Integrated Pest Management For Beef Cattle On Western Ranges

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Introduction

The purpose of this publication is to provide ranchers with information about pests affecting cattle so that they may develop an integrated pest management program that is economical and practical.

Many factors must be considered when developing a pest management program. Proper identification of pests and an understanding of their biologies are essential. If a pesticide is to be used, it should be carefully chosen so that whatever is used causes little or no harm to man, animals, wildlife and the environment. Laws and regulations affect what can be used because of concerns for worker safety, endangered species, excess and waste pesticide disposal and pesticide drift. Economics must also be considered. There is a point when further investment of resources will not yield a net return. All these factors interact and must be considered as a whole. Help in developing an integrated pest management program can be obtained from independent consulting services, your local veterinarian or the Cooperative Extension Service.

Because of the constantly changing status of pesticide registration, no specific recommendations are given in this publication. This information is available from the Cooperative Extension Service, State Departments of Agriculture, veterinarians or local agricultural chemical distributors.

General Range Management and Herd Health Practices

To be successful, integrated pest management (IPM) practices for range beef animals must optimize rancher profits. A combination of these programs should lead to more profitable beef cattle operations on ranges which will enable grazing programs to sustain themselves for several years.

Range improvement and range use programs will vary from state to state and between areas within a state. Basic principles for proper range management for all areas would include an appropriate grazing program for range improvement, the proper stocking rate for a given range, proper type of animal for a particular range, weed control and range fertilization, if necessary and feasible. These practices would be used to bring the range to optimum production in as short a time as possible and to maintain the productivity of that range over a prolonged period.

A good herd health program that includes pest management practices should be conducted in conjunction with proper range management programs. Veterinarians should be consulted for the internal parasites that occur in a given state or area. If, for example, cattle are grazed on ranges where elk herds also feed, inspections and treatments for lungworm would be recommended. Ranchers should be especially vigilant to control coccidiosis, an important internal parasitic disease affecting range cattle.

The use of good range management practices and a good herd health program will provide a healthy herd which will respond to IPM practices.

Insects, Mites and Ticks

Introduction

Insects, mites and ticks may cause economic damage to range cattle in a number of ways. Damage to meat and hide or reduced weight gains are common effects. These pests also cause other problems that are not as easily recognized, problems such as transmission of diseases, reduced resistance to other diseases, anemia, allergic reactions and decreased reproductive efficiency. Table 1 is an estimate of losses that would be incurred by United States beef and dairy cattle producers in the absence of control measures.

Management of these pests on range cattle is difficult because the cattle are scattered and difficult to approach. This means less observation of the animals than in feedlot or pasture situations and thus more difficulty in assessing developing pest problems. Thorough inspections are made more difficult by the fact that sick animals or those irritated by flies will often hide in brush. A cursory inspection will often miss the cattle with problems. A good horse and knowledgeable rider are almost necessary in locating animals and assessing problems. A knowledge of the pests in an area and the time of their seasonal appearance can help ranchers focus on potential problems.

Pests such as face flies, horn flies, mosquitoes and blackflies can be identified without restraining the animal. Other pests such as lice and scabies require close inspection when the animal begins to show indications of an infestation. If control measures are postponed until the lice or scabies lesions are obvious, economic losses have already occurred.

Ranchers must assume that certain insect pests will be a problem because they have caused problems before. Cattle grubs are the best example of this because it is impossible to estimate the number of grubs within a cow.

Choice of control techniques can be a complex decision, dependent only in part on the pest present. Treatment for one pest may reduce the impact of several other pests or it may cause other problems. For example, in northern states, use of a systemic insecticide for cattle grub control in the fall may have the added benefit of reducing louse populations. Use of the same systemic for louse control in winter may, however, kill cattle grubs near the spine or gullet, causing a toxic reaction in the cattle. Understanding the life cycles of the pests in your area and the effectiveness of available pesticides will help maximize benefits while minimizing the risks.

Table 1. Estimated potential losses in cattle production due to insects, ticks and mites.

Arthropod pest	Annual Losses
	($ million)
Horn fly	730.3
Mosquitoes	38.7
Face fly	53.2
Cattle grub	607.8
Lice	126.3
Scabies and mange	29.7
Ticks	275.7

Adapted from: Drummond, R. O., G. Lambert, H. E. Smalley, Jr. and C. E. Terrill. 1981. Estimated losses of livestock to pests. *In* Pimentel, D. (ed). Handbook of pest management in agriculture. CRC Press, Inc., Boca Raton, FL. pp. 111-127.

How many flies, lice or other pests should be present before control measures are economically worthwhile? This number is known as the economic threshold. Economic thresholds depend on many variables including the ability of the pest to reduce weight gains, ability to transmit disease, speed of pest reproduction, price of cattle and cost and effectiveness of the control method. Many compounding factors have made establishment of economic thresholds difficult, not the least of which is evaluating the effect of each pest species under rangeland conditions. Unfortunately, economic thresholds have not been established for most pests of rangeland cattle.

Although ranchers usually do not have the resources to establish economic thresholds, they have at least partial control over cattle nutrition. Nutrition appears to be a factor in determining the impact of pests on cattle. Poor nutrition generally increases the impact of parasites on infested animals and may actually enhance parasite populations. Animals fed low protein diets or inadequate amounts of some vitamins have been found to harbor significantly greater numbers of certain external parasites than well-fed animals.

Resistance or tolerance of cattle to insect pests is a complex subject that is not well understood. Some of the Indian breeds appear to perform better than the European breeds in areas heavily infested with ticks. Individual animals within a breed can vary in their resistance or susceptibility to parasites. Breeding for natural defense mechanisms (resistance) in cattle to reduce external parasite infestation has not been widely practical to date, however.

A variety of other things should be considered when choosing a control technique, especially when pesticides are used. These include potential toxicity and exposure to pesticides by workers, neighbors, wildlife, fish and other organisms. Workers who are mixing or applying pesticides need to read and carefully follow the safety precautions on the product label.

Endangered animal and plant species will soon be protected by new laws and regulations that prohibit the use of certain pesticides in areas where these species occur.

Under the hazardous waste laws, proper disposal of excess pesticide spray or spent dip solution is becoming more difficult and enforcement of the laws is becoming stricter. One of the main concerns about improper pesticide disposal is the potential for surface and ground water contamination.

Cooperation among cattlemen for pest control can be a major factor in reducing pest damage and control costs. In the United States, a cooperative program among cattle producers and state and federal agencies has practically eliminated the primary screwworm. Quarantines for scabies have reduced and restricted outbreaks.

Some agencies that can provide insect control information are the Cooperative Extension Service, U.S. and state departments of agriculture, state health department and state department of ecology or environment. Other sources of such information include veterinarians, local pesticide dealers, cattlemen's associations and private consultants.

Face Fly

Origin and Distribution

The face fly, *Musca autumnalis* DeGeer (Fig. 1), was introduced into North America from Europe in the early 1950's. Since then it has spread throughout the United States except for parts of the South.

Fig. 1. Adult face fly.

Fig. 2. Heavy face fly infestation.

Description

Adult face flies are similar in appearance to house flies but are slightly longer and heavier bodied. The larvae are small, white maggots that taper toward the head and have the back end squared off.

Injury

The mouthparts of the adult face fly act like sponges, soaking up the tears, mucus and saliva that the insect uses as a source of protein. Their mouthparts have small bristles that can cause irritation when the flies feed at the surface of the eye or at the conjunctiva around the eye (Fig. 2). The resulting irritation has been thought to reduce animal grazing and feed use. This irritation may cause the cattle to bunch together or seek dense shade to avoid the flies. Research in Oklahoma indicated that face flies had no effect on weight gains of beef heifers that had access to optimum feed and that had no evidence of eye disease.

Other research indicates that the face fly's involvement with pinkeye is of major economic importance. Pinkeye, also known as infectious bovine keratoconjunctivitis (IBK), is an inflamation of the cornea and conjunctiva that may eventually result in blindness. Typical symptoms include sensitivity to light, excessive tearing and clouding and ulceration of the cornea. Pinkeye occurs most frequently in the summer. All ages of cattle are affected but the problem tends to be prevalent in cattle younger than 1 year. Although the incidence of pinkeye varies from year to year, it is usually a recurring problem within affected herds. A bacterium, *Moraxella bovis*, has been proven to cause pinkeye. Face flies have also been shown to transmit this bacterium. Pinkeye can occur without the presence of face flies, however, so face fly control will not absolutely prevent pinkeye outbreaks.

Research does indicate a correlation between face fly numbers and the incidence of pinkeye. In a Tennessee study, herds with 6 to 10 face flies per face had a 12 percent incidence of pinkeye and herds with 16 to 25 flies per face had 28 percent pinkeye.

Factors that may predispose cattle to pinkeye include bright sunlight; dust or pollen; tall, rough forage; nutritional deficiencies; viral infections, especially infectious bovine rhinotracheitis (IBR), and irritation from face fly feeding.

Eye worms of the genus *Thelazia* can be mechanically transmitted by the face fly. The economic significance of these nematodes is not clearly defined. Eye worm larvae are ingested from the surface of the cow's eye by the adult face fly. The larvae then develop to the infective stage in the fly and are retransmitted when the infected flies feed around the eye.

Life Cycle

The life cycle of the face fly from egg to adult may be as short as 10 days during the summer months and as long as 21 days in the spring and fall. The adults

lay eggs in fresh, undisturbed cattle dung. The eggs hatch within a day, and the maggots complete their growth in 3 to 4 days. The maggots migrate out of the manure pat and pupate in the soil. The pupal stage lasts from 3 to 10 days, after which the adult flies emerge, mate and feed.

