as well as control. Preventive dips or sprays may be applied if animals scour during the warm months. Wounds may also be treated. Infested animals may be dipped or sprayed with dilute insecticide. If only a few animals become infested, spot treatment of the infested site is a possibility.

GNATS

Gnats, also referred to as sand flies, are small biting flies that are an annoyance and cause irritation. If a gnat swarm is large enough they may cause an animal to feel as if it is suffocating.

Gnats reproduce in wet or aquatic habitats where the females lay the eggs in masses of 25 to 300 in the water. They may over-winter as eggs or larvae and the larvae have an eel like appearance.

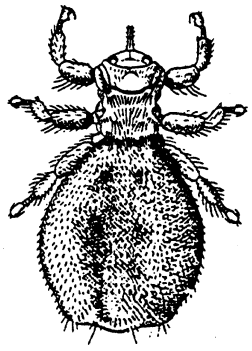
Gnats are a vector for blue tongue because they feed on the blood and transmit the disease from infected sheep to other animals. Bluetongue may cause sores in an animal's mouth, irritation in the feet, and abortion in sheep.

Gnat Control

Gnats are very difficult to control. Periodic insecticide spraying of confinement areas and/or livestock provides temporary relief. Elimination of standing water and moisture will reduce the prime locations that allow for gnat reproduction.

SHEEP KED

The sheep ked, *Melophagus ovinus*, is a common pest of sheep and has a tick like appearance. The entire life of a sheep ked is spent in the fleece of the host. The adult and pupa stages are commonly found on the underside of the host, although they may also be on other locations of the body. Adult sheep keds spread from one host to the next by direct contact.



Sheep ked

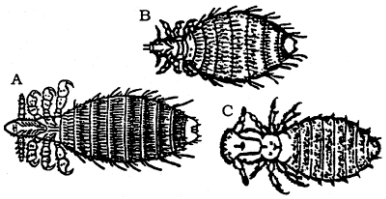
The sheep ked is a blood feeder and it crawls rapidly through the fleece of the host animal. . These bites irritate the sheep and leave lesions that reduce the grade and value of the sheepskin. The excrement of the keds causes permanent discoloration of the fleece. Sheep ked populations build up during the autumn and winter months and reach peak numbers in January and February. Over the summer months the population numbers of sheep keds decline.

Sheep Ked Control

Several methods of control are available for sheep keds. Each has its advantages and disadvantages, depending on the particular sheep management program. Sheep can be treated in the spring after shearing, all sheep in the flock must be treated, and all animals introduced into a flock should be treated to prevent re-infestation. Methods of application for sheep ked control include dipping, pressure spraying, pour on, and dusting with insecticides.

LICE

The species of lice that can infest sheep and goats include one species of chewing louse and several species of sucking lice. The bloodsucking body louse, the foot louse, and the biting louse are discussed in this section.



A. Blood sucking body louse
B. Foot louse
C. Biting louse

Bloodsucking Body Louse

The bloodsucking body louse deprives sheep of nutrition and stains the wool with small brown fecal spots. The sucking body louse may also infest the sheep's belly and scrotum of rams and spreads during breeding.

Foot Louse

The foot louse is a sucking louse that feeds on blood. This louse is normally not injurious to the sheep since louse feeding occurs on the hairier parts of the body and the sheep exhibits little discomfort. In severe infestations the sheep foot louse may cause some lameness.

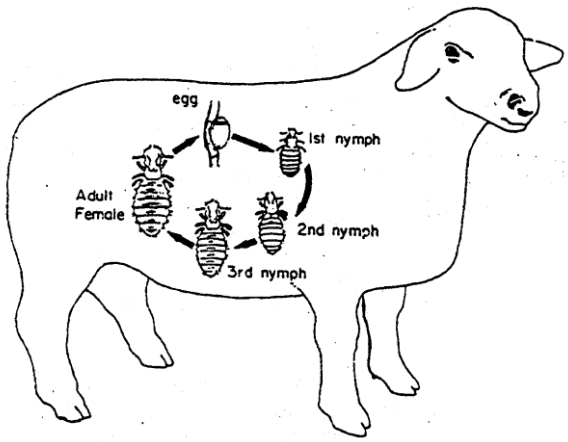
Generally, lambs and younger sheep are more heavily infested by the sheep foot louse than are older animals. Light infestations commonly occur as small colonies of lice around the accessory digits. From this location, the sheep foot louse may spread down to the feet and up the shank. In heavy infestations, these lice also infest the scrotum and sometimes the belly of the rams.

Biting Louse

The biting louse, *Bovicola ovis*, is a small species with a pale abdomen, darker thorax, and reddish head. The foot louse, *Linognathus pedalis*, is up to two millimeters long, has a short head, nearly as wide as it is long, and has an abdomen thickly covered with long, slender bristles. The bloodsucking body louse, *Haematopinus ovillus*, is larger than the biting or foot louse, but similar in shape.

The adult, nymphs, and egg stages all appear on the host. The three nymphal stages resemble the adult lice in general appearance, but they are smaller in size. The lice eggs are very small in size and are attached to wool fibers and hairs.

The sheep biting louse and sheep foot louse demonstrate a pronounced seasonal fluctuation in populations, numbers being greatest in winter and early spring and lowest in summer. Lice are spread by contact between sheep. The sheep foot louse can also be acquired from an infested pasture. The sheep biting louse is usually most abundant on older sheep and on sheep in poor condition. Their preferred location is near the skin along the back and the upper sides.



Biting louse life cycle

In heavy infestations, sheep lice may be found anywhere on the body. Biting lice feed on the skin scurf and cause intense irritation that sheep relieve by biting and pulling the wool and by rubbing against objects. The fleece of heavily infested sheep becomes ragged and torn.

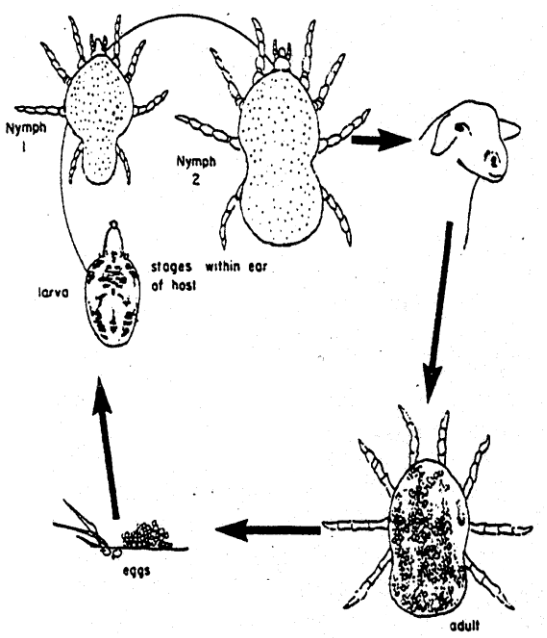
Louse Control

Control of lice depends on early inspection and thorough treatment. Insecticides can be used to treat sheep and several insecticides are available to control lice and label directions provide the details on techniques and application rates.

