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EC02-1550 Nebraska Management Guide for Arthropod Pests of Livestock and Horses

John B. Campbell

University of Nebraska - Lincoln, jcampbell1@unl.edu

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Nebraska Management Guide for Arthropod Pests of Livestock and Horses

John B. Campbell, Extension Entomology Specialist
University of Nebraska West Central Research and Extension Center



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Precautions

- Always read and understand label recommendations before opening a pesticide container. Preparation, rate, use and special instructions or restrictions are on the label.
- All insecticides can be hazardous to man and animals if not used correctly. Many livestock insecticides are not registered for use on lactating dairy cattle.
- Observe the minimum time between treatment and slaughter for beef cattle, treatment and freshening for dairy cattle and repeat treatment intervals.
- Note and follow label restrictions for treatment in conjunction with other insecticides or medication with sick or stressed animals and restrictions on age of animals to be treated.
- Never use insecticides not labeled specifically for use on horses.

® Restricted Use ®

Amitraz (Tactic), some formulations of Co Ral (coumaphos) and Lindane are classified as "*Restricted Use*" by the Environmental Protection Agency (EPA). These compounds are marked with an ®. To use this product, EPA certification is required. A valid certification card must be presented to your dealer when buying these chemicals.

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Insecticide Formulations

Understanding the differences in insecticide formulations is important to selecting the right one for the job. Dusts (D) may be preferred when only a few animals are to be treated or during extremely cold weather. Emulsifiable concentrate (EC), emulsifiable livestock insecticide (ELI) and livestock insecticide spray (LIS) may be mixed with water or diesel fuels. Flowables (F) are thick fluids which are mixed with water. Soluble powders (SP), wettable powders (WP) and water dispersible liquids (WDL) are mixed with water. Agitation is necessary to keep SP and WP formulations in suspension. Solutions (S) are used as light mist sprays or as prepared pour-ons. Some solutions are prepared for mixing with backrubber oils. When insecticide rates are discussed, the initials "AI" mean active ingredient.

Insecticides can be systemic or non-systemic. Systemic insecticides are absorbed through the skin into the animal's bloodstream and tissues and kill any blood-feeding arthropods or arthropods that spend part of their life cycle as internal parasites (grubs and bots). Systemic insecticides listed in this circular are coumaphos, trichlorfon, phosmet, fenthion, famphur, ivermectin, Dectomax (doramectin), Eprinex, Cydectin, Moxidectin and Phoenectin. These last five are called endectocides because they control both internal and external parasites. All other insecticides are non-systemic and function by remaining on the skin and hair as a residual contact poison.

Insecticides listed in this publication are considered safe when used according to label directions. Proper use will not result in illegal residues or injury to animals.

Insecticide Application Methods

Sprays: Both systemic and non-systemic insecticides are used as sprays. A systemic must be absorbed through the skin and requires a spray pressure of at least 300 psi (lbs/sq inch) to reach the skin. A non-systemic spray needs only to wet the haircoat which requires a spray pressure of only 40 psi. Adding household detergent helps the spray stick to the hair.

Feed Additives and Boluses: The insecticide enters the animal digestive system either by ingestion of feed (oral larvicide), salt or mineral containing the product or from the slow release of the toxin in the bolus which is retained in the reticulum or rumen of the animal. The insecticide passes through the digestive system with little absorption and is available in the manure to destroy fly larvae. Feed additives must be consumed at 24-hour intervals to ensure manure treatment. Salty vegetation may reduce salt consumption by cattle.

Pour-ons and Spot-ons: These relatively high concentrate insecticides are applied in small doses.

Self-treatment Devices: Oilers, dust bags and ear tags can be considered self-treatment devices. Place oilers and dust bags at a location frequented by cattle. For best results, force cattle to use them to obtain water, feed or mineral. If used free-choice, enough oilers and dusters should be available for all cattle to use daily. Ear tags have insecticide incorporated in polyvinyl chloride (PVC) for gradual release. When the ear moves, it wipes the insecticide on the animal's face, neck and back.

Area Sprays: Hydraulic sprayers, mist blowers, foggers or aircraft apply these short residual, quick knockdown insecticide sprays to areas infested with house flies and stable flies.

Residual Sprays: Long residual sprays are applied to surfaces which serve as house fly and stable fly resting places.

Baits: These insecticides are mixed with a house fly food source (sugar, molasses), and some include a pheromone attractant.

Larvicides: These insecticides are applied to house and stable fly breeding areas, but the term is also used for feed additives, i.e., oral larvicide.

Dips: Dips are generally systemic insecticides used for grub and lice control on cattle. Some sheep and hogs also are dipped for control of sheep keds and mange mites, respectively.

Injections: Most endectocides have an injectable formulation which is administered with a syringe, but they also have a pour-on formulation. Generally, the animal health industry recommends injectables for internal parasite control and pour-ons for external parasite control.

Management Suggestions

Cattle Grubs

Two species of grubs, the common and the northern, infest Nebraska cattle. The life cycles are similar except the northern grub emerges from the back of cattle about four to six weeks later than the common grub. Practically, grub treatments can be applied at fall weaning time. Systemic insecticides used for grub treatments also will reduce cattle lice numbers, however cattle may require another treatment for lice later in the winter. Treatment for grubs is not suggested for Nebraska cattle between November 1 and February 1 because of the potential for a host-parasite reaction. Cattle grubs migrate to the back through the esophagus (common) and spinal canal (northern). Cattle grubs killed by a systemic insecticide release a toxin which

causes swelling in animal tissue. Severe swelling in the esophagus will cause bloating, and swelling in the spinal canal will cause paralysis of the hindquarters.

Cattle grub infestations occur primarily in calves or yearlings. Therefore, a cattle grub control program can be successful if only calves or yearlings that remain at the farm or ranch from February through April (grub emergence time) are treated. Systemic insecticides may be used on lactating dairy cattle if the

label approves it. Dairy cattle seldom are infested with grubs, but if an infestation occurs, calves, replacement heifers and dry cows can be treated. (Note the treatment-freshening interval listed on the label).

For more information, see Cooperative Extension NebGuide, "Cattle Grub Control in Nebraska," G79-409, available from your nearest Cooperative Extension Office.

Insecticide Suggestions for Cattle Grub Control

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Doramectin (Dectomax)	Pour-on	5 mg/ml AI 1 ml/22 lb body wt	Treatment-slaughter interval of 45 days. Do not treat lactating dairy cows or dairy heifers over 20 months of age.
	Injection	1 ml/110 lb body wt	
Eprinomectin (Eprinex)	Pour-on	5 mg/ml AI	No treatment-slaughter interval. Do not treat calves less than eight weeks old.
	Injection	1 ml/22 lb body wt	
Famphur (Warbex)	Pour-on	13.2% AI 1/2 oz./100 lb body wt Do not exceed 4 oz	Treatment-slaughter interval of 35 days. Do not treat lactating dairy cattle, Brahma bulls, calves under three months, sick or stressed cattle, or use with other medication.
Fenthion (Teguvon)	Pour-on	3.0% AI 2 oz./100 lb body wt	Treatment-slaughter interval of 35 days. Do not treat calves less than three months old, sick or stressed cattle, or use with other medications or insecticides.
	Spot-on	20% AI 4 ml/300 lb body wt	
Ivermectin (Ivomec)	Injection	1% AI 1 ml/110 lb body wt	Treatment-slaughter interval of 35 days.
(Ivomec) (Phoenectin) (Prozap)	Pour-on	0.5% AI 1 ml/22 lb body wt	Treatment-slaughter interval of 48 days.
Moxidectin (Cydectin)	Pour-on	5 mg/ml AI	No treatment-slaughter interval. No restrictions on dairy cattle.
	Injection	1 ml/ 22 lb body wt	

Cattle Lice

Four species of lice infest cattle in Nebraska. Three of these feed on blood, and the fourth feeds on skin. The life cycles of all lice are similar. Eggs (nits) are deposited on the cattle hair. Immature lice resemble

adults, except for size, and have similar feeding habits. The cycle from egg to adult averages one month but accelerates during cold weather. Lice are spread by animal contact. Some animals are physiologically more susceptible to lice than others. These "chronic" or "carrier" animals should be culled from the herd. Grub

treatments in the fall will reduce lice numbers but may not prevent the buildup to economic levels later in the winter.