Successive generations occur from March to November depending on climate. Adult flies overwinter in protected areas such as inside buildings and hollow trees. In the spring these flies mate and then disperse. Face flies are strong fliers, capable of traveling more than a mile in search of food and resting sites.

Adult flies live 20 to 50 days depending on air temperature. Females lay an average of 100 eggs during their lifetime and use the eye secretions from cattle as a protein source for egg development. Males feed on cattle secretions only early in their adult life and so represent only about 7 percent of the flies on the cattle. Less than 5 percent of the adult population is on the cattle at any one time, making certain control measures relatively ineffective.

When To Control

An exact economic threshold has not been determined for face flies. However, research at Purdue University suggests that control be instituted when densities reach 8 to 10 flies per head. To survey, count face flies resting on the face and head during a 10-second interval and, if possible, include 15 animals in the survey. Survey only cattle that are of the same sex and age, and avoid using calves and bulls. Ideally, conduct the observations between 10 a.m. and 12 noon once a week during the fly season. Since face flies and horn flies occur at the same time, surveys for both of these pests can be made simultaneously.

Control

Control of face flies is difficult because face flies only remain on the cattle for short periods of time. Less than 5 percent of the face fly population may be found on livestock at any one time. Face flies can also move long distances in short periods of time, so treated cattle may be continually reinfested. Therefore, effective control must include many repeated insecticide applications to the faces of animals during the season.

Spraying or dipping is an effective but not a practical method of control on range cattle. Dust bags and backrubbers containing various insecticides are effective in controlling face flies especially if the cattle are forced to use them and the devices are constructed so that the animal's face is treated. Cattle can be forced to use self treatment devices if the devices are put up between pasture and water or in entrances to fenced salt-mineral boxes. Ear tags and ear tag tape treated with insecticides are also effective. Control is much more effective for face flies when one tag is used in each ear rather than one per cow or one per cow-calf pair as used for horn flies.

Feed additives containing insecticides have been used to control the maggots in manure. The effectiveness of this control method has been variable because of reinfestation from surrounding untreated areas and variability in consumption of the additive when it is provided as a self-fed mineral supplement.

Horn Fly

Distribution

The horn fly, *Haematobia irritans* (L.), is distributed throughout North America and has been classified by some authors as the single most important pest of range cattle on the continent. In 1976, this biting fly cost the United States an estimated $365 million in production losses and control costs.

Horn flies, both male and female, spend almost their entire adult life on cattle. Both sexes feed on blood by piercing the skin, causing annoyance and pain. They are intermittent feeders and may take from 10 to 30 blood meals per day. Bulls attract more horn flies than cows with as many as 10,000 flies per bull being reported. Populations of 1,000 to 4,000 are relatively common during mid-summer. Such numbers cause significant blood loss to cattle in addition to the extreme irritation from their feeding.

Horn flies are also implicated in transmitting a skin worm (*Stephanofilaria* spp.). This nematode reduces the value of hides for leather, but the incidence of the nematode in either cattle or horn fly populations is unknown. No other diseases are presently known to be associated with the horn fly.

Fig. 3. Horn fly adult.

Fig. 4. Heavy late fall infestation of horn fly.

Description

Adult horn flies are half the size of the common house fly and are light gray in color. The head of the horn fly usually points downward and the wings are held flat over the back and angling out from the body at about 60 degrees (Fig. 3).

The flies are usually concentrated on the backs and shoulders of cattle when the weather is cloudy or cool. During sunny weather the air temperature seems to determine their location on the animal. As the air temperature rises in the morning, the flies first concentrate on the sunny side of the animal, then on the shaded side and later on the underside along the belly midline. As the air temperature lowers during the late afternoon and evening, the flies return to the sides and back of the animal (Fig. 4). During inclement weather, horn flies tend to move to the belly midline.

Life Cycle

With the horn fly's reproductive potential and relatively short developmental period, large populations can occur in a short time. During her 3- to 7-week life span, a female may produce between 80 and 200 eggs, laying them in undisturbed dung less than 2 minutes old. The eggs hatch within 24 hours. Depending on temperature, the maggots take 3 to 10 days to reach the pupal stage. Pupation occurs in the manure or in the soil below the pat. Adults emerge in 5 to 13 days, and the new generation females begin to lay eggs after 2 days. Under ideal temperature and moisture conditions, the entire life cycle can be completed in less than 2 weeks. In dry areas, manure pats dry rapidly, so egg and larval mortality is high, and large fly populations do not develop. The flies overwinter in the pupal stage in cooler climates.

When To Control

Exact economic thresholds have not been determined for the horn fly on range cattle. In Oklahoma, fly-free Hereford steers had an average daily gain about 0.2 pound higher than steers infested with an average of 700 flies per animal. In the research literature, estimates of weight gain reductions vary from 0.25 to 0.5 pound per day.

Current guidelines indicate that control measures should be initiated when horn fly counts average 100 flies per side. Count flies on at least 15 animals of the same sex and age, avoiding bulls and calves. Estimate the number of flies resting on one side of the animal from top of back to the belly, and from the point of the shoulder to the back leg during a 10-second interval. Make the counts at the same time each day, preferably between 10 a.m. and 12 noon.

Fig. 5. Dust bags for range fly control.

Control Methods

Horn flies are controlled with insecticides. Dust bags and backrubbers were historically the most common method used in horn fly control on rangeland and have been shown to give good control when properly positioned and maintained (Fig. 5). Backrubbers and dust bags are now used in conjunction with ear tags and ear tag tapes to suppress horn fly populations.

Place dust bags and backrubbers in entrances to fenced salt boxes or watering areas so that the animals are forced to treat themselves. Use a minimum of one applicator device for every 25 head. Hang dust bags so that the bottom of the bag is about 38 inches from the ground and fill with 8 to 10 pounds of insecticide. Hang cable-type backrubbers so the middle portion of the cable is 18 to 30 inches above the ground. Recharge with insecticide-oil mixture every 2 weeks. Use the type of oil stated on the insecticide label. Do not use crankcase oil because it causes severe blistering of the skin. Excessive amounts can cause illness or death.

Insecticidal ear tags and ear tag tapes have provided good horn fly control (Fig. 6). These tags and tapes are impregnated with an insecticide that is released over several months. As the animal swings its head while grooming, the insecticide is distributed over its sides and back. The advantages of tags or tapes are that once they are in place no maintenance is needed and that they usually will provide several months of fly control. Unfortunately, horn fly resistance to some of the insecticides used in these devices has been reported in areas of the United States. If you suspect that horn fly resistance may be a problem in your area, contact your Cooperative Extension Service for guidance.

Fig. 6. Ear tag (unnumbered) for range fly control.

Insecticide-mineral combinations to be fed to cattle are available. The insecticide in the combination passes through the animal and kills the horn fly maggots in the manure. The effectiveness of these treatments has been variable because of reinfestation from nearby untreated areas and inconsistent consumption of the insecticide. Other methods such as sprays, pour-ons and aerial spraying are usually not practical for horn fly control in rangeland situations.

Black Flies

Distribution

Although black flies (primarily *Simulium* spp.) occur in all the Western States, they are a problem for range cattle only in some localities.

Injury

Black flies are not known to carry diseases of cattle, but they can cause considerable irritation and blood loss when populations are large. During moderate black fly attacks, grazing is disrupted and milk production decreases. Canada has reported numerous livestock deaths caused by extremely large black fly populations.

Description

Black flies have a humpbacked appearance from which they get the common name of buffalo gnat. Like mosquitoes, only the female flies feed on blood; males feed on flower nectar. The different species range from 1 to 5 mm long and may be gray or olive as well as black (Fig. 7).

Life Cycle

Larvae develop in swiftly flowing streams where they cling to rocks and aquatic vegetation. Depending on the species, water temperature and food availability, larval development takes from 2 weeks to a year with as many as 12 generations a year. Black flies are usually the greatest problem in early summer. The flies commonly travel several miles from their emergence areas but wind blown swarms have been reported to travel over 100 miles.

Control

Control of black flies on range cattle by individual ranchers is usually not economically feasible. Area-wide programs that control the larvae in the aquatic environment have been successful in some states. Applying insecticide to streams requires prior approval of state and federal agencies, however.

Fig. 7. Adult black fly.

Fig. 8. Mosquito adult.

Mosquitoes

Distribution and Injury

Mosquitoes are important pests of man and livestock because of their biting habits, potential for large populations, widespread distribution and ability to transmit disease (Fig. 8). The major effects of mosquitoes on cattle are irritation and blood loss.

Life Cycle

Several species of mosquitoes attack cattle. However, the timing and requirements of egg laying and development of the different species vary considerably. Mosquitoes need standing water for larval development, and generally, egg-laying and larval development occurs almost anywhere water collects. Several species, known as floodwater mosquitoes, lay their eggs on damp ground. The eggs can remain there several years until the area is flooded again and conditions become right for the eggs to hatch.

Control

Control of mosquitoes under rangeland conditions is rarely economically practical for the individual rancher. Insecticide sprays and repellents lack residual activity and only provide temporary control. Successful efforts have been aimed at controlling the mosquito larvae on an area-wide basis. Because of the differences in breeding habitats, identification of problem species is an important step in developing control measures. Local mosquito abatement districts or vector control authorities can often help identify mosquitoes and provide information about breeding sites and control.

Biting Gnats and Midges

Description and Injury

Biting gnats and midges (*Culicoides* spp.) are commonly called no-see-ums and punkies. These small, 0.6

Fig. 9. Adult *culicoides* gnat.

to 5 mm insects feed on blood and can cause considerable irritation if present in high numbers (Fig. 9). One species is an important vector of bluetongue disease in cattle.

