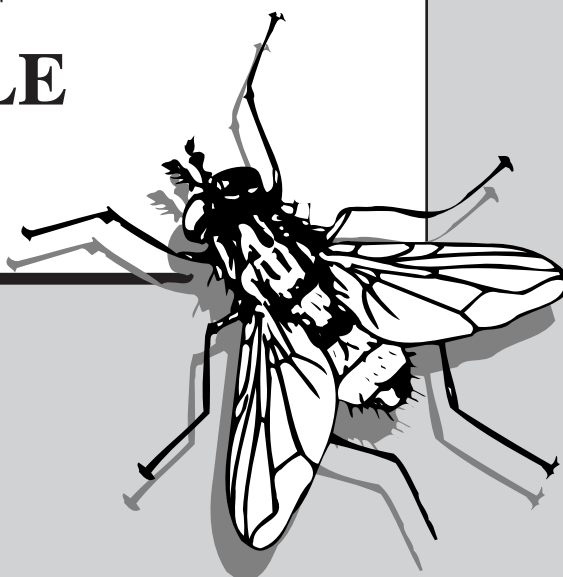


Entomology 200



**MANAGING
INSECT PROBLEMS
ON
BEEF
CATTLE**



Kansas State University Agricultural Experiment Station and Cooperative Extension Service

Foreword

Although fundamental principles discussed herein are applicable to other situations and other places, this publication was written specifically for beef producers in Kansas. Insect biology and seasonal cycles are discussed according to Kansas conditions.

In this publication, each listing of insecticides is alphabetical by common chemical names. Sequence does not indicate an order of preference.

The percentage figure after each entry is the concentration of the insecticidal mix that will result from the mixing directions that follow.

There are several hundred trade names of livestock insecticides sold in Kansas, and obviously, not all can be listed here. Reference to trade names in this publication is done only to identify commonly available chemical compounds for educational purposes and is not intended to imply endorsement or discrimination by the Kansas State University Agricultural Experiment Station and Cooperative Extension Service.

The insecticides listed in this publication have been registered by the Environmental Protection Agency and the State of Kansas, based on evidence submitted by the manufacturers, and are judged both safe and effective when used under label-specified conditions. The recommendations made in this bulletin are valid at the time of publication. However, any chemical use is subject to change or withdrawal at any time. County agents and dealers are advised when and if such changes occur.

Materials mentioned as **Restricted Use Pesticides** are for application only by Certified Private Applicators or Commercial Pesticide Applicators certified in livestock pesticide application.

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Need for Control

In nature, every animal is provider for an array of insect and mite parasites that use its hair coat for shelter and its skin or blood for food. Many of these insects use animal manure and bedding as a medium in which the immature stages develop. The more animals are concentrated together in herds or lots, the greater their attraction is to insect pests and the more easily flies, lice, ticks, and mange mites or scabies can move from one animal to another. This not only increases direct nuisance and damage from insect and mite feeding, but also increases the spread of diseases.

So, the potential benefits of animal husbandry, in which large numbers of livestock are confined to pens or pastures, can be realized only if insect and mite infestations are kept in check.

Insects, ticks and mites cause losses to the beef industry through reduced efficiency of feed conversion, reduced weight gain and milk production, increased meat trim, hide losses and, occasionally, death of the animal.

These losses result from blood loss, irritation, annoyance, behavior of animals to avoid the discomfort of insect attack, insect contamination of meat, and damage to hides and skin prior to slaughter.

In addition to these direct losses, many bovine diseases such as bluetongue, pinkeye, epizootic bovine abortion, and anaplasmosis are transmitted by insects.

The USDA has estimated that insect and mite pests cause \$2.2 billion annual loss to the cattle industry in this country. The author of this booklet estimates direct loss to Kansas beef production from insects and mites is \$130 to \$150 million annually.

Fortunately, eliminating the cost of damage from pests does not require total elimination of the pests. (The screwworm eradication program is a notable exception.) A low number of lice, flies or ticks does not cause measurable loss of production. Employing costly pesticides in time-consuming applications is unwise unless pest numbers threaten to exceed the economic injury level.

Economic injury level is defined as the lowest number or density of a pest that will cause damage equal to the cost of preventing that damage.

The **economic threshold** is the stage of a pest population's development which indicates that, with reasonable expected population growth and/or development, the economic injury level will be reached or passed.

These concepts are variations of the age-old "law of diminishing returns" applied to pest management.

Methods and Management

The first act of livestock management—the domestication and confinement of animals—tends to increase insect and mite pest problems. For both humane and economic considerations, it is the stockman's challenge to counteract such problems.