Treatment methods for cattle lice are the same as those noted for cattle grubs. Treated animals should be examined 14 days post-treatment to determine if a second treatment is needed because most insecticides do not destroy louse eggs. The systemic insecticides listed for control of cattle grubs also may be used for lice control. (See pages 1-2 for products, rates and precautions). The biting or chewing louse is not controlled by the internal systemic insecticides unless the lice contact the insecticide on the hair coat of the animal. Sprays

may be more effective than pour-ons, spot-ons or injections for control of this species. It is not necessary to use systemic insecticides for lice control. Low pressure sprays (with a small amount of household detergent to help the insecticide stick to the hair coat) are adequate for lice control. Animals suspected of having lice can be restrained in a squeeze chute and hair parts on the face, dewlap, neck and topline examined. If lice numbers average over three per square inch, treatment is suggested.

For more information, see Cooperative Extension NebGuide "Lice Control on Cattle", G92-1112, available from your nearest Cooperative Extension Office.

Insecticide Suggestions for Control of Cattle Lice

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Amitraz (Taktic)	Spray	12.5% EC, 0.025% AI 1 pt/50 gal water	No restrictions. Apply spray to runoff.
Cyfluthrin (Cylence)	Pour-on	1% AI 4 ml/400 lb body wt Maximum of 12 ml	Retreat in three weeks.
Coumaphos (Co-Ral)	Spray	11.6% ELI 5 oz/4 gal water	Restricted Use Pesticide Do not treat sick or stressed animals. Do not treat animals younger than three months. Do not treat lactating dairy cattle.
(Co-Ral Fly and Tick Spray)	Spray	6.15% EC 2 qt/50 gal water or 5 oz/4 gal water	Do not treat sick or stressed animals. Do not treat animals younger than three months.
Doramectin (Dectamax)	Pour-on	0.5% AI 1 ml/22 lb body wt	Treatment-slaughter interval of 45 days. Do not use on female dairy cattle, 20 months of age or older.
Eprinomectin (Eprinex)	Pour-on	5 mg/ml AI 1 ml/22 lb body wt	No treatment-slaughter interval. No restriction for dairy cattle. Do not treat calves under eight weeks of age.
Ivermectin (Ivomec)	Injection	1% AI 1 ml/110 lb body wt	Treatment-slaughter interval of 35 days.
(Ivomec)	Pour-on	0.5% AI 1 ml/22 lb body wt	Treatment-slaughter interval of 48 days.
(Phoenectin) (Prozap)	Pour-on	0.5% AI 1 ml/22 lb body wt	Treatment-slaughter interval of 48 days.

(Continued on page 4)

Insecticide Suggestions for Control of Cattle Lice (continued)

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Lamda-cyhalothrin (Saber)	Pour-on	1% AI 10 ml (1/3 oz)/600 lb body wt 15 ml (1/2 oz)/over 600 lb body wt	Apply product down back line. Do not apply more than every two weeks, and no more than four times during a six-month period.
Moxidectin (Cydectin)	Pour-on Injection	5 mg/ml AI 1 ml/22 lb body wt	No treatment-slaughter interval. No restrictions on dairy cattle.
Phosmet (Del-Phos)	Spray	11.6% EC 1 qt/38 gal water	Spray to thoroughly wet animal. Treatment-slaughter interval of three days.
Permethrin (Atroban DeLice)	Pour-on	1% AI 15 ml (1/2 oz)/100 lb body wt	Do not apply more than once every two weeks. Maximum of 5 oz per animal.
(Synergized DeLice)	Pour-on	1% Permethrin + 1% PBO AI 15 ml (1/2 oz)/100 lb body wt	Do not apply more than once every two weeks. Maximum of 5 oz per animal.
(Boss)	Pour-on	5% AI 3 ml/100 lb body wt	Maximum of 30 ml per animal.
(Ultra Boss)	Pour-on	5% Permethrin + 5% PBO AI 3 ml/100 lb body wt	Maximum of 30 ml per animal.
(Brute)	Pour-on	10% AI 3 ml/200 lb body wt	Do not treat more than once every two weeks. Maximum of 5 oz per animal.
(Permethrin)	Pour-on	1% AI 1/2 oz/100 lb body wt	Do not treat more than once every two weeks.
(Permethrin CDS)	Pour-on	7.4% Permethrin + 7.4% PBO 2 ml/100 lb body wt	Maximum of 20 ml per animal.
(Atroban)	Spray	11% EC 1 pt/25 gal water	Spray to thoroughly wet animal.
(Ectiban) (Insectiban)	Spray	5.7% EC 1 qt/25 gal water	Spray to thoroughly wet animal.
Gardstar	Spray	40% EC 4 oz/25 gal water 4 oz/2.5 gal water (Low pressure spray)	Spray to thoroughly wet animal. Repeat in 14 days.
Permethrin	Spray	10% EC 1 pt/100 gal water	Spray to thoroughly wet animal.

Ticks

Generally, Nebraska cattle are not infested with economic levels of ticks. However, in years with wet springs, cattle grazing lush vegetation along waterways may be infested with some Rocky Mountain wood ticks, *Dermacentor andersoni*, or American dog ticks, *Dermacentor variabilis*. Cattle brought into the Nebraska Panhandle from Wyoming, Montana or Idaho in the fall may have an infestation of the winter tick, *Dermacentor albipictus*. In 2002, a local herd in Hayes County had an infestation of the winter tick, but generally, native Nebraska cattle are not infested with this species. The insecticides recommended for control of cattle lice or horn flies also will control ticks. NebGuide G94-1220, "Controlling Ticks," discusses the ticks of Nebraska in detail.

Horn Flies

The horn fly is a small blood-feeding fly about one-half the size of a house fly. It remains on the animal most of the time. Eggs are deposited in manure, and the life cycle from egg to adult requires only about 14 days in the summer. The fly overwinters in the pupal form under dung pats in the northern states. In the south, populations may be continuous. In Nebraska, they develop to adults in late April, May and early June. Because of the short life cycle and high rate of egg production, horn flies increase rapidly to high numbers (several hundred per animal) by late spring and early summer.

Several insecticide application methods can be used to control horn flies. Under range conditions, self-treatment devices, i.e. dust bags, oilers and ear tags, are the most practical. Widespread resistance to pyrethroid insecticides used in ear tags has developed in Nebraska and most of the United States. Pyrethroids are being replaced with phosphate insecticides, newer more toxic pyrethroids, pyrethroids mixed with synergists such as piperonyl butoxide (PBO) which increase toxicity, or mixtures of pyrethroids and phosphates or phosphate mixtures. However, good management will be required to slow the development of resistance to these insecticides.

U.S. livestock entomologists have developed a list of management practices which should help reduce the resistance problem:

- 1) Rotate different ear tag insecticides yearly.
- 2) Delay application of ear tags until the horn fly population reaches an economic threshold (200 per animal).
- 3) Use additional horn fly control methods in August when populations peak and ear tag efficacy starts to decline; use dust bags, backrubbers or pour-ons

with an insecticide different than that in the ear tags.

- 4) Remove the ear tags as soon as the horn fly population declines after frost.