Bluetongue is caused by a virus that is transmitted by *Culicoides* gnats. Usually, less than 10 percent of an infected herd will show signs of the disease even though over 50 percent of the animals may harbor the virus. Early signs of the disease are a high fever, depression and reluctance to move. Infected cattle slobber profusely; their muzzles become crusty or have a burned appearance. Ulcers develop in the mouth, particularly on the dental pad and lips. In some cases, the tongue will become swollen, bluish and protrude from the mouth. Lameness may be observed and the skin may crack in the neck region or between the tail and udder. The teats of nursing cows may have a burned appearance. If cows are infected early in gestation, the brain of the developing fetus may be damaged, resulting in dummy calves.

A vaccine against bluetongue virus is available. Several problems are associated with the use of this vaccine, however, so veterinary advice should be sought.

Life Cycle

Biting gnats of the genus *Culicoides* breed between early summer and fall in areas of shallow water. This may be in wet pastures, along slow streams, in ponds or in open septic tanks. Shallow, muddy sloughs are favorite breeding sites for the gnats. Leaking water troughs also provide ample water and mud for developing larvae. The larvae feed on organic matter in the water, hence their preference for manure-polluted water. Many generations of gnats may develop per year, each requiring about 2 weeks from egg to adult. The insect usually overwinters as a larva, but in mild climates the adult may live through the winter.

Control

Reducing breeding areas is the most important way to control *Culicoides* gnats. Draining unneeded ponds reduces breeding areas. If this is not possible, consider managing water levels in the ponds. Raising and lowering the water level on a weekly basis will allow the pond edges to dry out before the larvae can mature. Make the banks steep so less shallow, muddy area is available for the larvae to develop. Eliminate vegetation around the pond to reduce adult resting sites. Repair leaking water troughs to eliminate additional breeding areas. Spraying range cattle for gnat control is probably not economically feasible.

Cattle Grub

Injury

Cattle grubs (*Hypoderma* spp.), also known as heel flies or warble flies, spend most of their lives as larvae migrating through the body of the host animal. Both the adult flies and the larval grubs reduce cattle production. The adult flies neither feed nor bite but can cause injury and can reduce milk production and weight gains as cattle run wildly in an attempt to escape them. Larval injury results in reduced weight gains caused by cysts and the accompanying irritations in the loin area. Hides that are perforated by the grubs are weakened and devalued.

Description

Two species of cattle grubs commonly affect cattle in the western U.S. They are the common cattle grub, *Hypoderma lineatum* (de Villers), and the northern cattle grub, *Hypoderma bovis* (L.). In both species, much of the adult fly's body is covered by black hairs, with bands of orange to yellowish white hair across the abdomen (Fig. 10). Although the adult flies resemble bees, they neither sting nor bite. In fact, the mouthparts of the adults are not functional, and the adult fly does not feed at all. Nevertheless, cattle will flee wildly when the female fly attempts to lay its eggs. The northern cattle grub fly is slightly larger and more aggressive than the common grub fly. Cattle seem to react more strongly to the attack of the northern grub fly.

Life Cycle

The life cycles of the common and northern cattle grubs are similar. During their 3- to 10-day adult life, female flies can lay about 500 eggs. The eggs are usually attached to the hairs of the animal's lower legs but may also be attached to the sides, udder or rump. The eggs hatch in 3 to 4 days, and the tiny larvae move down the hair and burrow through the skin. When these larvae penetrate the skin, a small quantity of serum oozes out. This, together with the irritation in the skin itself, can produce a scab.

Fig. 10. Adult heel fly (cattle grub).

Once inside the animal, the larvae migrate through

the connective tissues. Within 1 to 2 months, the first instar larvae of the common grub have migrated to a resting site beneath the lining of the gullet, although they also may be found around other internal organs. The larvae of the northern cattle grub concentrate in tissues around the spinal cord. In the 6 to 7 months that the larvae live in these locations, they grow from about the size of a grain of rice to six times that size.

Larvae that survive migrate to the back of the cattle, cut a breathing hole in the skin and form a pouch or warble between the inner and outer layers of skin. Warbles are oval bumps about the size of a half walnut when the larvae are fully grown (Fig. 11). After growing rapidly for 6 to 8 weeks, each larva enlarges its hole, exits the warble and falls to the ground. The larva pupates and, depending on temperature, the adult fly emerges in 14 to 60 days to mate and start the cycle again.

Fig. 11. Mature cattle grub larva in back of cow.

Fig. 12. Damage to hide from cattle grubs.

Fortunately, the mortality of the larvae from the time the eggs hatch to the time they emerge from the back is probably greater than 50 percent, and in resistant animals mortality may approach 100 percent. Many ranchers have observed that older cattle have fewer grubs than calves or yearlings. Five-year-olds are often completely free of infestation and are more likely to show a localized skin reaction to the entry of newly hatched larvae (Fig. 12).

Control

Effective control of cattle grubs is possible with systemic insecticides that are absorbed into the cow's system and kill the larvae within the cow (Fig. 13). Efforts to control the adult flies or the larvae before they penetrate the skin have not been effective.

The systemic insecticides currently in use can provide effective control but occasionally cause problems if not applied at the right time. If a large population of the common cattle grub is around the esophagus when killed, the reaction of the cow's body to the dying larvae can cause the area to swell and partially or completely close the esophagus. If this happens, bloat, profuse salivation and discomfort are the common symptoms. In extreme cases death has resulted from bloating. Northern cattle grubs that are killed while in the spinal column may cause pressure on the spinal cord, resulting in temporary or occasionally permanent paralysis of the hind quarters.

Fig. 13. Dipping cows for cattle grubs and other external parasites.

With both fly species, affected cattle may also be wobbly and stagger when walking, have difficulty eating or drinking and show general discomfort. This host-parasite reaction does not always occur. Some large commercial feedlots have reported incidences of host-parasite reactions occurring in about 2 out of 1,000 cattle treated.

Unfortunately, many of these symptoms resemble organophosphate insecticide poisoning and treating the animals for this poisoning can make the situation worse. With most organophosphates, symptoms will usually appear within 12 hours after the chemical was applied. If the label directions for the insecticide have been followed, the symptoms are much more likely to indicate a host-parasite reaction than an insecticide poisoning. Treatment with lower-than-labeled doses may prolong the death of the grubs, making a host-parasite reaction even more likely. Cattle should be observed for 48 hours after treatment, and a veterinarian should be consulted if any of these problems occur.

Ideally, the migrating larvae should be controlled before they reach the gullet or spine. Although the parasite's life cycle seems fairly straightforward, several factors expand the egg-laying period and make decisions about the timing of control difficult. One factor is that the northern cattle grub adults usually emerge 30 to 60 days after the common cattle grub. The common grub covers the entire United States while the northern grub is present over about the northern two-thirds of the country. Therefore, the egg-laying period is longer in the northern region. Temperature is the major factor affecting maturation of the pupa, so elevation and latitude have a considerable impact on the date of fly emergence. In the spring, relatively short warming periods above 54°F can cause fly emergence. Also, moving cattle from warmer to cooler regions in the spring can expose them to more fly attacks.

These factors complicate the timing of grub control. In the northern states, application of systemic insecticides is usually recommended soon after the first killing frost in the fall. In areas with warmer climates, insecticides must be applied earlier to avoid host-parasite reactions. Your Cooperative Extension Service specialist or veterinarian can recommend treatment dates for your area.

Wound Maggots

Injury

Maggots that infest wounds can be a problem when surgical procedures are done or accidental wounds occur during the time flies are active. Wound maggots can be divided into those that must feed on a living host and those that normally feed on carrion but can become a parasite of living animals if the opportunity occurs. These two types of fly parasitism are known as obligatory and facultative myiasis, respectively.

The best-known example of obligatory myiasis in the United States is the primary screwworm [*Cochliomyia hominivorax* (Coquerel)]. Before the eradication program that started in 1962, primary screwworm cost Southwest cattle producers millions of dollars in livestock losses and treatment costs. Through the release of sexually sterile male screwworm flies, the range of this pest has been moved farther south in Mexico. Outbreaks have since occurred periodically in the previously infested areas of the U.S., however, and cattlemen should report any infestations of maggots in fresh wounds. Several species of screwworms that normally attack only dead or decaying tissue are occasionally found in fresh wounds so proper identification of maggots is important to the continuing control effort.

Facultative myiasis occurs when flies that normally feed on carrion lay their eggs on dead tissues in wounds. Some of these species will feed only on the dead tissue but others may proceed into living tissues, causing secondary infections.

Description and Control

Blow flies (*Phaenecia* spp., *Phormia* spp.) are the most common wound maggots. The adult flies have a metallic blue, green, bronze or black metallic sheen (Figs. 14abc).

Because of the stress and secondary infections that wound maggots cause, preventing infestations is much better than curing them. If possible, castrating, dehorning and branding should be done before large fly populations develop. Cattle with open wounds from surgery, accidents, fighting, etc., should be treated with an insecticidal spray wound treatment to prevent or control maggot infestations during fly season.

Fig. 14. (a) Adult green blow fly, (b) blow fly and (c) blow fly larvae in wound.

Lice

Injury

Cattle lice cause losses to ranchers in a variety of ways. Heavy louse infestations reduce weight gains of cattle. In Nebraska, heifers with infestations of 10 or more lice per square inch gained 0.2 pound less per day than treated animals. Lousy cows produce less milk and wean lighter calves. Due to the great blood loss, extremely heavily infested cows may develop louse-induced anemia and abort their calves. Anemia may also lower the animal's resistance to diseases. Infested cattle damage fences, corrals and feed bunks by rubbing to relieve the irritation caused by lice feeding.