The bloodsucking body louse, biting louse, foot louse and other species of lice that occur on sheep may be controlled by the use of dipping, pressurized sprays, and pour on insecticide formulations. There are also animal drugs that control lice on sheep and goats.

TICKS

The Rocky Mountain wood tick and the spinose ear tick discussed in the cattle section of this chapter can be serious problems for sheep and goats. Ticks are arachnids and they are obligatory parasites that require blood meals in order to develop. Male, female, and immature ticks feed on blood. Ticks feed by driving their mouthparts into the skin of the host. Their feeding causes wounds and removes large quantities of blood.



Spinose ear tick life cycle

Ticks have four developmental stages that include the egg, larva, nymph, and adult. The larvae, nymphs, and adults can be differentiated according to size. Larval ticks possess six legs, whereas adults and nymphs have eight.

To lay eggs the fully engorged females drop off the host and lay eggs on the ground. The larvae hatch and climb vegetation to contact passing animals. They molt into nymphs and then into adults, staying on the host the whole time. Ticks can cause anemia and they can be a vector for diseases transmitted to humans such as lyme disease and Rocky Mountain spotted fever to humans.

Tick Control

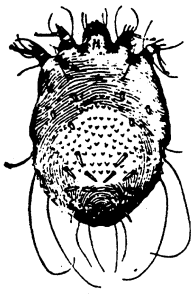
Control methods for ticks are similar to those discussed in the cattle section. Please refer to those sections for more information on control measures. Thorough coverage by an insecticide spray or dip is necessary to control Rocky Mountain wood ticks. Several different insecticides are approved for this purpose. The spinose ear tick can also controlled with ear tags.

Mites

Three different mite species produce mange in sheep and goats. Mange is a contagious skin disease caused by sarcoptic mites, psoroptic mites, or chorioptic mites. Correct diagnosis of mange requires that the mites be scraped from an infected area on the host animal and microscopic examination must be used for positive identification. Mites are very small and barely visible to the naked eye. Mites live on the host throughout all stages of their life. Mange from the host animal is spread by contact between animals or with contaminated equipment.

Sarcoptic Mange

Sarcoptic mange is rare in sheep and goats. Adult sarcoptic mites burrow within the skin of the host and cause severe irritation. Mite eggs are laid within the burrows. Development of the mite from egg to reproductive adult takes about two weeks. This form of mange occurs only on the non-wooly skin of the animal. Lesions usually appear first on the head and face.



Sarcoptic mite

Psoroptic Mange

Psoroptic mange, caused by the *Psoroptes ovis* mite, is also called sheep scab. Sheep with psoroptic mange must be quarantined and the state or federal regulatory agencies must be notified immediately of the disease. Psoroptic mites do not burrow in the skin of the host. They prick the skin to feed and cause serum to ooze from the wounds. Accumulation of serum causes the formation of scabs. Scabs occurs almost exclusively on the parts of the sheep's body covered with wool. The wounds appear as large crusted lesions.

Psoroptic infestations may eventually involve large areas of skin and sheep's wool becomes ragged with tags of wool torn out or rubbed away by the sheep. Psoroptic mange causes severe weakness in the sheep and extensive loss of wool. In severe cases animal deaths are not uncommon.

The psoroptic mite life cycle requires about two weeks to complete and the infestation can spread rapidly. Psoroptic mites are abundantly under the scabs and the irritated sheep rub and scratch against objects and other sheep which rapidly transfers the disease.

Chorioptic Mange

Chorioptic mange is the most widespread mange throughout the US. Chorioptic mites live on the surface of the skin and feed on scurf and skin secretions. Although the mite sometimes causes considerable irritation to the host, the only noticeable skin lesions occur on the scrotum of rams. Infested animals may often be observed biting or licking their lower legs and feet. Chorioptic mange is also known as leg or foot mange. This mange is found on those areas of the legs, face, and scrotum having no wool. Little damage results to the fleece and little weight is lost by fattening lambs.

Mite Control

Dipping or injections are the preferred method of treatment for mange control in sheep and goats. An infestation of psoroptic mite, known as sheep mange or scabies requires a control program supervised by state and federal regulatory officials.

PESTS OF SWINE

A number of insects and related pests are problems to Utah swine producers. Many of the pest discussed in the cattle section of this chapter also attack swine. That information will not be repeated in this section, but

reference should be made to the earlier sections on cattle.

FLIES

Most flies that are pests of cattle are also pests of swine. Refer to pest descriptions and control recommendations in the cattle section.

LICE

The presence of lice on hogs is indicated by their excessive scratching and rubbing. This causes reddening and thickening of skin and results in reduced weight, especially in young pigs. The life cycle for hog lice is the same as that of cattle lice and heavy infestations of lice on hogs may cause death.

Hog blood sucking louse, 3/8 inch in length

Louse Control

There are a number of sprays and dips that control lice on hogs and there are granular insecticides that can be used in bedding for small pigs. There are also dust formulations available for young and mature pigs.

SWINE MITE

The swine mite is specific to the swine, but it is virtually the same as the mites responsible for mange in other livestock. Refer to the sections on cattle for more information about mites. Since hog mange spreads rapidly, especially in winter, the entire herd should be treated when any individual develops mange.

Hog mange mite

Swine Mite Control

Routine treatments that control mites will help prevent a mange outbreak. Such a program requires an insecticide treatment of pigs at weaning, sows a month before furrowing, boars prior to the breeding season, and all feeder pigs or newly acquired hogs in the fall before placing them in facilities with mite free hogs.

VERTEBRATE ANIMAL PESTS

A variety of large and small vertebrate animal pests and predators can attack livestock. Young, pregnant, and/or sick livestock in unprotected circumstances are easy victims to vertebrate animal pests that would not present a danger to healthy adult livestock. Some of the agricultural animal pests include wolves, coyotes, dogs, feral dogs, skunks, weasels, raccoons, foxes, bears, bobcats, mountain lions, feral cats, house cats, snakes, and predatory birds. In addition to these pests, starlings and other birds such as the wild turkey have proven to be pests by their consumption of livestock feed and health concerns caused by the large numbers of birds defecating on livestock feed. Furthermore, livestock may be injured or killed by predator attacks, they may be injured while attempting to escape, or from collisions with other livestock trying to evade attacks, and they can die from diseases such as rabies contracted from infected animal pests.

Vertebrate Animal Pest Control

The primary method of managing vertebrate animal pests is to exclude them from livestock confinement areas and to kill them or otherwise reduce their numbers. Predator control methods include trapping, shooting, and poisoning. The lethal control of some predator species such as wolves and predatory birds and certain control methods such as poisoning and trapping are regulated by state and federal laws. Livestock owners must know and follow the appropriate regulations. Before initiating a pest control program, managers should correctly identify the pest and the number of pests causing losses.

III. COMMON EQUINE PESTS

TOPIC **PAGE**

PESTS OF HORSES

Horses, mules, and donkeys have some of the same pests as other agricultural animals. If a pest common to the equine family has been described in other parts of this manual, this chapter will reference the appropriate chapter and section of this manual for more information.