Dust bags and oilers are most efficient when cattle are forced to use them to obtain water, feed or salt and minerals. Bulls and older animals tend to dominate the use of these self-treatment devices, leaving some animals untreated unless a forced-use system is employed. Insecticides used in backrubbers should be diluted with No. 2 diesel fuel or a commercial backrubber oil. Do not use engine oils. It is very important to treat bulls by some method because horn flies are attracted to testosterone and build up to high numbers on bulls.

Other horn fly control methods include sprays, pour-ons, boluses and feed additives. Sprays and systemic pour-ons are not practical except for small herds that return to the farmyard daily. These treatments need to be applied at two- to three-week intervals. Systemic insecticides remain active in the blood of treated animals for three to seven days. The non-systemic sprays may be effective on the hair coat for seven to ten days.

Boluses are administered at the beginning of the summer fly season. They remain in the reticulum, slowly releasing insecticide which passes through the digestive system and into the manure where it kills developing fly larvae. Feed additives do the same thing, but the insecticide is incorporated into feed or mineral and must be consumed at intervals of less than 24 hours to be effective. The feed additive and bolus systems are most effective where cattle are relatively isolated. Newly emerging horn flies migrate to cattle, usually downwind, and can travel a considerable distance; so migrating flies from a neighboring herd may reduce the effectiveness of a bolus or feed additive for the treated herd.

Insecticide-impregnated ear tags are not as popular as they were before the development of pyrethroid resistance in horn fly populations. Resistance developed because there was widespread use of the tags, thus little refuge of untreated flies (non-resistant) to mate with resistant ones. In addition, products were very toxic to the flies, and there was a long residual effect. These factors meant that although only a very small percentage of the flies were resistant, they could mate only with other resistant flies which spread resistance very rapidly because horn flies have several generations per year. The movement of cattle from the south (where resistance began) to the north contributed to the rapid spread of resistance throughout the United States and Canada. However, with certain management practices recommended by livestock insect entomologists, the ear tags available now can provide good horn fly control.

The ear tags currently available are more toxic to horn flies than were the earlier ones either because of increased dosage, newer compounds or the addition of a synergist such as pipernol butoxide (PBO). Some of the ear tags now contain two insecticides, either a phosphate and a pyrethroid or two different products of the same chemical family. All of these factors should

delay or prohibit the development of resistance to these newer products.

For more information, see Cooperative Extension NebGuide "Horn Fly Control on Cattle," G93-1180, available from your nearest Cooperative Extension Office.

Insecticides Suggested for Horn Fly Control on Cattle in Nebraska

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Coumaphos (Co-Ral)	Spray	11.6% ELI 2.5 oz/4 gal water	Restricted Use Pesticide Do not treat animals younger than three months. Do not treat lactating dairy cattle.
(Co-Ral Fly and Tick Spray)	Spray	6.15% EC 2 qt/50 gal water or 5 oz/4 gal water	Spray to run-off. Treat no more than six times per year. Do not make applications less than 10 days apart.
(Co-Ral Plus)	Ear Tag	20% Coumaphos + 20% Diazinon AI	Two tags per animal. Calves less than three months of age should not be tagged.
Beta-Cyfluthrin (CyLence Ultra)	Ear Tag	8% Beta-cyfluthrin + 20% PBO AI	Two tags per animal. Calves less than three months of age should not be tagged.
Cyfluthrin (CyLence)	Pour-on	1% AI 4 ml/400 lb body wt	
(Cutter Gold)	Ear tag	10% AI	Two tags per animal.
Doramectin (Dectomax)	Pour-on	5 mg/ml AI 1 ml/22 lb body wt	Treatment-slaughter interval of 45 days. Do not treat lactating dairy cows or heifers over 20 months old.
Diazinon (Terminator)	Ear tag	20% AI	Two tags per animal.
(Optimizer)	Ear tag	20.4% AI	Two tags per animal.
(Cutter 1)	Ear tag	40% AI	Two tags per animal.
(Patriot)	Ear tag	40% AI	Two tags per animal.
(Warrior)	Ear tag	40% AI	Two tags per animal.
Eprinomectin (Eprinex)	Pour-on	5 mg/ml AI 1 ml/22 lb body wt	Do not treat calves under eight weeks of age.
Ethion (Commando)	Ear tag	36% AI	Two tags per animal.
Fenvalerate (Ectrin)	Ear tag	8.6% AI	Two tags per animal.
Ivermectin (Ivomec) (Phenectin)	Pour-on	0.5% AI 1 ml/22 lb body wt	Treatment-slaughter interval of 35 days. Do not treat lactating dairy cattle.

(Continued on page 7)

Insecticides Suggested for Horn Fly Control on Cattle in Nebraska (continued)

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Lamda-cyhalothrin (Saber Extra)	Ear tag	10% Lamda-cyhalothrin + 13% PBO	PBO = Piperonyl butoxide. This material increases the effectiveness of synthetic pyrethroid insecticides. Two tags per animal.
(Double Barrel)	Ear tag	6.8% Lamda-cyhalothrin + 14% Pirimiphos methyl	Two tags per animal.
(Saber)	Pour-on	1% AI 10 ml (1/3 oz)/600 lb body wt 15 ml (1/2 oz)/ over 600 lb body wt	Apply product down back line. Do not apply more than once every two weeks, and no more than four times during a six-month period.
Permethrin (Atroban Extra)	Ear tag	10% Permethrin + 13% PBO	Two tags per animal.
(Atroban DeLice)	Pour-on	1% AI 15 ml (1/2 oz)/100 lb body wt	Do not apply more than once every two weeks. Maximum of 5 oz per animal.
(Atroban EC)	Spray	11% EC 1 pt/25 gal water	Spray to thoroughly wet animal.
(Boss)	Pour-on	5% AI 3 ml/ 100 lb body wt	Maximum of 30 ml per animal.
(Ultra Boss)	Pour-on	5% Permethrin + 5% PBO 3 ml/100 lb body wt	Maximum of 30 ml per animal.
(Brute)	Pour-on	10% AI 3 ml/100 lb body wt	Do not treat more than once every two weeks.
(DeLice Synergized)	Pour-on	1% Permethrin + 1% PBO 15 ml (1/2 oz)/100 lb body wt	Maximum of 5 oz per animal. Do not treat more than once every two weeks.
(Ectiban) (Insectiban)	Spray	5.7% AI 1 qt/25 gal water	Spray to thoroughly wet animal.
(Gardstar Plus)	Ear tag	10% AI	Two tags per animal.
(Gardstar)	Spray	40% EC 4 oz/25 gal water (High pressure spray) 4 oz/2.5 gal water (Low pressure spray)	Spray to thoroughly wet animal.
(Permethrin)	Pour-on	1% AI 1/2 oz/100 lb body wt	Maximum of 5 oz per animal. Do not treat more than once every two weeks.
(Permethrin CDS)	Pour-on	7.4% Permethrin + 7.4% PBO 2 ml/100 lb body wt	Maximum of 20 ml per animal.