Description

Cattle lice are primarily a problem during the winter. Populations are usually much lower during the summer because temperatures are higher and the animal's hair is shorter, allowing better self grooming. Usually, however, 1 to 2 percent of the cattle in a herd are carriers that harbor high numbers of lice all year. Bulls are often carriers because of their denser coat and lesser ability to groom themselves thoroughly. Lice spread by contact between these carriers and the rest of the herd. Research has indicated that animals fed a low-protein diet have less resistance, which allows louse populations to increase.

Two types of lice infest cattle, sucking lice and biting lice (Figs. 15abc). The common sucking lice in the western U.S. are the shortnosed cattle louse [*Haematopinus eurysternus* (Nitzsch)], the longnosed cattle louse [*Linognathus vituli* (L.)], and the little blue cattle louse (*Solenopotes capillatus* Enderlein). Adult sucking lice vary from 1/16 to 1/10 inch in length, have strongly clawed legs and have relatively small heads. The cattle biting louse or little red louse [*Bovicola bovis* (L.)] does not suck blood like these species but feeds by scraping material off the surface of the skin. Adult biting lice are about 1/16 inch long, do not have strong claws and have a much larger head than the sucking lice.

When To Control

Cattle are commonly infested with more than one species of lice. The different species tend to have different preferences for age of cattle and feeding location on the animal's body. However, one species or another can be found on cattle of all ages and in most locations on the animal. Except for large populations, infestations of lice are not immediately obvious.

When examining cattle for lice, special attention should be given to the base of the tail, topline, neck, dewlap and head. To find the lice, part the hair and examine the skin and base of the hair under a strong light.

Control

Control of cattle lice involves treatment with one of several registered insecticides. Many different application methods are available including sprays, dips, pour-ons, dusts, dust bags, backrubbers and injections.

When using systemic insecticides, ranchers should be aware of the possibility of host-parasite reactions in grub-infested cattle (see section on Cattle Grubs). Cattlemen should also realize that systemics do not control louse eggs and a second treatment may be required for heavily infested cattle.

Cattle with severe louse-induced anemia may be more susceptible to insecticide poisoning, especially with systemics, and should be handled gently because of their stressed condition. Consult your Cooperative Extension Service specialist or veterinarian for specific control recommendations.

Sanitation can help limit the spread of lice in a herd. Isolate and examine newly purchased animals. If they have lice, treat them before incorporating them into the herd. If infested cattle have come in contact with bedding, feed bunks, sheds or trucks, keep other cattle away for 10 days.

In cold weather, lice and eggs that fall off or are rubbed off die in a few hours. In warm weather, however, lice can live away from the cattle for several days, and some eggs that fall off the cattle may hatch.

Fig. 15. (a) Colonies of little blue sucking louse, (b) cattle biting louse and (c) little blue sucking louse.

Ticks

Injury

Ticks have the potential of causing a variety of problems for ranchers. Irritation from these blood-sucking parasites may reduce food intake and weight gains. Tick-induced anemia, tick paralysis and tick-borne diseases such as anaplasmosis can result in serious losses.

Description

Ticks are classified as hard or soft ticks by their structure. Hard ticks are smooth and flat before they engorge themselves with blood, and their mouthparts can be seen easily from above (Fig. 16). Soft ticks have a leathery, granulated or raisin-like appearance before engorgement, and their mouthparts usually cannot be seen from above.

Life Cycle

Ticks are also classified by their life cycle. Ticks infesting cattle in the United States are most commonly one- or three-host ticks. One-host ticks require only one animal on which to complete their life cycle. Adult females drop off their host to lay eggs. Small 6-legged larvae or seed ticks emerge from the eggs and try to find a suitable host. Once a host is found, the one-host tick will feed and molt on that same animal to become an 8-legged nymph and then a sexually mature adult that will start the cycle again.

Two-host ticks are not usually found in the United States.

Three-host ticks use a different host for each life stage. Eggs are layed off the host. Each larvae, nymph and adult requires a blood meal. After feeding, each drops off the host to molt. Hosts for the larvae and nymphs are usually birds or small mammals. Adults tend to feed on larger animals such as cattle. None of the stages has a distinct host preference, however. The life cycle of some of these ticks can take as long as 3 years. Most of that time is spent off the host where temperature, rainfall, vegetation type and host availability affect tick survival.

Control

Control of ticks in rangeland situations is often difficult because of the large number of potential hosts and their long survival time without feeding. To obtain adequate control, insecticides must be applied to the entire body as a dip, spray or dust. Under most conditions, insecticides will not provide season-long tick control. Because the spinose ear tick only infests the ear, certain insecticide impregnated ear tags and sprays or dust applied in the ear have been effective for this pest. Management techniques such as brush removal to reduce favorable habitat and improve range condition have been helpful in reducing populations of certain ticks. Rodent control to reduce larval hosts and rotation grazing to leave infested areas vacant usually have not been economically practical.

Ticks of major importance on cattle in the western U.S. include the Rocky Mountain wood tick, spinose ear tick, winter tick, Pacific coast tick and pajaroello tick.

Rocky Mountain Wood Tick

The Rocky Mountain wood tick (*Dermacentor andersoni* Stiles) is a three-host, hard tick that is distributed in the western U.S. between the Rocky Mountains and the Cascades and Sierra Nevadas. This species is one of the main causes of tick paralysis. This condition results from the ticks feeding at the base of the skull. Sometimes the animal will not be able to stand and may die if the ticks are not removed. Rapid recovery usually follows removal of the ticks. This tick is also a vector of anaplasmosis, a protozoan disease causing severe anemia in cattle. Anaplasmosis causes more severe losses than the effects of the ticks.

Spinose Ear Tick

The spinose ear tick [*Obobius megnini* (Duges)] is a soft, one-host tick that is distributed throughout the western U.S. The life cycle of this tick is slightly different from that of other one-host ticks. The larva attaches deep in the host's ear, feeds and molts (Fig. 17). After the second molt within the ear, the nymph has its characteristic spiny appearance. This nymph feeds, drops to the ground and molts to an adult.

Feeding of this tick within the ear canal causes considerable irritation which results in the animal tossing its head and rubbing its ears. Deafness can result from perforation of the ear drum or secondary infections.

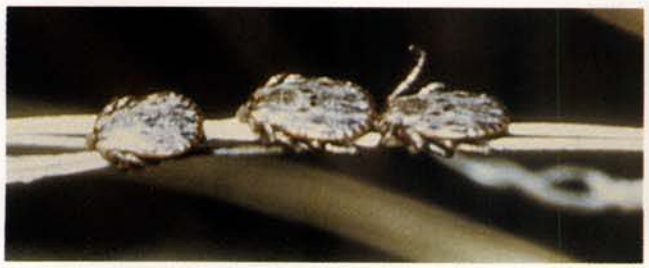

Fig. 16. Hard ticks on grass.

Fig. 17. Spinose ear ticks.

Winter Tick

The winter tick [*Dermacentor albipictus* (Packard)] is a hard, one-host tick who is most active during December and January. The ticks feed on cattle for 5 to 14 weeks, developing from larvae to nymphs to adults. Females drop off the host and lay their eggs. Larvae hatch in the spring but are inactive until the fall when they seek a host by climbing onto vegetation. The winter tick can transmit anaplasmosis but is not considered an important vector of the disease. Distribution is throughout the West.

Pacific Coast Tick

The Pacific coast tick (*Dermacentor occidentalis* Marx) is a hard, three-host tick found west of the Cascade and Sierra Nevada mountains except for the desert regions of southern California. It has been implicated as a vector of anaplasmosis and several diseases affecting humans. It also can cause tick paralysis.

Pajaroello Tick

The pajaroello tick [*Ornithodoros coriaceus* (Koch)] is a soft, multihost tick that has been found in much of California, southern Oregon and northern Nevada. This tick inhabits deer and cattle bedding areas. Eggs hatch in 10 to 20 days. After finding a host, the larva feeds for about 7 days, then falls off and molts to a nymph. Nymphs may molt as many as 7 times, each molt requiring a blood meal. The nymphs drop from the host after each meal. Feeding time is short compared to most other ticks, lasting from 8 to 100 minutes. Adults can complete feeding in 5 to 50 minutes. These ticks do not attach to moving hosts but wait to attack until the host lies down. Females lay 150 to 300 eggs in each of about 4 batches a year over a lifetime of up to 5 years. Nymphs and adults can do without a blood meal for as long as 2 years.

Pajaroello ticks have been incriminated as a vector of Epizootic Bovine Abortion (EBA) or foothill abortion. In humans, their bite can cause a severe allergic reaction that requires medical attention.

Mange and Scabies

Mange and scabies in cattle are caused by several species of parasitic mites that live on the surface of the skin. Large infestations of these mites cause intense itching, skin damage, reduced weight gains and even death. The most damaging of the mange-causing species are sheep scab mite [*Psoroptes ovis* (Hering)], chorioptic mange mite [*Chorioptes bovis* (Gerlach)] and itch mite [*Sarcoptes scabei* (De Geer)]. In addition, the cattle itch mite (*Psorergates bos* Johnston) has been an occasional problem in the Southwest. Infestations by any of these mites are considered reportable conditions, subject to state and federal quarantines. Quarantine and mandatory federal control have reduced mange and scabies to rare problems, but cattlemen should be aware of these diseases to prevent major outbreaks.

Sheep Scab Mite — Psoroptic Scabies

The sheep scab mite is considered the most economically important species infesting cattle. Research in Texas indicates that weight gains of beef steers began to decline when the infestation covered more than 15 percent of the body area. This research also found several calves with infestations covering more than 40 percent of the body died as a result of hypothermia caused by loss of hair and mite-damaged skin. The cost of complying with quarantine regulations is probably the major cost of this disease.