Good management must be based on good information, including a thorough understanding of many interrelated items. The total livestock management system must provide for the following:

Financing	Health care
A source of quality livestock	Personnel
Shelter and spatial arrangement	Schedules
Nutrition	

This means personnel and equipment must be provided to accomplish the following activities:

Purchasing and marketing	Breeding and genetic management
Livestock handling (squeeze chutes, loading chutes, scales, fences, pens, gates, alleyways, barns, etc.)	Pasture and range management
Manure handling	Feed storage and handling
Pesticide storage, application and cleanup	Water supply
	Doctoring and pest management
	Record-keeping on most of the above

Many of the items listed above have implications for pest management. For example, the purchase of infested animals, overcrowding, poor nutrition, and inadequate manure handling all contribute to serious insect and mite problems. Sloppy feed handling and overfilled watering facilities create fly-breeding environments. Poorly trained or insufficient personnel let problems go undetected or make inappropriate or ill-timed attempts to solve them.

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Pest Biology, Ecology

Incorporating good pest management into the framework of good production management also requires a knowledge of the pests. What are they? Where do they come from? How do they multiply? How do they behave? And how is their presence reflected in cattle behavior? In other words, we need to understand insect and mite biology and ecology.

Four factors that make each pest species different from all others are: its life cycle (the way it develops), its mobility (the way it moves in various stages), how it feeds, and what it feeds on. The three latter factors may be different for each life stage within the same species.

Insect Growth and Development

Biologists have named several different strategies for growth and development. Among these, two are sufficient to describe the life cycles of insect and mite pests of beef cattle.

Gradual metamorphosis is the term describing a moderate change in which immature insects somewhat resemble the adult form when they hatch from eggs. As the insect grows, it goes through three or four nymphal stages, each of which looks progressively more like the adult. Some blood-sucking cattle pests such as sucking lice and ticks undergo gradual

metamorphosis. Some insects with chewing mouthparts, e.g. the cattle biting louse, also develop in this way, as do mange mites. In a given species, because immature forms have the same kind of mouthparts as adults, they feed in a similar manner. Eggs, nymphs, and adults of lice and scabies mites are all found on the animals' skin or hair coat. Control with pesticides necessarily includes direct application to the animal.

None of the cattle parasites that undergo gradual metamorphosis ever have wings. The only way such pests can move from animal to animal is by crawling. Such transfer happens primarily when animals are in direct contact with one another at feed bunks or during breeding, nursing, crowding or shipping. In a “closed herd” system, eradication of such pest species can be maintained.

Flies, mosquitoes, and many other insects undergo **complete metamorphosis** or growth and development including dramatic change. Typically, eggs are laid, tiny worm-like creatures hatch, and several worm-like larval stages occur as the insects grow toward winged adulthood. When each larva attains full growth, it enters into a resting stage called a pupa. The pupa may be protected by a thin shell called a puparium. When the pupal period has passed, the emerging adult looks nothing at all like it had as a larva.

In immature insects undergoing complete metamorphosis, the mouthparts are usually very different from those of adults in the same species. The immature forms not only feed differently, but also have entirely different environmental requirements from the adults. And, of course, they are not as mobile as the winged adults.

Control strategies for such insects may include sanitation to eliminate larval development sites, pesticides applied as larvicides to such sites, and residual insecticides applied to adult resting places, thus reducing the amount of insecticide applied directly to the animal.

Using Insecticides

Difficulty in controlling pests often occurs because of a poor understanding of the pest's biology, resulting in the application of insecticides to the wrong place or at the wrong time. Also, behind many poor results is lack of attention to mixing directions, use directions and other details on chemical labels. This can lead to unrealistic expectations, as well as endangering both the applicator and the livestock.

Pesticide Formulations

For each material chosen, there may be a variety of formulations—liquids, wettable powders, emulsifiables, dusts, solutions, suspensions, aerosols, slow-release products and feed mixes. The choice of formulations needs to be based on safety, legality, efficacy (effectiveness), compatibility with available application equipment, placement, versatility, and other considerations, as well as cost.

Many spray formulations may be purchased as wettable powders (WP) and emulsifiable concentrates (EC) which must be diluted and mixed. Others come ready to use (RTU). Mixing directions given in this publication are based on popular formulations. Be sure to mix and apply exactly as directed on the actual label of the product you're using.

Carefully observe the following restrictions: (1) dosage, (2) waiting intervals between application and slaughter, (3) frequency of permissible applications, (4) use of an insecticide in conjunction with other insecticides, synergists (additives which help some insecticides work better), or other types of medication during the same time period, and (5) ages and conditions of animals to be treated.