FLIES

Flies, both the bloodsucking and nuisance types, are major pests annoying horses. The fly pests common to cattle are also common to horses. See the cattle section in the previous chapter of this manual for a discussion of the fly pests of agricultural animals.

Bot Flies

There are three species of bot flies that are equine pests in Utah. They are the throat bot fly, the common bot fly, and the nose bot fly. The adult female bot fly attaches her eggs to hairs on a horse. Each species of bot fly has a particular site of preference where the eggs are laid. When the eggs hatch, the larvae enter the horse's mouth and penetrate the mucosal lining and the tongue. After a period of development, they migrate to the stomach where they attach to the stomach lining and feed. This activity often causes un-thriftiness, colic, and other problems in horses.

As the bot fly larvae reach the latter stages of development they detach from the stomach lining and are excreted in the feces. The bot fly larvae burrow under loose debris in the soil, where they pupate and develop into adult flies.

Horse bots cause injury in several ways. Since the mouthparts of the adult flies are nonfunctional, they cannot bite. However, the egg laying habits of flies annoy or frighten the horses and cause them to mill or run, thus interfering with work and grazing. Horses may lose weight and vitality because of bot fly annoyance. Young bot fly larvae penetrate and irritate sub-mucosal tissues of the inner lip, mouth, and tongue. This induces horses to rub their mouths on hard objects, causing additional sores. Older bot fly larvae attach to the lining of the stomach and intestines where they remove nutrients and cause inflammation. Heavy bot fly infestations hinder passage of food through the alimentary canal and impair digestion of food.

Common Bot Flies

Common bot fly females lay up to 1,000 eggs that they usually attach to the hairs of the forelegs or in other places the horse can reach with its mouth. After a five-day incubation period, heat caused by the horse licking stimulates the eggs to hatch. Young larvae are taken into the horse's mouth where they burrow into the mucous membrane of the tongue. After three to four weeks, the larvae pass to the stomach, where they attach to the lining and remain there during their second and third larval stages.

Bot fly

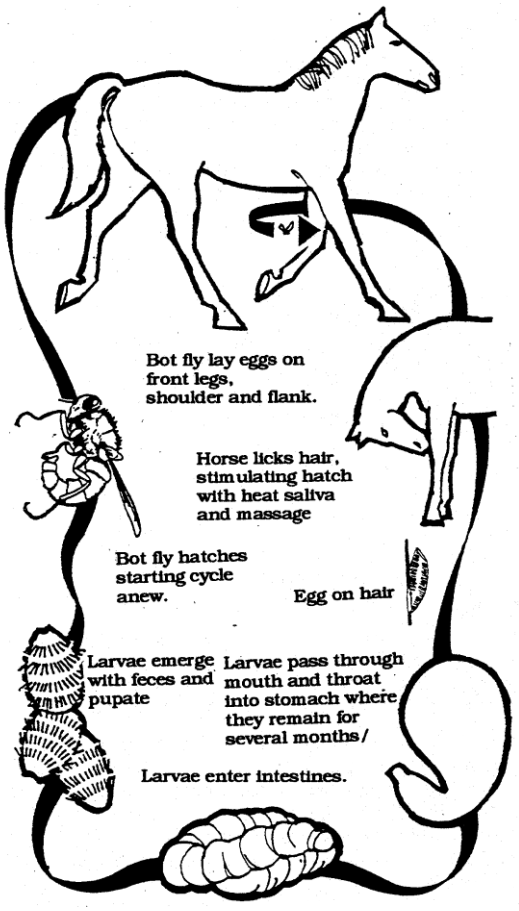
The common bot fly larvae remain in the horse's stomach for ten months until the following spring when they pass out with the feces. Pupation takes place in loose soil or ground litter. The pupal period lasts from three to five weeks. Individual adult common bot flies may live for about three weeks. Larvae continue to drop from the horse over a long period of time and common bot flies will be a pest to horses from late summer into early fall.

Nose Bot Fly

The life cycle of the nose bot fly differs slightly from the throat and common bot flies. The eggs of the nose bot fly, which are laid mainly in the hairs of the horse's upper lip, require an incubation period of about two days. Moisture provided by licking may be necessary for hatching. The larvae penetrate the lips and migrate into the tissue of the mouth. This species moves to the stomach and attach to the small intestine during the second and early third larval stages. Unlike the other species, nose bot flies then detach from the wall of the small intestine and reattaches in large numbers in the rectum, very close to the anus, before dropping out with the feces.

Bot fly control

There are several pesticides that are partially effective at controlling adult flies. The use and application of pesticides for flies are discussed in the previous chapter of this manual under the heading of fly control. Bot fly control in horses is done primarily by using an animal drug referred to as a boticide that targets the larvae in the stomach during the winter months.



Nose bot fly life cycle shown above is similar to other bot fly life cycles

LICE

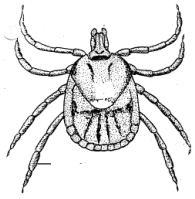
There are two species of lice that infest horses, a biting louse and a sucking louse. These lice are host specific and only affect horses. They are mostly a winter problem, increasing in number when the horses have a longer hair coat and bunch together during cold weather. The biting louse feeds on tissue and sloughed skin cells. The sucking louse feeds on blood. These lice can cause sever itching and horses rub to relieve the irritation. The most commonly affected areas are the forelock, mane, tale, and fetlocks. Heavy infestations may cover the entire body. Horses may lose weight due to infestations. The entire life cycle is completed on the host, from eggs that are laid on the hairs and hatch in 10-20 days, to nymphs that begin feeding until they become adults. The louse life cycle is completed in 2 to 4 weeks.

Lice Control

Lice are transmitted directly from infected animals, buildings, brushes, or tack. When a lice infestation is diagnosed, all equipment should be treated with an approved insecticide or sanitized by boiling. The process should be repeated two weeks later. Animals can be treated with insecticides formulated as pour ons, powders, or shampoos.

TICKS

As with other agricultural animals, ticks are also equine pests. The Rocky Mountain wood tick and the spinose ear tick are discussed in the previous chapter of this manual in the cattle section. The life cycle, explanation of problems, and control recommendations are described in detail in those earlier sections.



Tick

Winter Tick

The winter tick is a common pest of horses. This tick's preferred hosts include horses, moose, and elk. Younger animals are especially vulnerable to attack from the winter tick and may be killed by heavy infestations. This tick is a pest in the fall, winter, and early spring. The larval or seed ticks, which are similar to the adults except for smaller size and having six legs rather than eight, spend the summer in clusters on the ground.

When the cool weather of fall approaches, the larval ticks become active and seek a host. The tick remains on and feeds on the blood of the same host throughout its life. For this reason, the winter tick is called a one host tick. The mated, fully blood engorged female tick drops off the host in early spring. Egg laying takes place on the ground later in the spring.