Sheep scab mites live on the surface of the skin, feeding on lymph and plasma that exudes when the mites pierce the skin. Eventually, this feeding causes hard, crusty, blood-stained scabs. Lesions of psoroptic scabies traditionally appear first on the withers, rump and neck. Increased use of dust bags and pour-ons to apply insecticides have made traditional distinction less clear, however.

Cattle usually will show symptoms of the mite irritation before lesions appear. Cattle become increasingly restless and irritable during the early phases of the infestation. Constant tail switching, rubbing and licking may also indicate a scabies infestation. If these symptoms are present, cattle should be examined for scabies as well as lice. Lice can easily be seen by pulling the hair back to expose the skin. Mite-infested cattle will have hard, blood-stained scabs, but scabies mites can only be confirmed by a microscopic examination of skin scrapings by an experienced person.

Cattle infested with or exposed to psoropti scabies must be reported to state regulatory agencies and owners must comply with quarantine regulations to prevent the spread of the disease. Quarantine regulations not only require ranchers to treat infested cattle but also to disinfect and clean corrals, trucks and other facilities that the animals may have contacted.

Spread of psoroptic scabies most commonly occurs by direct contact with infested animals. Most transmission occurs during winter when cattle bunch together and mite populations are high. Cattle having low mite populations but no disease symptoms can spread the disease during the summer, however. The outbreak then occurs in the late fall or winter. Animals can also pick up the mites from scabs rubbed off by infested cattle on fences, corrals, chutes, trucks and other structures. The mites will survive off the cattle for about 30 days under winter conditions, about 14 days under warm and moist conditions and less than 1 week under extremely hot and dry conditions.

Chorioptic Mange Mites — Chorioptic Mange

Chorioptic mange is the most common form of scabies in the United States. Chorioptic mites live on the surface of the skin and feed on sloughed skin and hair. The serum exudates associated with this mite are thought to be part of an allergic response to the presence of the

mites. This type of scabies is also most prevalent during the winter. It usually starts at the base of the tail and then spreads down the tail and inner thighs and to the udder or scrotum. On heavily infested animals, lesions may spread over much of the body (Fig. 18). Lesions are similar in appearance but usually less severe than those produced by psoroptic mites, and the rate of spread is much slower. The life cycle of chorioptic mites requires 3 to 4 weeks to complete.

Control of chorioptic mange is accomplished in the same manner as psoroptic scabies (see control section). Skin scrapings and microscopic identification by an expert are necessary to confirm the infestation. Cases of double infestation of chorioptic and psoroptic mites have been reported.

Itch Mites — Sarcoptic Mange

Unlike sheep scab mites and chorioptic mange mites, itch mites burrow into the upper skin layers. The females lay eggs in these tunnels and the newly hatched mite larvae burrow into the surrounding area, destroying more tissue and forming large crusty scabs. At least some of the mites are thought to spend part of their lives on the skin surface. The complete life cycle takes from 12 to 15 days. Initial lesions are usually found above the scrotum or udder and on the inner surface of the thighs. Eventually, the entire body may be covered if the disease is not controlled. Infested cattle will rub vigorously, causing skin abrasions and secondary bacterial infections.

Inspection for and control of itch mites are the same as for sheep scab mites. Itch mites are susceptible to dry conditions and survive off the host for only a few days. Itch mites from cattle can also infest man. Although infestations contracted from cattle are usually of short duration, individuals who work with these cattle should wear gloves, wash thoroughly and be extra careful to prevent becoming infested.

Fig. 18. Mange infestation.

Cattle Itch Mite

The importance of the cattle itch mite has not been fully documented. This mite was first reported in New Mexico in 1963 and so far has only been found in the Southwest. The skin condition associated with this mange mite is of minor importance and appears to exist for no more than 2 years even on animals that were once heavily infested. Nevertheless, it is a reportable and quarantinable disease.

Control

Control of scabies mites on cattle has usually meant thorough dipping in a USDA-approved insecticide. To ensure that the infestation has been eliminated, state or federal officials usually supervise control and sanitation procedures. Because the life cycle from egg to adult mite varies from 11 to 17 days and because the available insecticides do not control the eggs, two treatments 10 to 14 days apart are required to control mites. To ensure successful treatment, you must mix the solution adequately before treating cattle and maintain proper insecticide concentration in the dip solution throughout treatment. Hand-treat lesions with the dip solution immediately before dipping the animal to ensure a thorough treatment. Break up hard scabs so the dip can reach the mites below the scab. **Do not dip thirsty animals or pen them in the same lot as the dip vat.** During treatment, cattle must be fully submerged at least once. When animals are dipped in extremely cold weather, drive them a moderate distance after they have been dipped to prevent chilling. To prevent reinfestation, you will need to clean and disinfect corrals, fences, work areas and trucks that have been used by scabies-infested animals.

Additional Reading

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Poisonous Plants

Introduction

Poisonous plants cause large economic losses to cattle ranchers each year. Livestock deaths due to poisonous plants have been estimated at 3 to 5 percent. The National Academy of Science has estimated that 8.7 percent of all nutritionally sick animals in the western U.S. are sick as a result of eating poisonous plants. In addition, poisonous plants cause decreased weight gains; abortion and birth defects. Decreased forage use and increased management add to the total cost.

General guidelines for dealing with poisonous plants on rangeland have centered around grazing management. With some notable exceptions, most poisonous plants are not very palatable to cattle, so many poisoning problems occur when cattle are forced to eat these plants because of hunger or lack of good forage.

The first step in managing poisonous plants is to learn what ones are present. A large number of poisonous plants occur in the United States, and several are considered major problems to cattle in the West. This publication deals only with the major problem species that are widely distributed in the western U.S. Information on other plants is presented in several books and pamphlets on this subject. Information on local poisonous plant problems can be obtained through your Cooperative Extension Service.

Once the poisonous plant problems are identified, learn under what conditions they are toxic and how they are toxic to livestock. While some plants are poisonous at all times, others are poisonous only when environmental conditions favor production of the toxic chemicals.

Although it is rarely an economically viable option, one way of preventing poisoning is to avoid grazing areas where poisonous plants occur. This may involve fencing infested areas and not using these areas at all. When this option is not practical, the impact of these plants can be minimized by several grazing and range management practices.

The main principle in managing poisonous plants is to ensure that cattle always have an adequate supply of quality feed. Most poisonous plants are relatively unpalatable and cattle will not usually eat enough to produce toxic effects if good forage is available. In a few cases, however, poisonous plants are palatable enough to be eaten even in the presence of adequate, good quality forage.

Poisonous plants such as larkspur, which emerges before the main forage species in the spring, are attractive to cattle that have been eating dry forage or hay all winter. To avoid problems with these plants may require supplemental feeding or withholding cattle from an area until the forage has good growth. Adequate water availability is also necessary to reduce the attractiveness of poisonous plants.

Cattle should be fed before putting them on range containing poisonous plants. Hungry animals that have been transported, trailed or handled may not graze selectively. Dense stands of poisonous plants should be avoided when moving or holding hungry cattle.

Animals that are unfamiliar with an area sometimes will eat poisonous plants that native animals will not. New animals should not be introduced to areas that are heavily infested with a poisonous species.

Under limited circumstances, rangeland infested with certain poisonous or nonpoisonous weeds may be grazed by livestock other than cattle with no adverse effects. For example, sheep are less susceptible to larkspur poisoning than cattle and so may feed in early spring on areas where cattle losses would be high.

Control of poisonous plants may be necessary if grazing management practices do not reduce the hazard. Control by mechanical methods or chemical methods is often practical only around intensively used areas such as watering places or holding areas. However, control over large areas may be necessary if infested rangeland is to be used at all. Various herbicides are registered for rangeland use, but local regulations may prohibit herbicide use on public and private land in certain areas. Your Cooperative Extension Service, state department of agriculture or land management agency can provide more detailed information on chemical control and herbicide use restrictions.

If a chemical control program is planned, ranchers should be aware that herbicides may affect the amount of toxic compounds in the plant and the palatability of the plant. Whether the toxicity and palatability increase, decrease or stay the same depends on the plant species and the herbicide used. To avoid this problem and to allow forage species to regenerate, livestock should be withheld from treated areas for 4 weeks. If grass is injured by herbicide treatment, 90 days would be a better waiting period. Good forage must replace the weeds for lasting control.

Arrowgrass

Arrowgrass (*Triglochin maritima* L. and *T. palustris* L.) is a grass-like perennial with fleshy, dark green, half-round leaves that grow from the plant base. The clumps of leaves are 6 to 18 inches tall, and the slender flower stalks may be up to 4 feet tall (Fig. 19). The small, green flowers appear close together on the upper part of the stalk. Arrowgrass starts growing early in the spring on wet alkaline soils and may be common in marshy pastures and native grass hay areas.

Arrowgrass develops toxic amounts of hydrocyanic acid (HCN) when the plant becomes stressed because of lack of water or frost damage. Plants with adequate moisture usually do not cause poisoning. The toxicity of arrowgrass depends on the amount of HCN in the plant and the rate at which it is eaten. As little as

¼ pound of stunted arrowgrass is enough to kill a 600-pound animal.

Fig. 19. Arrowgrass.

Signs of arrowgrass poisoning are typical of cyanide poisoning. These include blue coloring of the lining of the mouth; rapid breathing and gasping; salivation; excitement; muscle twitching, staggering and convulsions; coma; death. Once an animal ingests a toxic amount of arrowgrass, it may die within minutes. The effects of HCN are not cumulative and an animal's system can effectively detoxify sub-toxic doses. Under range conditions, poisoned animals rarely can be treated because HCN acts so rapidly. An antidote is available, however, and poisoned animals might be saved if it is administered promptly. Consult a veterinarian for details.