(Continued on page 8)

Insecticides Suggested for Horn Fly Control on Cattle in Nebraska (continued)

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
(Permethrin)	Spray	10% AI 1 pt/100 gal water	Spray to thoroughly wet animal.
(Permethrin)	Dust bag	0.25% AI dust	Do not use in pyrethroid resistant areas.
Phosmet (Del-Phos)	Spray	11.6% EC 1 gal/50 gal water	Treatment-slaughter interval of three days. Do not treat non-lactating dairy cattle within 28 days of freshening.
	Back rubber	1 gal/50 gal of fuel oil, or other suitable carrier	
Pirimiphos-methyl (Dominator)	Ear tag	20% AI	Apply two tags per animal.
(Double Barrel)	Ear tag	6.8% Lambda-cyhalothrin + 14% Pirimiphos methyl	Apply two tags per animal.
Stirofos (Rabon)	Dust bag	3% dust	Follow label directions.
	Spray	24% EC	
	Back rubber		Apply 0.5 to 1 gal per animal.
	Spray	50% WP 4 lb/75 gal water	
	Mineral additive	1.23% AI	Follow label directions.
	ROL	7.76% AI Premix	Follow label directions.
(Ravap)	Spray	23% Rabon + 5.3% Vapona 1 qt/50 gal water	Do not use on dairy animals.
	Back rubber	1 qt/25 gal of approved back rubber oil	
Zeta-cypermethrin	Dust bag	0.075% Dust Zetacypermethrin + 0.10% PBO	
Python	Ear tag	20% Zeta-cypermethrin + 10% PBO (9.5 g)	Apply two tags per animal.
Python (Magnum)	Ear tag	10% Zeta- cypermethrin + 20% PBO (15.1 g)	Apply only one tag per animal and do not apply to calves under three months of age.

Face Fly

The face fly resembles the house fly in size and appearance but is considerably different in behavior and life cycle. Like horn flies the face flies deposit eggs in the manure of range or pastured cattle. The life cycle takes about three weeks from egg to adult in the summer. This fly overwinters as an adult in sheltered areas such as houses, barns and sheds.

Face flies feed on secretions around the eyes and noses of cattle and other animals. They also will feed on animal wounds and manure, and males often feed on pollen. Face flies have modified mouth parts which serve as a rasp when the fly feeds and can damage the eye tissue of cattle. This injury causes secretions (weeping eyes) which attract face flies. The injury also provides an avenue for entrance of eye pathogens such as *Moraxella spp.*, the causative agent of pinkeye. Face flies can transmit these pathogens mechanically from animal to animal. Face flies are, of course, only one of many factors that can cause injury to the eyes of cattle. Other factors such as sunburn, blowing sand, grass seed, pollen etc., also predispose the animal to eye pathogens.

The distribution of face flies is much more restricted than that of the horn fly. The face fly is found mainly in areas of 30 or more inches of precipitation which support lush vegetation. In the more arid range areas, the manure dries before the face fly can complete its life cycle. As a consequence, the western two-thirds of Nebraska has few face flies.

Control of face flies is difficult. These flies feed primarily on the face of cattle, which is a difficult area to treat. Only a portion of the face fly population feeds on cattle, and these do not remain on the animal very long. The major portion of a face fly population that feeds on cattle are young females seeking a source of protein (animal tears and mucous) prior to egg deposition. Systemic insecticides are ineffective for face fly control because these flies generally do not feed on animal blood.

The dusts, sprays, oiler mixes, some feed additives, boluses and ear tags registered for control of horn flies also are registered for face fly control. The exception is methoprene feed additive and bolus. The pyrethroid insecticide ear tags are registered for face fly control, but should be rotated annually with other insecticides because of horn fly resistance. Insecticides listed in the table for horn fly control, other than those mentioned above, will control face flies.

All Nebraska cattle will be infested with horn flies, but not all will have face flies. Horn fly control can be achieved without treating calves in a cow-calf herd. Face flies, however, are attracted at least as much to calves as cows, so both cows and calves must be

treated. When face fly populations are high, one method of treatment may not be enough. The best face fly control can be achieved by forcing cattle to use dust bags or oilers to obtain water, feed or mineral. Dust bags should be hung high enough for cattle to see under them when first employed. As the fly season progresses, they should be lowered so they treat calves as well as cows.

Back rubbers can be equipped with treated flaps which rub across the face of the animal as it passes under the oiler. A mineral feeder dispenses insecticide dusts (Dustacator) around the face and head. The same insecticide dusts suggested for dust bags can be used in the Dustacator. These devices should be managed so both cows and calves are treated. The migration of both face flies and horn flies is detrimental to control with feed additives and boluses. Face flies may migrate to a different group of cattle every time they feed, while horn flies may only move from one cow to the next. Both species may migrate a considerable distance in search of cattle when they first emerge as adults.

For more information, see Cooperative Extension NebGuide, "Face Fly Control Guide," G94-1204, available from your nearest Cooperative Extension Office.

Cattle Mange (Scabies)

Three species of mites can cause scabies. *Psoroptes bovis*, the causative agent for *Sarcoptic scabies* (scab mite), is by far the most injurious form of cattle scabies. It requires immediate quarantine and federal and state approved control measures. It is usually the only species present in Nebraska. The other two species are *Sarcoptes scabiei* (itch mite) and *Chorioptes bovis* (cattle itch mite). All three species are subject to federal and state regulations.

Scabies mites may attack any part of the body, particularly areas of thick hair. Lesions most commonly occur on the withers, along the back and around the tail. Itch mites are more likely to colonize body areas where the hair is thin and the skin tender. Cattle itch mites live on the surface of the skin where they usually do not produce severe or conspicuous lesions.

Symptoms of scabies may not be evident until winter because, like cattle lice, the reproduction rates of the mites decreases during hot weather and increases during cold weather. The life cycle is as short as 10-12 days during the winter. Except for the number of legs, the immature mites (three pair) and the adult mites (four pairs) are similar in appearance and feeding habits.

Scabies mites do not burrow into the skin, but their feeding causes severe skin irritation and itching. Rubbing and scratching by the animal further irritates the infested area. Eventually a scab forms which provides

a sheltered and optimum situation for the mite. Under these conditions, they increase rapidly. Infested animals fail to do well, and loss of hair during the winter can cause the animal's death.

The itch mite, *Sarcoptes scabiei*, burrows in the skin; otherwise its life cycle is similar to *Psoroptes bovis*. While not as severe, it tends to be more difficult to control. Cattle itch mites live in colonies on the skin but do not usually produce severe lesions. This species tends to be more of a pest on dairy cattle, particularly in the northeast United States.

Chorioptic bovis, mange mites, are not as severe as the other two species. This species also tends to be more of a problem on dairy cattle than beef cattle. Sometimes populations are quite heavy without visible symptoms normally associated with mite infestations.

There is a fourth mite species, *Demodex bovis*, the cattle follicle mite, found on cattle. These mites are found in dermal pustules, and are also more of a pest of dairy cattle in the northeast.

Mites spread from animal to animal by contact. This is why legislative control programs for *Psoroptes bovis*, scab mites, require not only the treatment of infested animals, but of any animals that may have come in contact with the infested animals. **There are only two insecticides approved for scabies control in Nebraska, and they are ivermectin and eprinomectin.** We have not had reported cases of scabies in Nebraska for several years. Perhaps widespread use of ivermectin has eradicated these mites in the United States.

For more information, see Cooperative Extension NebGuide *Scabies*, G96-1295, available from your nearest Cooperative Extension Office.

House Fly and Stable Fly Management in and near Livestock Facilities

House flies and stable flies, commonly referred to as filth flies, are pests around animal facilities. Both species breed in animal waste, mixed with decaying organic matter (feed stuffs), soil and moisture. The latter is critical in any consideration of sanitation practices. In addition, house flies breed in fresh manure.

The life cycles of the two species are similar; but in the summer, house flies are able to complete their life cycle in two weeks compared to three weeks for stable flies. Both species probably overwinter as larvae in areas below the frostline. As temperatures increase, the larvae migrate upward and pupate. The flies that emerge give rise to the first generation in the spring.

Stable flies annoy and stress beef and dairy cattle, causing reduced weight gain performance, feed efficiency (0.48 lb/day and 11 percent, respectively, in Nebraska trials) and milk production (as much as 40

percent in Illinois trials). Losses from house flies are not as acute, but these flies are disease vectors. Both fly species may be the cause of lawsuits when urban housing areas infringe on agricultural production areas.