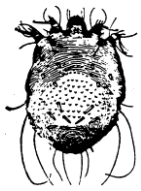
Winter Tick Control

If ticks are manually removed from a horse, an antiseptic should be applied to the bite.

Thorough coverage of an infested animal is necessary for insecticidal control of the winter tick and the Rocky Mountain wood tick. Several different insecticides are approved for this purpose and application can be by sprays, dips, or hand applications. Treatment for spinose ear ticks requires dust or oil insecticide formulations to be placed in the horse's ears.

MITES

Several different mite species cause mange in domestic animals, including horses. The types include sarcoptic mange, psoroptic mange, or chorioptic mange of horses. Refer to sections in the previous chapter on cattle mites for more information. The symptoms of mange in horses include blisters and small bumps on the skin, swelling and inflammation of the skin, scabs that consist of serum and scurf, and, in advanced cases, a dry, leathery skin condition.



Mange mite

Mange in horses is highly contagious. Mange mites are transmitted by contact with infected animals or equipment. Mite populations are generally greatest in the winter when hair coats are long and horses are crowded together.

Mite Control

Refer to the sections in the previous chapter of this manual on controlling mites in cattle.

MOSQUITOES

Mosquitoes are small flying insects with long piercing and sucking mouth parts and only the females feed on blood. The main concern with mosquito pests as they relate to horses is the potential for disease transmission. West Nile virus, Eastern Equine Encephalitis, and Western Equine Encephalitis are all vectored by mosquitoes. These diseases are all potentially life threatening to horses.

The life cycle of the mosquito has four stages. Mosquitoes lay eggs on the surface of water, on moist soil, and/or on sites that will be flooded. Such sites include ditches, ponds, puddles, old tires, a variety of containers, and anywhere water will stand. The eggs normally hatch within three days and the larvae, also known as wigglers, feed on organic matter in the water. Mosquitoes pass through four larval stages in about 10 days. The pupal stage lasts two to three days and the adult mosquito emerges at the water surface.

Mosquitoes annoy horses, they have painful bites and large numbers of mosquitoes feeding on a horse can cause un-thriftiness and weight loss. If feeding mosquito swarms are very large, horses can experience the feeling of suffocation or even death from heavy blood loss.

West Nile Virus

Mosquitoes become infected with West Nile after biting infected birds that serve as the primary host of the virus. The virus multiplies inside the mosquito and accumulates in the salivary glands. Mosquitoes salivate every time they bite and are capable of transmitting the virus 10 to 14 days after feeding on an infected bird. After contracting the disease, an infected mosquito can transmit the disease to horses and other animals after that time. Female mosquitoes require a blood meal before they can lay eggs, so they require a blood meal every few days for several weeks.

Symptoms of West Nile virus are related to encephalitis and affect the horse's brain function. Horses with West Nile virus will shows signs by staggering, a loss of appetite, depression, fever, weakness or paralysis of the hind limbs, head pressing, inability to swallow, circling, hyper-excitability, convulsions, and/or coma.

There are vaccines to inoculate horses against West Nile virus, but it involves multiple treatments. These vaccinations have proven to be about 94 percent effective in the horses,

require several weeks to be effective, and slightly different inoculation procedures are required for pregnant mares and foals. Booster vaccinations are also recommended and vaccinations are typically done by veterinarians.

Mosquito Control

Although exclusion of mosquitoes from structures where horses are stabled is effective, in many cases it is not practical. Where possible, the number of mosquitoes should be reduced by eliminate breeding sites. Locations with standing water should be drained and any open container with water that is not needed should be emptied and stored so as to not collect rainfall or irrigation water. A variety of insecticide sprays for mosquitoes control on horses are available and the almost daily contact that many owners have with their horses can make this process effective.

VERTEBRATE ANIMAL PESTS

A variety of large and small vertebrate animal pests and predators can attack horses. Young, pregnant, and/or sick animals in unprotected circumstances are easy victims to smaller animal pests that would not present a danger to healthy adult equine. Some of the pests include wolves, coyotes, dogs, feral dogs, bears, mountain lions, and large predatory birds. Horses may be injured or killed by predator attacks, they may be injured while attempting to escape, or from collisions with other animals or objects trying to evade attacks.

Vertebrate Animal Pest Control

The primary method of managing vertebrate animal pests is to exclude them from horse confinement areas and to kill them or otherwise reduce their numbers. Predator controls methods include trapping, shooting, and poisoning. The lethal control of some predator species such as wolves and predatory birds and certain control methods such as poisoning and trapping are regulated by state and federal laws. Horse owners must know and follow the appropriate regulations. Before initiating a pest control program, managers should correctly identify the pest and the number of pests causing problems.

IV. COMMON POULTRY PESTS

TOPIC **PAGE**

PESTS OF POULTRY

The primary poultry in Utah are chickens and turkeys. The pests common to these animals are also pests in numerous other domestic and wild birds. Special care is necessary when applying pesticides near and on animals and special label directions describe pesticide treatments for poultry destined for food and egg production.

LICE

Chewing lice infest poultry and spend their entire lives on the host. Louse transmission is by direct contact with infested birds. The lice are active year round, but they are most prolific during the summer. The most common and economically important louse to poultry is the chicken body louse. Poultry lice feed on dry skin scales, feathers, scabs, and the blood the lice get by puncturing the base of soft feather quills near the poultry's body.

Chicken body louse, underside of female

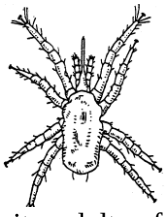
The entire life cycle of poultry lice is completed in four to six weeks and allows for multiple generations annually. Lice females lay 50 to 300 eggs, attaching them to the base of the poultry's feather shafts. The eggs hatch within a few days and young lice resemble their parents, except they are smaller and transparent. Infested birds become restless and damage themselves by pecking at body areas. Weight gain and egg production may decrease.

Louse Control

Insecticides can be applied by dusting or spraying the bird or by providing self treatment devices such as dust boxes.

MITES

Birds infested with mites develop skin irritation and anemia. If not controlled, dense mite populations may reduce weight gains and egg production or cause death. Mite infestations are transferred from bird to bird. They sometimes are a result of invasion of poultry houses by wild birds. Other means of transference are infested materials such as feathers, poultry handling equipment and flats, manure, and the feet of other poultry and human workers.



Chicken mite, adult unfed nymph
1/30 inch in length

The most common poultry mite is the chicken or red mite, which feeds on blood during the night and hides in cracks of the house during the day. Another common mite is the northern fowl mite, which spends all of its life on the bird.

Red Mite

Infestations of red mites, also referred to as the chicken mites, may go unnoticed because the mites are concealed in the cracks of the poultry houses during the day. Poultry houses must be examined for masses of mites, eggs, mite excrement, and skin casts from immature stages.

The female red mite requires a blood meal before laying eggs. Red mites deposit eggs in batches of 25 to 50 in the cracks and crevices of poultry housing. The eggs hatch in two to three days and under good conditions the life cycle of the red mite can be completed in 10 days. The short life cycle allows for multiple generations annually.