Because arrowgrass is reported to be somewhat palatable, management is limited to keeping animals off areas where the plant has been stressed by frost or lack of water. Arrowgrass does not have to appear stunted to have toxic amounts of HCN. Check with local sources regarding chemical control.

Bracken Fern

Bracken fern, western bracken or brake-fern [*Pteridium aquilinum* (L.) Kuhn] is a herbaceous perennial with leaves (fronds) that develop from a stout horizontal rhizome (Fig. 20). The fronds are coarse, narrowly to broadly triangular and up to 6 feet in height. Bracken fern grows in moist to dry woods, upland pastures and recently cleared land. Growth begins early in the spring, and the fronds remain green until they are killed by frost.

All parts of the plant are toxic, but the rhizome has about five times the toxicity of the fronds. Green fronds are more toxic than dried, but livestock have been poisoned by hay containing dry bracken.

Fig. 20. Bracken fern.

Early symptoms of bracken poisoning in cattle include a rough coat, depression and a mucous discharge from mouth and nostrils. These are followed about a week later by acute symptoms, including high temperature, loss of appetite, nasal and rectal bleeding, bloody urine and hemorrhaging of mucous membranes. Acute symptoms appear suddenly and last from 1 to 4 days after which the animal usually dies. Ingestion of an amount approximately equivalent to the animal's body weight over a period of 1 to 3 months is necessary to produce the acute disease. Poisoning symptoms may take some time to appear. Deaths have been reported to occur as long as 8 weeks after animals no longer had access to bracken.

Cattle usually will not graze bracken if adequate forage is available. Supplemental feeding may be necessary in dry years when other forage is less available. Poisoning also occurs in the spring when bracken is the only green forage present. Control of bracken by cultivation or mowing is possible but may take 2 to 3 years and may be difficult under range or forest conditions. Check with local sources regarding herbicide registrations and grazing restrictions on herbicide treated rangeland.

Chokecherry

Chokecherry (*Prunus virginiana* L.) grows as a bush or small tree in areas where moisture is plentiful. Leaves are finely toothed and glossy. Flowers are borne in elongated masses, and the small cherries that develop may be red to black (Fig. 21).

Like arrowgrass, chokecherry produces hydrocyanic acid (HCN), primarily in the leaves. The HCN content is highest early in the year and gradually tapers off as the growing season progresses. Heavy frost or water stress may increase the toxicity.

Fig. 21. Chokecherry.

The symptoms and treatment of chokecherry poisoning are the same as those listed under arrowgrass. Ingestion of approximately 0.25 percent of the animal's body weight in chokecherry leaves can be fatal.

Some individual animals seem to develop a preference for chokecherry, but most livestock problems with this plant can be avoided by not allowing hungry or thirsty animals to have access to infested areas. Chokecherry is usually mixed in with other tree or brush species, so control with herbicides is usually not practical over large areas. Control around watering and holding areas may be worthwhile, however.

Larkspur

Larkspur (*Delphinium* spp.) is a herbaceous perennial with leaves that are usually deeply divided into 3 to 5 major segments and flowers that each have a single spur projecting backwards (Fig. 22). Flower color is variable depending on species. The larkspurs can be divided into tall and low larkspurs. The tall larkspurs range from 3 to 6 feet tall and usually grow in open moist areas at higher elevations. They appear early in the growing season, flower in summer and die back in the fall. The low larkspurs are usually less than 3 feet tall and grow in drier areas at lower elevations. They appear early in the spring but flower soon afterward and die back in early summer.

Fig. 22. Larkspur.

Alkaloids have been identified as the toxic components of larkspurs. These alkaloids are at their highest concentrations early in the spring, decreasing as the growing season progresses. The seeds are very toxic, however.

Alkaloids affect the animal's nervous system. Symptoms include uneasiness, a stiff gait, back legs held far apart, repeated falling and rising, involuntary muscle twitching, rapid and weak pulse, constipation, bloat and nausea. Exciting animals that have eaten a toxic dose will induce or intensify the symptoms. Death occurs either by respiratory paralysis or asphyxiation due to inhalation of vomit. The amount needed to poison an animal depends on the species of larkspur and the growth stage of the plant. As little as 0.7 percent of a cow's body weight of larkspur eaten within an hour has caused death.

Management of larkspur is complicated by the fact that it is highly palatable to cattle. Losses can be expected if cattle are grazed on larkspur-infested areas, especially early in the growing season when larkspur is growing and good forage is scarce. Although larkspur poisonings have been reported, sheep appear to be much less susceptible than cattle and have been grazed on infested ranges with no obvious ill effects. Repeated grazing by sheep has not provided effective control of larkspur.

Control of larkspur is often the only option if infested rangeland is to be used effectively. Although it is generally not a viable option, hand grubbing has successfully controlled larkspur when the top 10 to 12 inches of the root has been grubbed and dried. Certain herbicides have been used to control larkspur economically, but some herbicides appear to increase palatability while maintaining the plant's alkaloid concentration. Cattle should not be grazed in treated areas until frost has dried the plants. Contact local information sources for specific herbicide recommendations.

Astragalus (Locoweeds, Milkvetches)

Locoweeds (*Astragalus* spp. and *Oxytropis* spp.) are mostly perennial herbs with flowers that resemble sweet peas (Fig. 23a). Flowers are arranged in groups of a few to many on the end of the flowering stalk. Flower color is variable. Leaves are pinnately compound, each stem having numerous leaflets with one leaflet on the tip of the stem. Fruits are legume pods of various sizes and shapes (Fig. 23b). The genus *Astragalus* is the largest in the legume family with over 300 species listed by some botanists. For this discussion, *Oxytropis* species will be considered the same as *Astragalus*.

Fig. 23. (a) *Astragalus* milkvetch, (b) locoweed and (c) *Astragalus*.

Both types of plants produce identical symptoms in animals that consume them. Many of these species are not poisonous but identification of members of this genus is often difficult, even for trained people. Seed pods may be needed in addition to the flowering plant for accurate identification (Fig. 23c). Locoweeds are commonly found in semi-arid foothills and plains. Growth may start in late fall, winter or early spring depending on species and locality.

Toxicity of *Astragalus* species can be divided into three groups based on their toxic principles and poisoning symptoms. The three types of poisoning are those caused by selenium-accumulating *Astragalus*, nitro-containing *Astragalus* and *Astragalus* plants that cause locoweed poisoning.

Selenium-Accumulating *Astragalus*

Selenium-accumulating plants show many forms and are widespread geographically. These plants accumulate selenium in their foliage. The concentrations are high enough to be toxic to cattle. Plants of this type include two-grooved milkvetch (*A. bisulcatus*), Paterson milkvetch (*A. pattersonii*), stinking milkvetch (*A. pectinatus*) and alkali milkvetch (*A. racemosus*).

Symptoms of poisoning by these plants can be acute or chronic. Acute poisoning is exhibited in abnormal movement, labored breathing, high heart rate and temperature, watery diarrhea, prostration and death. Acute poisoning is rare because of the disagreeable odor and unpalatability of shoots with high selenium concentrations.

Chronic poisoning is exhibited in either "alkali disease" or "blind staggers." The major effect of chronic selenium poisoning is decreased reproduction. Animals will have rough coats, lack vitality, develop lameness and lose appetite, which causes emaciation. Blind stagger symptoms are wandering, stumbling, impaired vision and la ck of appetite. Blind stagger symptoms may be due to an interaction of selenium and other substances in the plant.

Analyzing an animal's hair for selenium content is one way to confirm selenium poisoning.

Nitro-containing *Astragalus*

These milkvetches grow in a variety of habitats including sagebrush deserts, grasslands, mountain forests and alpine meadows. Milkvetches emerge from April to June depending on their habitat. Representative species of this group are *A. emoryanus*, *A. tetroptarus*, *A. canadensis* and varieties of *A. mises.*

Nitro compounds are found throughout the plant, with the highest concentrations in the leaves. As the plant dries, the levels of nitro compounds fall. Nitro poisoning occurs more rapidly and at lower dosages than locoweed poisoning. Acute and chronic poisoning can occur.

Acute poisoning may occur if a cow eats as little as 2 pounds of green milkvetch. Signs of acute poisoning include muscular weakness, frequent urination, lowered head and extended neck, rapid heart beat, respiratory difficulty with a roaring or wheezing sound upon exhalation, bluish mouth and nasal mucous membranes, convulsions, coma and death. Death is a result of heart and respiratory failure.

Chronic poisoning occurs when cattle graze poisonous milkvetches slowly over a period of several days or weeks. Chronic poisoning usually is seen as a condition called cracker heels where the fetlocks knuckle over and weakness in the hind legs causes the rear hooves to knock together as the animal walks. Chronically poisoned animals also exhibit nervousness, staggering gait, respiratory difficulty and visual impairment. Some animals may seem normal until they are forced to move. Chronically poisoned animals may be permanently impaired. There is no known antidote for milkvetch poisoning.

Management of nitro-containing *Astragalus* is difficult because cattle will readily eat it even when other forage is available. Poisoning by milkvetch can be reduced by not grazing animals on infested areas when the levels of nitro compounds are high. Research with Wasatch milkvetch indicates that as the plant dries and loses its green color, the levels of nitro compounds rapidly drop. Because milkvetches are highly palatable and highly toxic, herbicidal control may be necessary if heavily infested range is to be used during the growing season of this plant. Consult local information sources regarding herbicidal control.

Locoweed Poisoning

Locoweeds are probably the most destructive of all poisonous plants. They are widespread, and cattle will develop a preference for feeding on them. There are over 50 varieties in 8 species of *Astragalus* and *Oxytropis* that may cause this type of poisoning.