Managing animal wastes and moisture is critical to any successful fly control program. Major fly breeding areas should be either cleaned or spread out thin enough to dry quickly. Leaky waterers should be fixed and run-off drainage areas properly maintained. Spilled feed should not be allowed to accumulate longer than one week. Summer harvested haylage should be covered with black plastic where seepage occurs.

In confined livestock units that use slatted floors and pits in waste management, agitation should be used to prevent a crust from developing on the waste surface. House flies will breed just below the crust. If air or water is not used for agitation, the pits should not be allowed to fill more than within one foot of the slatted floor so that dropping waste can provide agitation.

Screening ventilator openings and air intake vents in confined animal or poultry facilities reduces the number of flies entering buildings for feeding or egg deposition. Using high pressure water hoses to clean out areas hard to reach with regular cleaning equipment will improve sanitation.

Area Spray: Insecticide applications also should be considered as a part of the total management strategy. The application method most often used is a mist blower (area spray). Diluted insecticide is dripped into a high velocity air stream which breaks the spray into fine droplets. The insecticide droplets are dispensed by the air stream into space occupied by flies. The droplets kill flies they contact. Insecticides approved for this application method have little residual value because they decompose rapidly in the environment. The popularity of this system is due more to its labor and time requirements than its efficacy.

Factors that will improve the efficacy of mist blower applications include:

- 1) Control of weeds and other vegetation around animal facilities. This practice removes a favorable habitat and forces flies to congregate in fewer areas.
- 2) Avoid spraying when temperatures are below 65°F or above 90°F. Insecticides are not very active at cool temperatures, and evaporation and inversion reduce the effectiveness of mist applications at high temperatures.
- 3) Spray what is mixed the day it is mixed. Insecticides deteriorate when mixed for more than a few hours.
- 4) Flies rest in trees or other vegetation adjacent to the feedlot during the hot part of the day. Spraying into

the trees and vegetation may kill more flies than spraying the pens.

- 5) Rotate insecticide types, i.e. Vapona, a phosphate with permethrin or pyrethroid, once or twice during the season or at least from one season to the next to reduce the potential for resistance developing in the fly populations.

Although mist blowers are the most popular method of applying area sprays, aircraft, hydraulic sprayers and foggers also may be used. Equipment should be adjusted to deliver fine droplets of insecticide into the fly-infested area. Insecticide labels often give application rates in terms of amount of product per cubic foot of space. We suggest one to five gallons finished spray per acre.

Residual Spray: Residual insecticides will kill flies that contact the material for about 7-14 days. Direct sunlight (ultraviolet radiation, UV) decompose the materials, and rainfall will wash it off treated surfaces.

Residual insecticides are most effective when applied to shaded fly resting surfaces. House flies will "roost" under eaves or inside buildings on the walls, rafters and ceilings at night. Stable flies generally do not enter buildings unless they are well-lighted. They rest on the shady sides of feed bunks, buildings and windbreaks, or on vegetation. Flies absorb enough insecticide when it is applied to the resting sites to kill them. Applying insecticides to resting areas requires more time and labor than applying area sprays.

Labels on residual insecticides usually give the amount of finished spray to apply to 1,000 square feet of surface. In general, insecticides can be applied to the point of run-off, being careful not to contaminate feed and water. Some residual insecticides will require removing animals from buildings while the spray is applied. Others will have restrictions on treating the inside of buildings, treating animals under a certain age, or treating dairy milking parlors.

If fly resting areas are not too extensive, residual and area sprays may be rotated. House fly and stable fly females both take about six days after emergence to reach the egg deposition stage. In a rotation, a good mist blower application could be followed a week later with a residual application which should be effective for another week. This rotation could be followed throughout the fly season.

Baits: Baits may be used in dry form as purchased or prepared as liquids by adding water, sugar, corn syrup or molasses. Baits should be replaced at two- to four-day intervals. Since stable flies feed only on blood, baits are not appropriate for them. Baits will not fully control a house fly population, but they can be used to supplement other control methods. They may be particularly useful around offices, feed storage areas, in the alleyways of confined units and other similar places. Baits can be mixed with water into a slurry and used as a residual treatment in swine, poultry and beef confinement units. Baits should be replaced weekly.

Feed Additives or Boluses: Feed additives are not effective for stable fly control but may be effective for house fly control in arid regions where the only suitable breeding habitat for house flies is fresh manure. The same considerations are true for boluses. Under some management conditions, feed additives may be useful for house fly control in confined beef, swine or poultry units.

Animal Treatments: Spraying, dusting, pour-ons, spot-ons, dips, ear tags or any other method of applying insecticides directly to animals for control of house flies or stable flies are generally ineffective. The possible exception is the daily application of insecticides to riding horses or show animals for protection from stable flies.

Larvicides: Applying insecticide to fly breeding areas is not suggested because the pH of the breeding area causes rapid decomposition of the insecticide and the possibility of resistance. However, if the fly breeding area is too wet or otherwise difficult to clean, larvicides can be used as a temporary solution.

Stable Flies on Range Cattle

Stable flies, generally considered pests of only confined livestock, have in recent years also become pests of pastured and range cattle. Nebraska trials on grazing steers indicate that stable flies cause as much of a decrease on weight gains of grazing steers (0.2kg average daily gain) as they do on cattle being finished for slaughter. Unfortunately, at present we do not know the sources of these flies, and we have no efficient method of controlling them. Thus the major effort of Regional Research Project S 1005 will be on trying to solve these problems during the next five years.

Insecticides Suggested for Control of House Flies and Stable Flies In and Around Livestock Facilities

Mist or Area Sprays			
<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Dichlorvos (Vapona)	Mist or Area Spray	40.2% EC, 0.5% AI 1 pt/12 gal water	1-5 gallons of finished spray per acre.
Fenvalerate (Ectrin)	Area Spray	10% EC, 0.05% AI	1-5 gallons of finished spray per acre.
Naled (Dibrom)	Mist or Area Spray	58% EC, 0.25 lb AI 5 pt/100 gal water	5 gallons of finished product per acre.
Permethrin (Atroban)	Mist	11% EC, Overhead system, 1 pt/10 gal diesel or mineral oil	4 fl oz spray/1000 cubic ft of air space.
(Ectiban) (Insectiban)	Mist	5.7% EC Undiluted Overhead	4 fl oz. spray/1000 sq ft of surface area. 1 qt./2.5 gal of diesel fuel or mineral oil, 4 fl oz spray/1000 sq ft of air space.
(Gardstar)	Overhead System	40% EC 4 oz/10 gal Mineral oil	4 fl oz of mix per 1000 ft of air space. Do not use in milk rooms.
	Space Spray	1.5 fl. oz./1 gal water 10% EC	2 fl oz of mix per 1000 ft of area.
(Permethrin II)	Misting	Undiluted in mist blower	4 fl oz/1000 sq ft.
Stirofos (Ravap)	Mist	23% Rabon + 5.3% Dichlorvos 1.25% AI 1 gal/25 gal H ₂ O	1-5 gallons of finished spray per acre.
Residual Sprays			
Cyfluthrin (Tempo SC)	Spray	11.8%, 0.025% AI Mix 8 ml with 1 gal water	Do not spray areas when animals are present.
(Tempo WP)	Spray	20% WP, 0.05% AI 2 level scoopfuls of Tempo WP to 1 gal water	
Lamda cyhalothrin (Grenade ER)	Spray	9.7%, 0.03% AI 2 ml/1 gal water	Treat to point of runoff.
(Grenade WP)		10%, 0.03% AI one packet per 1 gal water	
Malathion	Spray	57% EC 1 qt/12 gal water	Apply 1 gal per 1000 sq ft of surface area.