Northern Fowl Mite

The northern fowl mite normally spends its entire life on the bird. Under ideal conditions it can live up to three weeks away from host. The northern fowl mite is prolific during winter

months. They congregate near the bird's vent, tail, back, and neck. The life cycle or the northern fowl mite is similar to the red mite.

Scaly Leg Mite

The scaly leg mite is primarily found on poultry legs, but will also appear on the comb and wattle. The scaly leg mite causes enlargement of poultry feet and legs and infested poultry can exhibit a rough appearance. In severe cases the bird's joints become enflamed and when walking birds will appear lame.

Mite Control

Control the chicken (red) mite by spraying insecticide into the cracks and crevices of the poultry house and on the floor surfaces. Northern fowl mites and scaly leg mites are controlled by spraying or otherwise applying insecticide directly on the birds. Retreatment may be required for effective control of all mites.

FLIES

Many types of domestic flies such as the house fly and the stable fly are poultry pests. Some flies transmit disease to poultry and adults flies disperse into surrounding areas and become a nuisance to people. Flies can also transmit human and animal diseases. For more information about flies, their life cycles, and control, refer to the sections in the previous chapter on cattle flies.

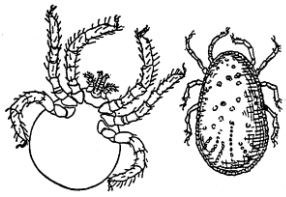
Adult house fly and enlarged side view of head

Fly Control

Sanitation should be the first step in a poultry fly control program. The removal of poultry manure and the elimination of other fly attractants is important. Follow the recommendations in the cattle section of the previous chapter for general fly control and follow the label directions for handling, application, and rates.

TICKS

Although several species of ticks may infest poultry, the most prevalent is the fowl tick. The fowl tick causes about the same kind of damage as poultry mites. The larvae, nymphs, and adults ticks attach to the skin of poultry where they suck blood and cause skin irritation. Loss of blood in chicks can be great enough to cause death. Ticks can cause older birds to become anemic and thereby lower weight gain and/or egg production.



Nymph fowl tick, adult fowl tick

Fowl ticks feed on poultry at night and during the day remain concealed in nests and cages and in the cracks and crevices of roosts, floors, and walls. Poultry with tick infestations may be restless while roosting and red spots may be seen on the bird's skin where ticks have fed.

Fowl Tick Control

Fowl tick control requires that the poultry house be thoroughly cleaned and insecticides applied to kill the ticks present. The birds must be dusted or sprayed to eliminate a tick infestation before allowing them into a clean poultry house.

DARKLING BEETLE

The darkling beetle is a common pest found in poultry houses. It is a brownish or black beetle that causes damage to the poultry structure by tunneling through boards and feeding on insulation. This beetle can transmit Mareks' disease and salmonella. The darkling beetle female lays 250 to 300 eggs singly or in clusters. The eggs hatch in 1 to 2 weeks and the larval stage may last up to 2 years, but most mature by fall and pupate to the adult stage in the spring.

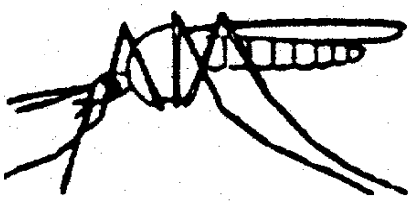
Darkling Beetle Control

It is difficult to eliminate all darkling beetles from poultry houses. Lower population numbers indicate that an insecticide treatment has worked or is not yet necessary. The darkling beetle should be monitored during the first week of a new flock cycle and continue weekly until birds are removed. Insecticide treatments are effective in controlling beetle numbers.

MOSQUITOES

Poultry can act as reservoir hosts for West Nile virus. Mosquitoes are small flying insects with long piercing and sucking mouth parts. They annoy poultry and the female mosquito's bites are painful. The main concern with mosquitoes is disease transmission, specifically West Nile virus.

The life cycle of the mosquito has four stages. Mosquitoes lay eggs on the surface of water, on moist soil, and/or on sites that will be flooded. Such sites include ditches, ponds, puddles, old tires, a variety of containers, and anywhere water will stand. The eggs normally hatch within three days and the larvae, also known as wigglers, feed on organic matter in the water. Mosquitoes pass through four larval stages in about 10 days. The pupal stage lasts two to three days and the adult mosquito emerges at the water surface.



Mosquito

West Nile Virus

West Nile virus has been confirmed in more that 140 avian species, including commercial poultry flocks. Poultry producers should implement effective mosquito control measures as well as bird handling precautions. When handling a dead bird that is suspected of having West Nile virus, take precautions to avoid exposure to the disease. Care should be taken to wear protective gloves and a facemask. All dead birds should be double bagged prior to disposal in an outdoor waste container with a cover to prevent access by scavenger animals.

Mosquito Control

Where possible, the number of mosquitoes should be reduced by eliminate breeding sites. Locations with standing water should be drained and any open container with water that is not needed should be emptied and stored so as to not collect rainfall or irrigation water. A variety of insecticide sprays for mosquito control are available. Human working in and around poultry where West Nile virus is suspected should use proper protective clothing and mosquito repellent.

VERTEBRATE ANIMAL PESTS

A variety of large and small vertebrate animals can attack poultry. Some of these are coyotes, dogs, feral dogs, wolves, skunks, weasels, raccoons, foxes, bobcats, mountain lions, feral cats, house cats, snakes, and predatory birds. Poultry may be injured or killed by a predator, they may be injured or die while they are attempting to escape or by the actions of other birds that are trying to evade a predator.

Vertebrate Animal Control

The primary method of managing predators is to exclude predators from the poultry house. Predator control methods include trapping, shooting, and poisoning. The lethal control of some predator species such as wolves and predatory birds and certain control methods such as poisoning and trapping are regulated by state and federal laws. Poultry owners must know and follow the appropriate regulations. Prior to initiating a predator control program, managers should correctly identify the predator and the number of predators causing poultry losses.

V. PESTICIDE APPLICATION AND SAFETY

TOPIC **PAGE**

METHODS OF PESTICIDE APPLICATION

Insecticides are the type of pesticide commonly used to manage agricultural animal pests. Diluted insecticide sprays are commonly used to spray animals and the treatment involves wetting the skin of the animal to control pests. Using a compressed air sprayer to spray animals in a fenced or otherwise enclosed space is a fairly simple technique. This spray technique can also be used to treat wall, floor, and ceiling surfaces and will also work on the ground. In addition to directed spraying there are numerous other techniques that effectively control agricultural animal pests.

DIETARY ADDITIVES

An effective and economical method of treating agricultural animals for a variety of pests is through feed additives and dietary supplements that work through systemic and/or digestive processes to control pests. Dietary additives require less labor to administer that many other treatment methods. When individual animal consumption is controlled, this method provides the appropriate dosage and minimum waste for optimum pest control.