Locoweed poisoning is a chronic condition that develops slowly. The substance that causes the poisoning has not been determined. Alkaloids have been suspected but may not be the true causative agent. Symptoms of locoweed poisoning are depression, slow staggered gait, loss of coordination, nervousness, dull, staring eyes, a rough coat and emaciation. Pregnant cows will abort or give birth to malformed calves. Affected animals will cease sexual activity, become solitary and hard to handle and may have difficulty eating and drinking.

Symptoms may appear 2 to 8 weeks after the animal has started consuming these plants. Death can be avoided if the animals are removed from infested areas and given good care.

Locoweeds appear to be distasteful to livestock and are usually not eaten unless forage is scarce. Once forced to eat locoweed, cattle may develop a craving for it and prefer it over good forage. Therefore, they should not be grazed on infested ranges until good forage is available.

Water Hemlock

Water hemlocks (*Cicuta* spp.) are biennial herbs 5 to 10 feet tall at maturity (Fig. 24). A small plant grows from a seed or root shoot the first year. A larger plant is produced the following spring and the flowering stalk appears in the summer. Water hemlocks are similar in appearance to poison hemlock, wild carrot and many other species of the wild carrot family. Water hemlocks are distinguishable from the others by the thickened storage portion of the plant. These plants have many tuberous roots rather than a single tap root (Fig. 24a). The thickened underground portion of the stem is hollow with several diaphragms of pith tissue running across it. When the stem is cut it exudes a yellowish, oily liquid that is pungent and smells like raw parsnip.

Water hemlocks occur throughout the U.S. and Canada and grow only in swampy, wet habitats such as streambanks, marshes or areas that are marshy part of the year.

Plants of the genus *Cicuta* are considered to be the most violently poisonous plants in North America. The poisonous substance is found mostly in the roots and rootstock and somewhat less in the below-ground portion of the stem. Early spring shoots are also highly toxic but mature foliage is non-toxic. The roots do not lose toxicity with age or death. The toxin, cicutoxin, is present in the oily liquid in the roots and stem, and is toxic to all livestock as well as human beings.

Poisoning symptoms are very distinctive and specific. Cicutoxin is a convulsant, acting on the central nervous system. Symptoms generally occur about one-half hour after ingestion. Excessive salivation occurs first followed by periods of spasmodic convulsions and periods of relaxation. Convulsions are extremely violent: The animal throws back its head and neck and flexes its legs as if running. The pupils of the eyes dilate and the temperature elevates. Death results from respiratory failure due to complete paralysis, sometimes in less than an hour, usually within 8 hours. Bloat after death is common.

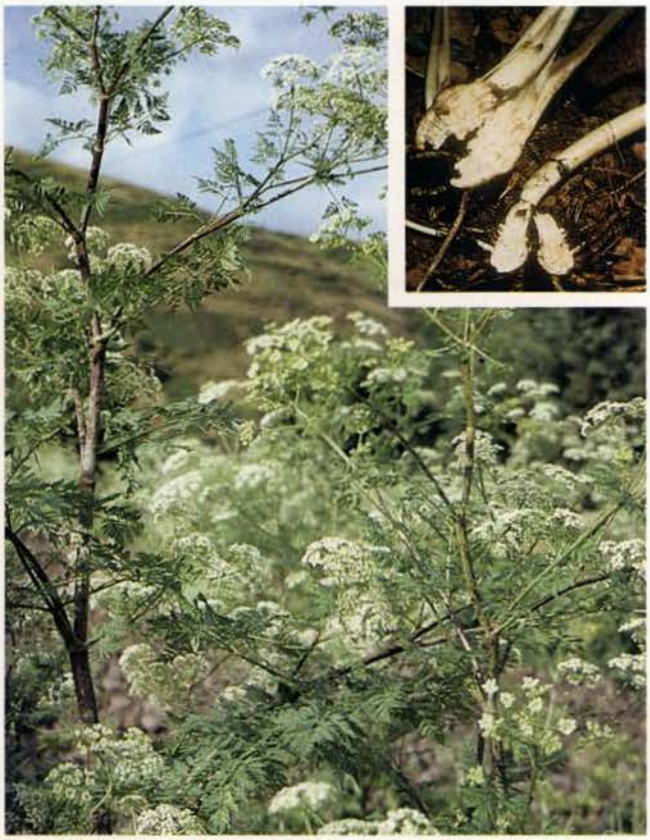

Fig. 24. Water hemlock and (a) inset, water hemlock root showing pith tissue.

Most cattle deaths occur in the spring when cattle feed on early hemlock growth before other forage is available. The ground is also soft in spring and roots may be pulled out of the ground and eaten with the foliage. Management strategies should include not putting cattle on the range until suitable forage is available. The plant can also be controlled by improving drainage of infested areas, if this is possible. Digging up the plants by hand may also be warranted in certain areas. Some mowing and chemical control of the regrowth may be necessary.

Poison-Hemlock

Poison-hemlock (*Conium maculatum* L.) is a biennial or perennial herb that may grow to 10 feet tall. Individual flowers are small, white and arranged in clusters (Fig. 25). Stems are hollow except at the nodes and are usually spotted with purple (Fig. 25a). Leaves are large with a lacey or fern-like appearance. Leaves emerge from the tap root in early spring. Crushed leaves and stems have an unpleasant mousey odor. Poison-hemlock generally inhabits moist areas such as along streams, irrigation ditches or fence lines (Fig. 26).

The toxic constituents of poison-hemlock are alkaloids. All parts of the plant contain dangerous amounts of alkaloids. The concentration of these alkaloids varies according to the part of the plant and the plant's growth stage. The toxicity of the plant parts increases in this order: roots, stems, leaves, fruits. Alkaloid concentrations reach a maximum in these plant parts just before seed maturation.

Poison-hemlock produces acute poisoning and birth defects. Symptoms include nervous trembling, lack

Fig. 25. Poison hemlock in bloom and (a) right, characteristic purple spotting on poison hemlock stem.

Fig. 26. Poison-hemlock on stream bank.

of muscular coordination, excessive salivation, dilation of the pupils, rapid, weak pulse and coma. These signs usually appear within an hour of ingestion. Death from respiratory paralysis usually follows within 2 to 3 hours. As little as 10 to 16 ounces of green leaves are enough to poison cattle. Treatment of poisoned cattle with stimulants and large doses of mineral oil has been reported to save some animals. Cows that eat sublethal quantities of poison-hemlock between the 40th and 70th day of gestation may give birth to deformed calves. The deformities are indistinguishable from those caused by lupine (see the following section for details).

Losses caused by poison-hemlock can be minimized by ensuring that adequate forage is always available on infested ranges and pastures. Most cattle appear to find poison-hemlock distasteful and will not graze it if other feed is available. Herbicidal control has been effective. Consult local sources for herbicide recommendations.

Lupine

Lupines (*Lupinus* spp.) are annual to perennial herbs or semi-shrubs with flowers that resemble those of sweet-pea and compound leaves with leaflets that radiate out from the end of the leaf stem. Flowers are borne in groups at the end of a flower stalk and are most often blue but may also be white, yellow, pink or violet (Figs. 27 and 27a). Lupines generally grow in open areas on well-drained soils. Most of the toxic species are perennials that emerge fairly early in the spring and flower in May to June.

Fig. 27. Range infested with yellow lupine and (a) inset, blue lupine.

Some lupines are toxic to cattle. Alkaloid content is high in young plants and highest in seed. Drying does not reduce the alkaloid content. Other species of lupine have been selected for low alkaloid content and are used for forage and grain.

Poisonous lupines cause a skeletal birth defect in cattle known as crooked calf disease. This defect is characterized in mild cases by bowed forelegs. In severe cases, the forelegs are twisted and cannot be extended. Spinal curvature, twisted neck and cleft palate may also be present. These deformities occur when cows graze certain species of lupine between the 40th and 70th day of gestation. The lupines that have been identified as a cause of crooked calf disease are silky lupine (*Lupinus sericeus* Pursh), tailcup lupine (*L. caudatus* Kell.) and spurred lupine (*L. laxiflorus* Dougl.). Sheep are not susceptible to this syndrome but are susceptible to acute lupine poisoning.

The hazard of lupine to cattle can be reduced by grazing management. The hazard is minimized when the lupine is either in the early flower stage or has dropped its seeds and the average gestation stage of the cows is either before the 40th day or after the 70th day.

Control of perennial lupines by cultural methods usually has not been satisfactory. Herbicidal control has been effective but reinvasion can be rapid, requiring retreatment in 4 to 5 years. Consult local information sources regarding herbicide use.

Ponderosa Pine Needles

Ponderosa pine (*Pinus ponderosa* Dougl.), also known as western yellow pine, grows up to 200 feet tall (Fig. 28). The bark of old trees is cinnamon red and divided into large, thick plates. The needles are yellow green, 4 to 10 inches long and attached to the branch in 3-needle clusters.

Ranchers have recognized the association between consumption of ponderosa pine needles and abortion in cattle for many years, but the toxic constituents of

Fig. 28. Pine trees.

the needles have not been identified. Cows are most susceptible to pine needle abortion in the last trimester of pregnancy. The incidence of abortion in a herd can vary from only a few to 100 percent. Cows that are under stress from weather or disease or are in poor general condition appear to have a greater susceptibility. Research has shown that cows fed a total of 18 pounds of needles over 4 days aborted their calves in 2 out of 3 cases. Abortion usually occurs within 2 days of pine needle consumption but may be delayed as much as 2 weeks.

Symptoms of impending abortion begin with a depressed or dull appearance. Edema of the vulva and udder occur more rapidly than for a cow approaching normal birth. The vulva may show a bloody discharge in some cases. An abnormally high incidence of retained placenta is a common problem after abortion, and cows that develop resultant complications may require veterinary treatment. Impaired breeding performance of affected cows has been reported. The needles have not been found to be acutely toxic to the cows themselves.