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Insecticides Suggested for Control of House Flies and Stable Flies In and Around Livestock Facilities (continued)

Residual Sprays (continued)			
<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Methoxychlor	Spray	50% WP	Dairy animals should not be present while spraying. Apply one gallon of spray per 500 sq ft of surface area.
Permethrin (Atroban)	Spray	11% EC 1 pt/10 gal water	Covers 750-1000 sq ft. Spray to runoff.
(Ectiban) (Insectiban)	Spray	5.7% EC 1 qt/10 gal water	Follow label instructions.
(Gardstar)	Spray	40% EC	Follow label instructions.
Stirofos (Rabon)	Spray	50% WP 4 lb/25 gal water	Apply 1 gal of mix per 500 sq ft.
Baits			
Diazinon	Bait	50% WP	Follow label instructions.
Dichlorvos (Vapona)	Bait	23.7% EC	Follow label instructions.
Methomyl (Golden Malrin)	Bait	1.1% Methomyl + 0.049% Z-9 Tricosene	
(Blue Streak Fly Bait)	Bait	1.0% Methomyl + 0.025% Z-9 Tricosene	
Larvicides			
Stirofos (Rabon)	Larvicide	50% WP 1 gal/100 sq ft of fly breeding area	
Feed Additives			
Cyromazine (Larvadex)	Feed Additive	1% AI 1 lb/ton finished ration	Poultry, follow label instructions.
Stirofos (Rabon)	Feed Additive	7.76% or 93.3% AI 1.23% ROL	Beef, follow label instructions.

External Insects and Mites

Parasites of Swine

The hog louse and two species of mange mites (the common itch mite and the less common hog follicle mite) are the major external parasites of swine. House flies and stable flies (see cattle management suggestions, pages 10-14) also may be a nuisance and/or pest of swine.

Hog lice and both mange mites are found on a high percentage of swine slaughtered at Midwest packing houses. Ear scrapings have indicated that 26 percent of Nebraska swine were infested with mange mites. Both mange mites and lice are spread by animal contact. Breeding stock may be the principle reservoirs of these pests. The SPF (swine pathogen-free) swine health program used in several Midwest states (primarily for breeding stock) requires all participating stock to be free of lice and mange. Purchase of SPF stock should reduce the spread of these parasites.

Hog lice are blood-feeders. The life cycle from egg to adult averages about 24 days. The immatures

resemble the adults in appearance and feeding habits. Lice reproduction increases in the winter and declines in the summer. Although the hog louse is the largest of the domestic livestock species of lice, it may be difficult to see because its coloration may blend with that of the animal. Lice-infested animals itch, and the scratching causes the skin to become thickened and cracked, which results in sores. These signs are the main indicators of lice. Ivermectin will control hog lice, but is more expensive than the products listed below.

Any breeding stock being brought into the program should be isolated and treated for lice twice, about 10-14 days apart. SPF swine will have been treated. Sows should be treated at least two weeks prior to farrowing. Pigs should be treated at weaning before being placed in a finishing program, and boars should be treated before breeding season.

For more information, see Cooperative Extension NebGuide "Controlling Internal Parasites in Swine," G90-1049, available from your nearest Cooperative Extension Office.

Insecticide Suggestions for Management of Hog Lice

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Amitraz (Taktic)	Spray/Dip	12.5% EC 0.025% AI, 1 qt/50 gal water	Treatment-slaughter interval of one day.
Coumaphos (Co-Ral)	Spray/Dip	11.6% ELI 0.3-0.05% AI 2.5 oz./4 gal water	Restricted Use Pesticide Treatment-slaughter interval of 10 days. Do not treat animals less than three months old.
Doramectin (Dectomax)	Injection	1% AI 1 ml/75 lb body wt	Treatment-slaughter interval of 24 days.
Fenvalerate (Ectrin)	Spray	10% EC 0.05% AI 1 qt/50 gal water or 1 oz/1.5 gal water	Treatment-slaughter interval of one day. Retreat in 14 days.
Ivermectin (Ivomec Premix)	Feed Additive	0.01% AI 910 grams/ton feed	For growing pigs up to 220 lb. Treatment-slaughter interval of five days.
(Ivomec Premix)	Feed Additive	0.02% AI 182 grams/ton feed	Treatment-slaughter interval of 18 days.
(Ivomec)	Injection	0.27% AI 1 ml/20 lb body wt	Suckling and feeder pigs. Subcutaneous in neck.
(Ivomec) (Phoenection)	Injection	1% AI 1 ml/75 lb body wt	Treat sows 7-14 days prior to breeding. Treat boars twice yearly. Treatment-slaughter interval of 18 days.

(Continued on page 15)

Insecticide Suggestions for Management of Hog Lice (continued)

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Methoxychlor	Spray/Dip	25% EC or 50% WP 0.5% AI	Thoroughly spray animal until wet or dip animals including ears.
Permethrin (Atroban)	Spray	11% EC, 1 qt/50 gal water	Treatment-slaughter interval of five days.
(Ectiban) (Insectiban)	Spray	5.7% EC 1 qt/25 gal water	Treatment-slaughter interval of five days.
(Gardstar)	Spray/Dip	40% EC 60-118 ml/25 gal water	Thoroughly spray animal to wet or dip animals including ears.
(Swine Guard)	Pour-on	10% 3 ml/100 lb body wt	Repeat no more than once every two weeks.
Prolate (Del-Phos)	Spray/Dip	11.6% EC 1 qt/25 gal water	Apply to point of runoff. Treatment-slaughter interval of one day.
Stirofos (Rabon)	Spray	50% WP 4 lb/50 gal water	Apply course spray using 1-2 qt. per animal. Repeat in two weeks if necessary.

The burrowing of mange mites into the skin of swine causes intense itching. Mange-infested animals scratch primarily with their hind feet which causes lesions. The lesions scab over, creating an ideal environment for the mites to increase rapidly. Infested skin becomes scruffy, inflamed, raw and cracked. A positive mange diagnosis can be made only by examining skin scrapings (deep enough to penetrate the mite burrows) under magnification. The mites are spread by contact.

Infested animals may not gain weight efficiently and are more susceptible to stress-related diseases. Market hogs may be down-graded because of the rough, unkempt appearance.

When pigs are sprayed, be sure some of the insecticide gets into the ears. The ear serves as a reservoir for later infestations when winter arrives.

Insecticides Registered for Management of Swine Mange Mites

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Amitraz (Taktic)	Spray/Dip	12.5% EC 1 qt/50 gal water or 1 oz/2 gal water	Wet animals thoroughly. Treatment-slaughter interval one day.
Doramectin (Dectomax)	Injection	1% AI 1 ml/75 lb body wt	Treatment-slaughter interval of 24 days.
Fenvalerate (Ectrin)	Spray	10% WDL, 0.01% AI 1 qt/50 gal water or 1 oz/1.5 gal water	Wet entire animal thoroughly. Retreat in 14 days. Treatment-slaughter interval of 14 days.