MIST SPRAYS

An electric or hand operated pesticide mister may be used to apply small amounts of insecticide spray to animals. A fine spray is used so the pesticide will adhere to the animal's hair coat. Mist sprayers are also used to treat surfaces where pests such as flies tend to concentrate. Mist applicators are also used for application of space sprays as discussed below.

SPACE SPRAYS OR AEROSOLS

This is a method for quickly clearing spaces of flying insects. A machine is used that produces a fine mist or fog that remains suspended in the air for several hours. Usually the application is most effective indoors and must be repeated daily.

RESIDUAL WALL SPRAYS

Wall sprays are applied at low pressures to fences, ceilings, and inside and outside walls of buildings. Usually animals should be removed from buildings before spraying and care should be taken to not contaminating feed and water.

DIP VATS

Dipping is an excellent method for getting thorough coverage. Two popular types of dip vats are the swim vat and the cage vat. The dip vat method requires a relatively large initial expenditure for construction and materials as well as chemicals. The dip vat may be located near a convenient water source, but care should be taken to avoid a location where contamination of streams, ponds, or other water sources might occur.

The vat should be filled or charged immediately prior to dipping. The volume of the vat should be figured before charging. This can be determined by measuring or calculating the volume. Pesticide formulations of emulsifiable concentrate and wetable powder should be premixed prior to adding them to the vat. If a vat is to be replenished during dipping, it is advisable to situate a tank or drum adjacent to the vat.

After filling or recharging the vat, the vat contents should be mixed thoroughly. Also, provisions must be made for mechanical agitation of the vat to insure complete re-suspension of the contents after periods of non use.

BACK RUBBERS

The back rubber is a self treatment device that is commonly used for cattle. The back rubber is located so that cattle can rub against an absorbent surface that is saturated with the pesticide mixture.

POUR ONS

The pour on is a quick and simple method of applying insecticides to livestock. The method was originally developed for application of animal systemic for grub control. Now it is used with some non-systemic insecticides also. The pour on solution, either an oil solution or a water emulsion, is poured evenly from a calibrated dipper along the animals back so that none of the liquid drips off.

DUSTS

A small number of animals may be individually treated with insecticide dust. The dust may be applied by shaker can or other means and then worked into the hair-coat.

DUST BAGS

Dust bags are heavy cloth or burlap sacks that are filled with an approved insecticide dust and suspended below backline height in outdoor areas where animals are likely to pass. When an animal bumps or rubs against the bag, a small quantity of dust sifts through the fabric. The dust bags must be protected from rainfall and other moisture.

BAITS AND TRAPS

There are a variety of pesticide baits and pest traps available to control pests and some of these are effective for the pests of agricultural animals. Baits are useful in controlling some flying insects such as flies and when used in conjunction with regular sanitation measures can prove effective. Care should be taken any time poisonous baits are used because non target animals can be injured or killed.

A variety of traps are also available for pests. Through the use of an attractant, pests are drawn into a trap and cannot escape. Traps also work in conjunction with regular sanitation measures and are a good choice when poisonous baits cannot be used safely.

INSECTICIDE FORMULATIONS

There are several different insecticide formulations available to treat agricultural animal pests. Some, such as dusts or oil solutions, are ready to use without dilution, while others, such as wetable powders (WP) and emulsifiable concentrates (EC), must be diluted before application.

SYSTEMIC INSECTICIDES

Some of the insecticides that are used to control pests of agricultural animals are

systemically active. That is, they are absorbed and transported through the animal's body by its circulatory system. These compounds can be used for the control of several internal and external insect pests.

PESTICIDE SAFETY

The management of agricultural animal pests is necessary for high populations of livestock and poultry. Pesticides are selected because they are toxic to pests, but they may also be toxic to the animals being treated. Pesticides must be applied correctly to prevent adverse effects. In some cases animals may be sensitive to certain pesticides and adverse effects may occur even when label directions are closely followed.

If a pesticide is incorrectly applied or the treatment exceeds the label recommendations, pesticide poisoning may occur. The symptoms of animals with pesticide poisoning may include salivation, excessive defecation and/or urination, muscle twitching, swelling, sweating, difficulty breathing, staggering, and/or similarly unusual actions.

Animals that are excessively agitated or stressed should not be treated with pesticides. Care should be taken when treating young or small animals to prevent overdosing. When selecting a pesticide, choose the product and formulation that has the least risk of adverse effects and offers appropriate control.

Pesticide Precautions

1. Before applying any pesticide, read and follow the label directions.
2. Pay special attention to the treatment and slaughter intervals indicated on the pesticide label.
3. Strictly adhere to treatment cut off periods for dairy animals.
4. Follow label treatment restrictions concerning applications to young, sick, or stressed animals and restrictions concerning treatments in conjunction with the administering of medications.
5. Pesticides are toxic and can be fatal when handled incorrectly. Take care to minimize exposure or contamination of food, feed, or water.
6. Keep pesticides away from children and pets. Store all pesticides in their original container in a locked storage area.

VI. WORKER PROTECTION STANDARD

VII. PROTECTING GROUNDWATER AND ENDANGERED SPECIES

INTRODUCTION

Federal and state efforts to protect groundwater and endangered species have resulted in special requirements and restrictions for pesticide handlers and applicators. Pesticides that are incorrectly or accidentally released into the environment can pose a threat to groundwater and endangered species. Whether pesticides are applied indoors or outdoors, in an urban area or in a rural area, the endangered species and groundwater must be protected and state and federal agencies rigidly enforce this requirement.

The need for special action by the pesticide handler/applicator depends on site location. Groundwater contamination is of special concern in release sites where groundwater is close to the surface or where the soil type or the geology allows contaminants to reach groundwater easily. In the case of endangered species, special action is normally required in locations where the species currently live or in locations where species are being reintroduced. The product labeling is the best source to determine if pesticide use is subject to groundwater or endangered species limitations.

The U.S. Environmental Protection Agency (EPA) establishes the specific limitations or instructions for pesticide users in locations where groundwater or endangered species are most at risk. These limitations and instructions may be too detailed for inclusion in pesticide labeling. In such cases the labeling will direct the applicator or handler to another source for instructions and restrictions. The legal responsibility for following instructions that are distributed separately is the same as it is for instructions that appear on the pesticide labeling.

PROTECTING

GROUNDWATER

Groundwater is water located beneath the earth's surface. Many people think that groundwater occurs in vast underground lakes, rivers, or streams. Usually, however, it is located in rock and soil. It moves very slowly through irregular spaces within otherwise solid rock or seeps between particles of sand, clay, and gravel. An exception is in limestone areas, where groundwater may flow through large underground channels or caverns. Surface water may move several feet in a second or a minute. Groundwater may move only a few feet in a month or a year. If the groundwater is capable of providing

significant quantities of water to a well or spring, it is called an aquifer. Pesticide contamination of aquifers is very troubling, because these are sources of drinking, washing, and irrigation water.

Utah has implemented a comprehensive and coordinated approach to protect groundwater from pesticide contamination. Formulation of the Utah Groundwater and Pesticide State Management Plan is a cooperative effort between federal, state, private agencies, producers, and user groups. It provides a basis for continuing future efforts to protect groundwater from contamination whenever possible. Furthermore, this plan provides agencies with direction for management policies, regulations, enforcement, and implementation of groundwater strategies.