Management to reduce the incidence of pine needle abortion is a concern during the late fall, winter and early spring. Green needles on the tree, needles from logging slash and dry, fallen needles are toxic all year, but most herds are managed so that the cows are in their last trimester during late fall to early spring. Although pine needles are not considered a good forage, they are readily consumed under certain conditions. Winter storms often drive cattle to the protection of these trees and, if good forage or hay is in short supply in the area, needles may be eaten. If supplemental feed is provided, it should be placed so that needles are not accidentally ingested with the feed. Sudden availability of needles — during logging operations, for example — may also induce cattle to graze on them.

Threadleaf Snakeweed

Threadleaf snakeweed [*Gutierrezia sarothrae* (Pursh) Britt. & Rusby] is a densely branched perennial shrub or subshrub, up to 2 feet tall, inhabiting dry rangeland and desert. Leaves are narrow and are shed at maturity, leaving the lower parts of the woody stems leafless. The upper parts of the stems are herbaceous and bear the small flowers at the tip. Threadleaf snakeweed is in the same plant family as sunflower. It has a composite head with 3 to 8 strap-shaped, yellow ray flowers and 3 to 8 disk flowers per head (Fig. 29). Threadleaf snakeweed grows most actively in early spring although growth may also occur in the fall if moisture is adequate. Large stands of this species can be an indication of overgrazing, but other factors also affect stand density.

The toxic constituents of threadleaf snakeweed are thought to be saponins, which are chemically complex substances that produce a soaplike foam when mixed with water. Threadleaf snakeweed is most toxic during leaf formation. It is much more toxic when growing on sandy soils than on limestone soils.

Signs of severe poisoning are listlessness, anorexia, mucus in feces, vaginal discharge, periodic nasal discharge of mucus and pus, loss of appetite and weight, rough hair coat and diarrhea followed by constipation. The urine may contain blood. Poisoning most commonly causes abortion though acute cases can cause death. A retained placenta is common after abortion. Pregnant cows that have consumed smaller amounts of the plant may have periodic swelling of the vulva and premature udder development. Cows that do not abort will usually produce weak, underweight calves. The amount of snakeweed needed to produce toxicity varies considerably among individuals. Cows fed 20 pounds of fresh snakeweed aborted in 7 days in one experiment, but others ate as much as 1,097 pounds before aborting in 117 days. Cattle fed 10 to 20 percent of their body weight in fresh snakeweed died in 4 to 14 days.

Although the growing plant may be eaten to some extent by range animals when other vegetation is available, poisoning usually occurs when cattle are forced to eat the plant. Areas that have a heavy infestation of snakeweed, especially where it grows on sandy soil, should not be grazed while the plant is growing rapidly. Herbicidal control has been effective. Consult local information sources for herbicide recommendations.

Fig. 29. Threadleaf snakeweed.

Fig. 30. Halogeton in spring.

Fig. 31. Fall blooming halogeton.

Other Poisonous Plants

The plants discussed in this publication represent only a few of the plants that are potentially toxic to cattle. While some plants are poisonous at all times, other plants may be toxic only at certain times of year, under certain environmental conditions or when growing on soils containing certain minerals. Listed below are some other poisonous plants that are toxic to cattle. Some of these plants have limited geographical distribution within the West and some are of limited toxicity to cattle. Additional information is available in the references listed in this publication or through the Cooperative Extension Service.

bitter rubberweed (*Hymenoxys odorata* DC.)
common cocklebur (*Xanthium strumarium* L.)
copperweed (*Oxytenia acerosa* Nutt.)
deathcamas (*Zigadenus* spp.)
halogeton (*Halogeton glomeratus* Meyer) (Figs. 30 and 31)
hemp dogbane (*Apocynum cannabinum* L.)
horsetail (*Equisetum* spp.)
jimsonweed (*Datura* spp.)
milkweed (*Asclepias* spp.)
oaks (*Quercus* spp.)
pingue [*Hymenoxys richarsonii* (Hook.) Ckll. var. floribunda]
St. Johnswort (*Hypericium perforatum* L.)
sneezeweed (*Helenium* spp.)
spring parsley [*Cymopterus watsoni* (C. & R.) Jones]
tansymustard [*Descurainia pinnata* (Walt.) Britt.]
tansy ragwort (*Senecio jacobaea* L.)
california falsehellebore (*Veratrum californicum* Durand)
western waterhemlock [*Cicuta douglasii* (DC.) Coult. & Rose]

Additional Reading

Cheeke, Peter R., and Lee R. Shull. 1985. Natural toxicants in feeds and poisonous plants. AVI Publ. Co., Inc., Westport, CT.

James, L. F., R. F. Keeler, A. E. Johnson, M. C. Williams, E. H. Cronin and J. D. Olsen. 1980. Plants poisonous to livestock in the Western states. USDA Ag Info. Bull. 415.

Kingsbury, John M. 1964. Poisonous plants of the United States and Canada. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Vertebrate Predators and Pests

Introduction

Although coyotes (Fig. 32) are considered the most important predators of cattle, other vertebrates such as wild and domestic dogs, bears, cougars, bobcats, red foxes, wolves, eagles, crows, ravens, magpies and poisonous snakes occasionally attack cattle. The rodents that inhabit rangelands are other vertebrate pests that affect cattle. The most prominent and important rodent species are prairie dogs, ground squirrels and pocket gophers.

Fig. 32. Coyote

The status of these species as pests, game animals, fur bearers and threatened or endangered species has changed over time and from state to state. Laws vary concerning the rights of livestock owners to kill protected or game animals that are attacking their property. The rancher has responsibility to know the current laws and regulations pertaining to hunting, trapping, pesticide use and other control methods. Current information can be obtained from state game departments, the U.S. Fish and Wildlife Service and state departments of agriculture.

Predators are usually the greatest problem to livestock in the spring. At that time, the demand for food for their young is the greatest and young calves are most vulnerable. Basically, predators will usually take the most accessible prey, so as the calves grow, they become more difficult to kill and the predators usually switch to prey such as rabbits, rodents and birds. As winter approaches, these prey species may hibernate or their populations may fall, so the predators again may increase attacks on livestock.

Determining actual cause of an animal's death is often difficult since attacks by predators are rarely seen by the rancher. Wounds and feeding damage are sometimes used as clues to the attacking species. However, individual predators may not attack in the typical manner due to inexperience or physical impairment. Tracks and feces are important additional clues. The Wade and Bowns publication listed at the end of this section shows typical results of attacks as well as tracks and feces made by various predators. A fact that complicates the determination of the cause of death is that many predators will feed on animals that died from other causes. A postmortem examination is often needed to determine the true cause of death. Wade and Bowns give some suggestions on what to look for when doing an autopsy.

An individual predator may cause several losses. If the offending animal is controlled, losses may be significantly reduced. Because the hunting range of individual predators is limited, moving the herd out of an area of heavy losses may solve the problem.

Control of predators can be divided into methods that are lethal and those that are not. Non-lethal control methods such as fencing, guard dogs and carrion removal are not considered economically practical under rangeland conditions. Moving herds closer to human habitation during calving season has reduced predation in some cases but has had little effect in others.

In most instances, lethal control methods are strictly regulated by state and federal agencies. However, tax-

Fig. 34. Ground squirrel and mound.

Fig. 33. (a) Prairie dog and (b) prairie dog town.

Fig. 35. (a) Pocket gopher and (b) pocket gopher "snow castings."

funded predator control programs have been developed in some states. In states without such a program, the U.S. Fish and Wildlife Service Animal Damage Control Unit or the state game department can often help with specific predator problems.

Rodents are pests of rangelands and consequently of cattle using the rangeland. Rodents cause minor amounts of damage to range herds. Cattle do break bones when stepping in burrow entrances. Rodents are also hosts for ticks which will later infest cattle. The major damage caused by rodents, however, is their competition with beef animals for rangeland forage.

Prairie dogs snip and remove vegetation in the vicinity of their burrows for food and nesting material, and to clear the area so predators cannot hide near them. As prairie dog colonies enlarge, large areas of forage are denuded (Figs. 33ab). The feeding and burrowing activity of this rodent can cause a change in the plant species of the area, increase soil erosion from wind and rain, and bring to the surface poorer soils that support less forage growth.

Ground squirrels cause damage similar to prairie dogs, but their burrows and damaged areas are usually smaller. Ground squirrels consume green forage, dry forage and seeds of forage crops. High populations of ground squirrels can eat enough to make rangeland or pastures useless for livestock (Fig. 34).

Pocket gophers feed on many range plants and their tunneling activity can also cover up useful forage plants (Figs. 35ab). Gopher mounds provide seed beds for invading noxious or other weeds which could lead to a change in species composition of range plants, thus making the range less useful. Gopher tunnels also increase erosion of rangeland soils.

Ranchers should consult local animal damage control, U.S. Fish and Wildlife or county Extension personnel for control methods and toxicants. Local regulations on lethal or non-lethal methods will determine how control activities will be conducted.

Additional Reading

Timm, Robert M., ed. 1983. Prevention and control of wildlife damage. Great Plains Agricultural Council, Wildlife Resources Committee and Nebraska Cooperative Extension Service, Lincoln, NE.

Wade, Dale A., and James E. Bowns. 1982. Procedures for evaluating predation on livestock and wildlife. Texas A&M Univ. Ag Ext. Ser. and Ag Exp. Sta., and U.S. Fish and Wildlife Service, U.S. Dept. of Interior.

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Wyoming Range IPM Slide Set, Figs. 4, 5, 10, 12 and 32

Ent. Soc. Am., Principles of Ent., Fig. 14c

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