(Continued on page 16)

Insecticides Registered for Management of Swine Mange Mites (continued)

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Ivermectin (Ivomec Premix)	Feed Additive	0.01% AI 910 grams/ ton feed	For growing pigs up to 220 lb. Treatment-slaughter interval of five days.
(Ivomec Premix)	Feed Additive	0.02% AI 182 grams/ ton feed	Treatment-slaughter interval of 18 days.
(Ivomec)	Injection	0.27% AI 1 ml/20 lb body wt	Suckling and feeder pigs. Subcutaneous in neck.
(Ivomec) (Phoenectin)	Injection	1% AI 1 ml/75 lb body wt	Treat sows 7-14 days prior to breeding. Treat boars twice yearly. Treatment slaughter interval of 18 days.
Permethrin (Atroban)	Spray	11% EC 1 qt/50 gal water	Wet animal thoroughly. Treatment-slaughter interval of five days.
(Ectiban) (Insectiban)	Spray	5.7% EC 1 qt/25 gal water	Wet animal thoroughly. Retreat in 14 days. Treatment-slaughter interval of five days.
(Gardstar)	Spray/Dip	40% EC 0.026-0.05% AI 60-118 ml/25 gal water	Thoroughly wet animals. Spray pen, floors, sides and bedding. Repeat in 14 days. Treatment-slaughter interval of five days.
(Swine Guard)	Pour-on	10% AI 3 ml/100 lb body wt	Repeat no more than once every two weeks. Treatment-slaughter interval of five days.
Prolate (Del-Phos)	Spray	11.6% EC 0.25% AI 1 qt/25 gal water	Thoroughly wet animals. Treatment-slaughter interval of one day.

Insect Pests of Sheep and Goats

Nebraska sheep are subject to infestations of sheep keds "ticks"; three species of sheep lice; wool maggots; sheep nose bots; spinose ear ticks; stable flies, house flies and face flies; and the aquatic complex of biting flies (mosquitoes, *Culicoides*, black flies, tabanids and biting gnats). Goats have some of the same insects, and except for lactating goats, insecticide suggestions are similar.

Sheep keds are wingless flies that resemble ticks. Keds spend their entire life cycle on sheep, transferring to lambs by contact. The female deposits a fully developed larva on a wool strand, and a red puparium (case) forms around the larva. A fully developed sheep ked emerges from the puparium after about 21 days. Sheep keds feed on the blood of sheep.

A condition called "cockle" is thought to be the result of sheep keds puncturing the skin to feed. Hide buyers downgrade sheep skins with cockles. Several

states are following Wyoming's example and treating all animals in a flock so ked-free animals can be marketed.

The best time to treat sheep keds is right after shearing. If lambs are present and infested, they too should be treated. In addition, any replacement ewes or rams should be treated before they are allowed into the flock.

Biting lice are common pests of sheep. These lice feed on the skin scurf. The feeding causes irritation, and sheep react by biting and rubbing the infested skin area. The fleece of infested animals becomes ragged, torn and reduced in value. Sheep biting lice and sheep foot lice, both blood-feeding lice, also occasionally may be found on sheep. Generally, if sheep are treated for sheep keds, sheep lice also are controlled.

Wool maggots are the larvae of some species of blow flies (black blow flies, in particular). The flies deposit eggs in dirty, wet wool, usually in the crotch area or at wound sites. Maggot-infested sheep are rest-

less, stamp their feet, try to bite at the irritated area and may leave the flock in search of a secluded place. Care and medication of wounds, early shearing or clipping or cleaning dirty areas before fly season will reduce the incidence of fly infestation.

Sheep nose bots (head grubs) are the larvae of the sheep bot flies. These flies deposit live larvae in the nostrils of sheep. The larvae migrate to the head sinus and after development, migrate back down the nasal passage. The fly "strike" — when the flies deposit larvae — causes irritation to sheep as does the migration to and from the head sinus. Infested sheep bang their heads on the ground, feedbunks or fence posts. Bot flies may not be numerous in Nebraska, but feeder lambs shipped in from other states may be infested. Until recently, no insecticides were registered for control of the sheep nose bots. Now Ivomec (ivermectin) is registered as an 0.08 percent sheep drench solution. It can be applied with standard animal health drenching equipment at a dose of 3.0 ml/26 lb body weight after the first killing frost eliminates adult bot flies.

Spinose ear ticks are a pest of both cattle and sheep and are primarily found on arid range areas. Infested cattle or sheep in Nebraska usually have been shipped into the state. Spinose ear ticks prefer feeding in the inner folds of the outer ear. There also may be a few ticks of other species present on sheep, but usually not

enough to be economic.

Stable flies, house flies and face flies feed on sheep primarily at the sites of shearing wounds. If sheep are not sheared prior to fly season, the animals should be treated with an insecticide to provide protection until the wounds heal. Suggestions for fly control around sheep pens and buildings are the same as suggested for feedlots and dairies.

The aquatic biting fly complex is difficult to control. *Culicoides variipennis* transmit blue tongue to sheep primarily, but also to whitetail deer and cattle.

If possible, pasture sheep away from waterways that are breeding areas for these pests. Otherwise, treat sheep periodically with an insecticide listed for keds and lice.

Sheep scab mites are supposed to be eradicated from the United States, but there have been a few reports of sheep scab recently, including three in Nebraska. Like cattle scabies, sheep scabies is treated as a disease and is subject to federal and state quarantines and treatment laws. Control suggestions are not included in this guide.

For more information, see Cooperative Extension NebGuide, "Sheep Insect Management," G93-1142, available from your nearest Cooperative Extension Office.

Insecticides Suggested for Sheep Ked and Sheep Lice

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Coumaphos (Co-Ral)	Spray/Dip	25% WP 4 lb/100 gal water	Spray thoroughly. Treatment-slaughter interval of 15 days.
Diazinon	Spray	50% WP 1/2 lb/100 gal water	Restricted Use Pesticide Do not use on goats. Apply 1 gal/animal. Treatment-slaughter interval of 14 days.
Fenvalerate (Ectrin)	Spray	10% WDL 1 qt/100 gal water	Do not treat lactating goats. Spray up to 1 qt/animal. Treatment-slaughter interval of two days.
	Pour-on	4 oz down mid-line of back	
Ivermectin (Ivomec Drench)	Oral Drench	0.08% AI 3 ml/26 lb body wt	Treatment-slaughter interval of 11 days.
Malathion	Spray	57% EC 1 gal/100 gal water or 5-6.5 oz/5 gal water	Spray animals thoroughly.

(Continued on page 18)

Insecticides Suggested for Sheep Ked and Sheep Lice (continued)

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Methoxychlor	Spray	50% WP 2 lb/25 gal water 24% EC 1 qt/12.5 gal water	Do not use on lactating dairy goats. Treatment-slaughter interval of 0 days.
Permethrin (Atroban)	Spray	11% EC 1 pt/25 gal water or 3 Tbsp/2.5 gal water	Thoroughly wet animal. Retreat in 14 days.
(Atroban/DeLice)	Pour-on	1% AI 7.5 ml/50 lb body wt	Maximum of 3 oz/animal. Retreat in 14 days.
(Boss)	Pour-on	5% AI 1.5 ml/50 lb body wt	Maximum of 18 ml/animal. Retreat in 14 days.
(Ultra Boss)	Pour-on	5% Permethrin + 5% PBO AI 1.5 ml/50 lb body wt	Maximum of 18 ml/animal. Retreat in 14 days.
(DeLice Synergized)	Pour-on	1.0% Permethrin + 1.0% PBO 7.5 ml/50 lb body wt	Maximum 3 oz/animal. Retreat in 14 days.
(Gardstar)	Spray	40% EC, 0.05% AI 118 ml/25 gal water	Thoroughly wet animal. Retreat in 14 days.
Zetacypermethrin (Python Dust)	Hand Dust	0.075% AI 2 oz/animal	Repeat as necessary, but no more than once every three days.

Insect Control for Sheep Wool Maggot

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Coumaphos (Co-Ral)	Spray	25% WP 0.125% AI 2 lb/25 gal water	Repeat as necessary. Treatment-slaughter interval of 15 days.
Permethrin (Catron IV)	Aerosol	0.50% AI	Spray wound thoroughly, repeat every five to seven days.

Control procedures of house flies and stable flies in and near livestock facilities are the same for sheep facilities. The animal sprays listed for control of sheep keds and lice will protect sheep from the biting fly

complex (including aquatic flies). These sprays will need to be repeated at 14-day intervals throughout the fly season.