Utah recognizes that the responsible and wise use of pesticides can have a positive economic impact, yield a higher quality of life, enhance outdoor activities, and give relief from annoying pests. The EPA has authorized the Utah Department of Agriculture and Food (UDAF) to enforce the protection of groundwater from pesticides.

The UDAF, in concert with cooperating

agencies and entities, demands strict

compliance with all pesticide labels,

handling procedures, and usage to protect

groundwater in the state.

Prevention of groundwater contamination is important, because once the water is polluted, it is very difficult and costly to correct the damage and in some instances impossible. City and urban areas contribute to pollution because water runoff can contain pesticides. Shallow aquifers or water tables are more susceptible to contamination than deeper aquifers or water tables. Sandy soils allow more pollution than clay or organic soils, because clays and organic matter adsorb many of the contaminants. For more information about what groundwater is and where it comes from, read the study manual ***Applying Pesticides Correctly: A Guide for Private and Commercial Applicators.***

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended, establish a policy for determining the acceptability of a pesticide use or the continuation of that use, according to a risk/benefit assessment. As long as benefits outweigh adverse effects, the EPA can continue to register the pesticide. Although the intent of a pesticide application is to apply the pesticide to the target or pest, part of the pesticide will fall on the area around the target or pest. Rain or irrigation water then can pick up the part that is not degraded or broken down and carry it to the groundwater via leaching.

There are many factors that influence the amount of pesticide contamination that can get into groundwater. The major factors are the soil type, soil moisture, persistence in soil, placement of the pesticide, frequency of application, pesticide concentration and formulation, pesticide water solubility, and precipitation. Each of these factors will influence the amount of pesticide that can penetrate the soil surface, leave the root zone, and percolate into groundwater.

Although some pesticides may have a high adsorption quality, when they are applied to sandy soil, they may still migrate to the

water table because there are few clay particles or little organic matter to bind them. The management and use of pesticides is up to the individual applicator and/or landowner as to whether safe practices are used. Groundwater is a very valuable resource and it must be protected from pesticide contamination.

PROTECTING ENDANGERED SPECIES

The Federal Endangered Species Act lists the three classifications as endangered, threatened, and experimental. Endangered has the highest level of protection. The phrase "endangered species" is used when referring to these classifications. This Act was passed by Congress to protect certain plants and wildlife that are in danger of becoming extinct. A portion of this Act requires EPA to ensure that these species are protected from pesticides.

EPA's goal is to remove or reduce the threat to endangered species that pesticides pose. Achieving this goal is a portion of the larger continuing effort to protect species at risk. Normally these restrictions apply to the habitat or range currently occupied by the species at risk. Occasionally the restrictions apply where endangered species are being reintroduced into a habitat previously occupied.

Habitats are the areas of land, water, and air space that an endangered species needs for survival. Such areas include breeding sites, sources of food, cover, and shelter, and the surrounding territory that provides space for normal population growth and behavior.

Utah's endangered species plan is a cooperative effort between federal, state, private agencies, producers, and user groups. This plan provides agency direction for regulations, enforcement, management policies, and implementation of threatened and endangered species protection strategies.

EPA launched a major project known as Endangered Species Labeling (ESL). The goal is to remove or reduce the threat to endangered species from pesticides. EPA has the responsibility to protect wildlife and the environment against hazards posed by pesticides. The ESL program is administered by the U.S. Fish and Wildlife Service (FWS) in the U.S. Department of Interior. The FWS reports to EPA concerning endangered species. EPA and FWS work cooperatively to ensure that there is consistency in the pesticide restriction information provided to agencies and pesticide users.

The UDAF acts under the direction and authority of EPA to carry out the ESL project as it relates to the use of pesticides in Utah. Many states have web sites with maps designating the habitat boundaries and listings of endangered plants and wildlife. Utah's online web site for this information is www.utahcdc.usu.edu.

References: ***Applying Pesticides Correctly: A Guide for Private and Commercial Applicators.*** Also, Endangered Species Act of 1973, with amendments through 1996 <www.house.gov/resources/105cong/reports/105_c/esaidx.htm>.

GLOSSARY OF TERMS

A

ACARICIDE - A pesticide used to destroy or inhibit mites, ticks, or other arachnids.

ACTIVE INGREDIENT - The chemicals in a pesticide responsible for killing, poisoning, repelling, or other biologic activity.

ACUTE TOXICITY - Injury within 24 hours following exposure.
ADJUVANT - Material added to a pesticide mixture to improve or alter the deposition, toxic effects, mixing ability, persistence, or other qualities of the active ingredient.
ADULTICIDE - A pesticide used to destroy or inhibit adult pests.
AEROSOLS - An extremely fine mist or fog consisting of solid or liquid particles suspended in air. Also, certain formulations used to produce a fine mist or smoke.
ANTICOAGULANT - A chemical that prevents normal blood clotting.
ANTIDOTE - A treatment to counteract the effects of poisoning.
ARTHROPOD - Invertebrate animals such as insects, spiders, ticks, and crayfish of the phylum Arthropoda. They have segmented bodies and jointed appendages.
ATTRACTANT - A substance or device that will lure pests to a trap or poison bait.
AVICIDE - A pesticide used to destroy or inhibit birds.

B

BACTERIA - Microscopic organisms, some of which are capable of producing diseases in plants and animals.
BACTERICIDE – A pesticide used to destroy or inhibit bacteria.
BAIT - A food or other substance used to attract a pest to a pesticide or trap.
BIOLOGICAL CONTROL - Control of pests by means of predators, parasites, disease producing organisms, or competitive microorganisms.

C

CHEMICAL CONTROL - The control or management of pests with treatments of products produced by chemistry.
CHRONIC TOXICITY - Injury or illness beyond 24 hours following exposure due to prolonged or repeated exposure.
COMPATIBLE - Quality of two compounds that permits them to be mixed without effect on the properties of either.
CONCENTRATION - The amount of active ingredient in a given volume of diluent.

CONTAMINATION - The presence of an unwanted substance in or on plants, animals, soil, water, air, or structures.

CULTURAL CONTROL - A pest control method that includes changing sanitation and/or work practices.

D

DECONTAMINATE - To remove or break down a chemical from a surface or substance.

DEGRADATION - The breakdown of a pesticide into an inactive or less active form. Environmental conditions, microorganisms, or other chemicals can contribute to the degradation of pesticides.
DERMAL TOXICITY - Injury when absorbed through the skin.

DIAGNOSIS - The identification of the nature or cause of problem or fault.
DISINFECTANT – A pesticide used to destroy or inhibit microorganisms.
DOSE OR DOSAGE - Amount or rate of chemical applied to a given area or target.
DUSTS - Pesticides that are non-liquid and comprised of fine particles.