Insect Pests of Horses in Nebraska

Horses are subject to many of the same insect pests as cattle, but, as with most animal species, there are a few insects that parasitize only horses. The major insect pests of horses in Nebraska are stable flies, black flies, biting gnats, horse and deer flies and horse bot flies.

Stable and house flies not only feed on horses but are intermediate hosts and, thus, vectors of internal parasites of horses. The nematodes, *Habronema microstoma* and *Habronema muscae*, are associated with stable flies and house flies, respectively. Face flies feed on the eye secretions of horses and are a vector of the eye worms in the genus *Thelazia*.

It is difficult to devise insect control measures that will fit the many conditions in which horses are kept. These may include single pleasure or 4-H horse owners, horse breeding farms, race horse facilities or ranches. Numbers vary from one to a hundred or more. Sanitation measures discussed in the section on cattle insect control are also essential for house fly and stable fly control. The same residual insecticides and area sprays suggested for feedlots and dairies can be used in and around horse facilities, however, livestock sprays suggested for use on animals should not be used on horses unless the label specifically names horses.

Horses have very sensitive skin, which may be burned by sprays with petroleum carriers. As a consequence, insecticide formulations suitable for horses often are available only through companies, such as Farnam, that specialize in horse products. They formulate the registered insecticides with carriers suitable for horses.

A sponge or wipe may be the most practical way to apply insecticides to only a few horses for protection from biting flies. The applicator should wear rubber gloves with long cuffs when using wipes.

Black flies feed primarily in horse ears, and pressurized spray cans may be the most effective treatment. Some species of mosquitoes transmit strains of encephalitis that affect both horses and man. Horses should be vaccinated annually for protection against encephalitis. West Nile virus is similar to encephalitis.

The best mosquito control can be achieved by a concentrated effort to control the immature forms at the aquatic breeding site. Either develop a drainage system to prevent standing water or treat the water with biological insecticides such as *Bacillus thuringiensis* var. *israelensis*, a bacterium.

Horses perspire, which washes away the insecticide or repellent and probably causes a more rapid breakdown of the product. Horse protection with spray requires repeated applications at two- to three-day intervals.

Insecticide-impregnated plastic strips that can be attached to the halter or fastened around the throat both repel and control biting flies. These function in a way similar to an ear tag; the insecticide is released gradually through the plastic matrix and is rubbed onto the hair coat.

In addition to the insects mentioned that regularly attack horses, horn flies and occasionally cattle grubs also will use horses as hosts. Horn flies may attack horses in the spring when adults first emerge from the overwintering phase of their life cycle if cattle are not yet in summer pastures and horses are present. Face flies are regular pests of horses. Face masks may be the best method of relief. Horses brought to Nebraska from western mountain states may be infested with the winter tick.

Cattle grubs cannot complete their development beyond the encysting stage in horses and cannot cut a breathing hole in the skin of horses as they do in cattle. The grub incidence in horses is too low to indicate the need for treatment with systemic insecticides. Encysted grubs are quite irritating to horses and should be removed surgically, and the wounds treated to prevent infection.

There are three species of horse bot flies (gad flies). Females of the common bot fly deposit eggs on the hairs of the chest, legs, belly and flanks of horses. The eggs hatch immediately when the horse licks them, and the larvae bore into the tongue and gums. They migrate from the oral tissues to the stomach where they attach to the lining to complete the larval growth stage. When that stage is complete, they detach and are passed out with the manure where they pupate and, in time, emerge as a new generation of flies.

The life cycles of the other two species, throat bot flies and nose bot flies, are similar. Throat bot flies deposit eggs on hairs below the jaw. These eggs hatch without stimulation and migrate to the gum area of the cheek teeth before migrating to the stomach, pylorus or duodenum. Nose bot flies deposit eggs on the hairs of the horse's lips. The larvae of these species hatch on their own and penetrate the lip membranes in front of the incisors before migrating to the stomach wall.

Severe infestations of horse bots may cause gastrointestinal stress, block the stomach outlet (causing colic) or rupture the stomach (causing death). Gum and tongue inflammation and even abscesses may result from infestations in the mouth.

Delay treating horses for bots until after the first hard freeze, unless bot symptoms are apparent, to prevent reinfestation. Sponging the areas where eggs are attached with warm water will cause them to hatch and the larvae can be killed before they enter the mouth.

As with most animals, horses are infested with both a biting and a blood-feeding species of louse. Biting lice feed on sloughed skin, hair and skin secretions. Sucking lice feed on blood. The life cycle of both takes a month or more. They may be located anywhere on the animal but are found most often on the head, neck, mane and tail. Severe infestations bring about an unkempt hair coat and cause itching, provoking the animal to excessive rubbing and scratching. Severe infestations of the blood-feeding lice may

cause anemia. Lice are transmitted among horses by contact.

Ticks native to Nebraska will attach to horses but are not an economic problem in Nebraska. One other insect, blister beetles, may affect horses indirectly if they are ingested with hay. Blister beetles contain cantharidin which is very toxic to horses. First-cutting alfalfa usually is harvested before blister beetles are present. Prairie hay is less infested with blister beetles than is alfalfa. Alfalfa intended for horse use can be treated if many blister beetles are present. (For more information, see "Management of Blister Beetles in Alfalfa," NF02-551).

For more information, see Cooperative Extension NebGuide, "Horse Insect Control Guide," G89-950, available from your nearest Cooperative Extension Office.

Insecticides Suggested for Treatment of Flies on Horses

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Coumaphos (Co-Ral)	Spray or Sponge	11.6% ELI 1 pt/25 gal water	Restricted Use Pesticide
(Co-Ral Fly and Tick Spray)	Spray	6.5% EC 2 qt/50 gal water or 10 oz/4 gal water	For horses not intended for slaughter. No more than six treatments per year, no less than 10 days apart.
(Co-Ral)	Spray	25% WP 4 oz/12.5 gal water	
Fenvalerate (Ectrin)	Spray	10% WDL 2 oz/1.5 gal water	Apply 8 oz of diluted spray per horse. Do not apply to horses intended for slaughter.
Methoxychlor	Spray or wipe-on	0.05% Ready to use	Follow label instructions.
Permethrin (Atroban)	Spray	11% EC 1 pt/25 gal water or 3 tbsp/2.5 gal water	Spray to thoroughly wet animal. Repeat every 10-14 days.
(Buss Off)	Wipe-on, Spray or Pour-on	7.4% Permethrin + 7.4% PBO	
(Ectiban)	Spray	5.7% EC 1 qt/25 gal water or 2 1/2 Tbsp/1 gal water	Repeat application every 14 days.
(Gardstar)	Spray	40% EC 5-12.5 ml/2 gal water	Apply 30-60 ml per horse.
(Permethrin II)	Spray	10% EC 1/2 oz/3 gal water	Spray thoroughly to wet horse. Repeat in 14-21 days.

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Insecticides Suggested for Treatment of Flies on Horses

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Pyrethrins	Mist, spray or wipe-on	0.05-1.0% Pyrethrins + Piperonyl Butoxide Many formulations of ready to use.	Follow label instructions.
Stirofos (Rabon)	Feed additive	7.76% ROL	Follow label directions. Horn and face fly control only.

Insecticide Suggestions for Control of Horse Bots (Treat After Hard Freeze)

<i>Insecticide</i>	<i>Application Method</i>	<i>Application Rate</i>	<i>Restrictions and Comments</i>
Ivermectin (Agri-mectin) (Equalan) (Rotectin) (Zimectrin)	Paste	1.87% AI 1 ml/110 lb body wt	Do not treat colts under four months of age. Treatment-slaughter interval of 35 days.
Moxidectin (Quest Gel)	Paste	2.0% AI 0.4 mg/2.2 lb body wt	