E

EFFICACY - The ability of a pesticide to produce a desired effect on a target organism.
ENDANGERED SPECIES - Legally classified as a species in danger of extinction.
ERADICATION - Pest management strategy that attempts to eliminate all members of a pest species.
EVALUATION - To examine or investigate for the purpose of judging the value, extent, or success.
EXPOSE - To be subjected to or come in contact with a material.
EXPOSURE ROUTE - The dermal, oral, or inhalation (respiratory) route by which a substance may enter an organism.
EXTERNAL PARASITE - An animal smaller than its host that lives upon the outside of its host for at least part of its life cycle.

F

FOGS - Pesticide sprays composed of very fine droplets from 0.1 to 50 microns in diameter. Fogs remain suspended for a long period of time.
FORMULATION - Pesticide as prepared by the manufacturer.

FUMIGANT - Pesticide that controls by giving off fumes.

G

GERMICIDE - A pesticide used to destroy or inhibit germs.
GROUNDWATER - Water sources located beneath the soil surface from which water is obtained.

H

HARBORAGE - A site that shelters and provides the food and water required for a particular organism to survive.
HERBICIDE – A pesticide used to destroy or inhibit weeds.
HOST - Plant or animal that is invaded by a parasite and from which the parasite gets its nutrients.

I

INERT INGREDIENT - In a pesticide formulation it is an inactive material without pesticidal activity.

INHALATION TOXICITY- Injury when inhaled.
INHIBIT - To prevent something from happening such as a biological reaction
INSECT - Any of the class Insecta of arthropods with well defined head, thorax, abdomen, 6 legs, and typically 1 or 2 pairs of wings.
INSECTICIDE - A pesticide used to destroy or inhibit insects.
INSPECTION - A critical examination an evaluation aimed at forming a judgment or determination.
INTEGRATED PEST MANAGEMENT (IPM) - A planned pest control program in which various techniques are used to keep pests from causing economic, health related, or aesthetic injury.
INTERNAL PARASITE - An animal that lives within the body of its host for at lease a portion of its life cycle.

L

LARVICIDE - A pesticide used to destroy or inhibit larval pests.

LEACHING - Process by which some pesticides move through the soil.
LEGAL STATUS - Classified such that it is permitted or allowed by law.

M

MECHANICAL CONTROL - Physical control of pests using devices or machines that kill the pests and/or alter their environment.
MIST - Pesticide sprays composed of droplets 50 to 100 microns in diameter. Particle size is sufficient to settle fairly rapidly, but still remain suspended long enough to be effective.
MITE - Any of numerous small arachnids that often infest animals, plants, and stored foods.
MITICIDE - A pesticide used to destroy or inhibit mites.
MODE OF ACTION - The way a pesticide reacts with a pest organism to destroy it.

N

NONLETHAL - Not capable of causing death.
NONTARGET ORGANISM - Any plant or animal other than the intended target of a pesticide application.
NOXIOUS PLANT - Plant that is recognized as being offensive and/or injurious to animals or other plants.

O

ORAL TOXICITY – Injury when taken by mouth.
OVICIDE – A pesticide used to destroy or inhibit eggs.

P

PARASITE - An organism that lives on or in a living host and that gets all or part of its nutrients from the host.
PATHOGEN - Any organism capable of causing disease.
PEDICULICIDE – A pesticide used to destroy or inhibit lice.
PERCOLATE - To pass slowly through a material or spread throughout an area.
PERSISTENCE - To have a continued or prolonged effect after treatment.
PESTICIDE - Any substance or mixture of substances intended for defoliating or desiccating plants, preventing fruit-drop, inhibiting sprouting, or for preventing, destroying, repelling, or mitigating any insects, rodents, fungi, bacteria, weeds, or other forms of plant or animal life or viruses, except viruses on or in living man or other animals.
PHEROMONE - A chemical substance that is produced by an animal and serves especially as a stimulus to other individuals of the same species for one or more behavioral responses.
PHOTOLYTIC DECOMPOSITION - Chemical decomposition or breakdown by sunlight.
POLLUTION - The act of polluting or contaminating the environment with harmful chemicals or waste products.
PPE - Personal protective equipment.
PRECIPITATE - The formation of a suspension of an insoluble compound by mixing two solutions.
PREDACIDE - A pesticide used to destroy or inhibit predators.
PREDATOR - An animal that attacks, kills, and feeds on other animals.
PRESCRIPTION - A proven formula for the control of pests.
PREVENTION - An action that makes it impossible or very difficult for an unwanted activity to happen.
PROTECTED STATUS - Animal or plant species that is designated as endangered, threatened, or experimental, and is protected by federal or state law.

R

RATE OF APPLICATION - The amount of pesticide applied, usually measured as per acre, per 1,000 square feet, per linear foot, or per cubic foot.
RE-ENTRY INTERVAL - The length of time following an application of a pesticide when entry into the areas is restricted.

REPELLENT - A compound that keeps pests away.
RESIDUAL - Leaving a residue that remains effective for some time.
RESIDUAL SPRAY - A pesticide spray that leaves a residue that remains effective for some time.

RESISTANCE - Inherent ability of a host to suppress, retard or prevent entry or subsequent activity of a pathogen or other injurious factor.
RISK - A probability of an adverse effect in a given situation.

RUNOFF - The liquid spray material that drips from the foliage of treated plants or from other treated surfaces. Also, the rainwater or irrigation water that leaves an area and may contain trace amounts of pesticide.

S

SANITATION - Term used for cultural methods that reduce inoculum.
SANITIZER – A pesticide used to destroy or inhibit microorganisms.
SIGNAL WORDS - Required words that appear on pesticide labels to denote the relative acute toxicity of the product.
SOLUBILITY - The extent to which one substance is able to dissolve in another.
SPOT TREATMENT - Pesticide applied over small, restricted site rather than the entire area or animal.
STERILANT - A pesticide used to destroy or inhibit microorganisms
SURFACE WATER - Water on the earth's surface in rivers, lakes, ponds, streams, etc.
SURFACTANT - Material which in pesticide formulations imparts emulsifiability, spreading, wetting, dispersability, or other surface-modifying properties.
SUSCEPTIBILITY - Magnitude or capacity to react to pesticide treatment.
SUSPENSION - Liquid or gas in which very fine solid particles are dispersed but not dissolved.
SYSTEMIC - Pesticide absorbed or injected into the plant and then spread internally through the plant.

T

TARGET - The plants, animals, structures, areas, or pests at which the pesticide or other control method is directed.
TOXIC - Poisonous to living organisms.
TOXICITY - The degree or extent to which a chemical or substance is poisonous.

U

UNPROTECTED STATUS - Animal or plant species that is not protected by federal or state law.

V

VECTOR - An animal that can carry and transmit a pathogen.
VERTEBRATE ANIMAL- Animal with a segmented backbone and spinal column.
VIRUS - Ultramicroscopic parasites that can multiply only in living tissues and cause many animal and plant diseases.

W

WATER TABLE - The upper level of the water saturated zone in the ground.
WETLAND - Area with aquatic soils and vegetation.

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