Caution

- Never use an insecticide on any class of animal not listed on the label.
- Mix insecticides outdoors or in large, well-ventilated buildings. While mixing, stand to one side of any breeze blowing past the insecticide (if downwind, breeze contaminates you; if upwind, eddies bring vapors or dust back toward you).
- Plan to keep animals under observation after treatment. Should symptoms of toxicity develop, a veterinarian should be consulted.
- Insecticides are harmful if swallowed or inhaled.
- Do not get in eyes.
- Avoid repeated contact with skin.
- Do not allow the feed or water source of poultry, dairy animals, meat animals, horses, or pets to become contaminated by drift of insecticide.
- Store insecticides where livestock, pets, children, and unauthorized persons cannot gain access to them.
- To protect fish and wildlife, do not contaminate streams, lakes, ponds or marshes. Do not clean pesticide application equipment or dump excess material near such water.
- Obtain medical aid at once if concentrates or diluted sprays are accidentally swallowed or if excessive skin contamination occurs. Show the insecticide container label to the physician.

Flies on Pastured Cattle

Horn flies are the primary fly species of concern on pastured cattle. Face flies cause some annoyance, but their economic impact is only through their role in spreading pinkeye and in causing watery eyes which results in price discounts of affected feeder cattle sold at auction. Stable flies have historically been considered a problem of confined livestock, but they often are numerous enough on pastured cattle to cause economic loss. Outbreaks of large horse flies occur at various locations in Kansas nearly every year, and several species each of deer flies, mosquitoes, black flies (buffalo gnats) and gnats present additional nuisance. Because these fly species are so different in their biologies and behavior, we seldom can control more than one or two kinds with the same strategy or the same timing of control treatments.

Horn Flies

Horn flies are the most important insect pest of cattle nationally and occur in damaging numbers throughout Kansas every summer. Horn fly problems are limited to pasture and

range situations and are not of significant consequence in feedlot operations. Present throughout the country, these blood-sucking flies are the smallest of the commonly recognized pest flies. They are about half the size of the ordinary house fly.

In Kansas, the horn fly is found on cattle from April through October, with large populations from June through September. If uncontrolled, their numbers may reach several thousand per animal.

Adult horn flies of both sexes spend most of their time resting on the bodies of animals during the day as well as at night, feeding intermittently. The female leaves the animal just long enough to lay eggs in fresh cow manure. The eggs hatch in from 12 to 48 hours. The larvae or maggots feed in the manure and develop to full size in from 3 to 5 days, and the pupal stage requires from 6 to 8 days before adult emergence.

In hot weather the horn fly can thus complete its life cycle from egg to adult in 10 days. Several generations occur each summer. **Newly emerged horn flies may fly as far as 10 miles in search of cattle or other suitable hosts. Once having found cattle, the flies remain on or near the cattle without further wandering.**

Horn flies are usually found on the backs of cattle, out of reach of the animal's head or tail. During the hotter part of the day they move to the shaded side or underside of the animals. The sensitive skin area around the navel and central midline often becomes covered with sores from horn fly feeding. In cool weather, horn flies often congregate around the base of the animals' horns; hence the name "horn flies." At this latitude the species overwinters in the pupal (larval-to-adult transitional) stage.

Each fly feeds from 20 to 40 times in a 24-hour period, piercing the cow's skin each time. Thus, a cow with 1,000 horn flies may be "bitten" from 600,000 to 1,200,000 times in a 30-day period! It is no wonder, then, that horn fly control commonly yields an extra 15 to 30 pounds of beef per calf or stocker steer. In general, remedial controls are worthwhile at any time the number of horn flies exceeds 50 to 100 per cow.

Horn Fly Control

Little is available by way of nonchemical control of horn flies. Pasture harrowing on a weekly basis during fly season may be used to interrupt larval development in the manure pats. Not only is this costly, it cannot be accomplished on rough terrain. Furthermore, unless this is a very isolated pasture, flies migrating in from surrounding pastures will populate the cattle in the harrowed pasture.

Designs for a walk-through fly trap with a wooden frame are available from the University of Missouri; with a steel frame from South Dakota State University. Actual use of the traps in Illinois, Missouri, and Kansas has provided inconsistent results ranging up to 70 percent horn fly control, but more often about half that.

A number of strategies of insecticide use are available for horn fly control. One may use insecticidal ear tags, sprays, pour-ons, dust bags, backrubbers or self-oilers, and oral (feed-through) larvicides or some combination of these.

Insecticidal Ear Tags

Through the use of insecticidal ear tags stockmen have encountered the most widespread problem of resistance to insecticides ever experienced with livestock insect pests. **Insecticide resistance is a genetic change in a population** in which susceptible individuals are killed by an effective, frequently used or continually applied, and widely used material, leaving only resistant individuals.

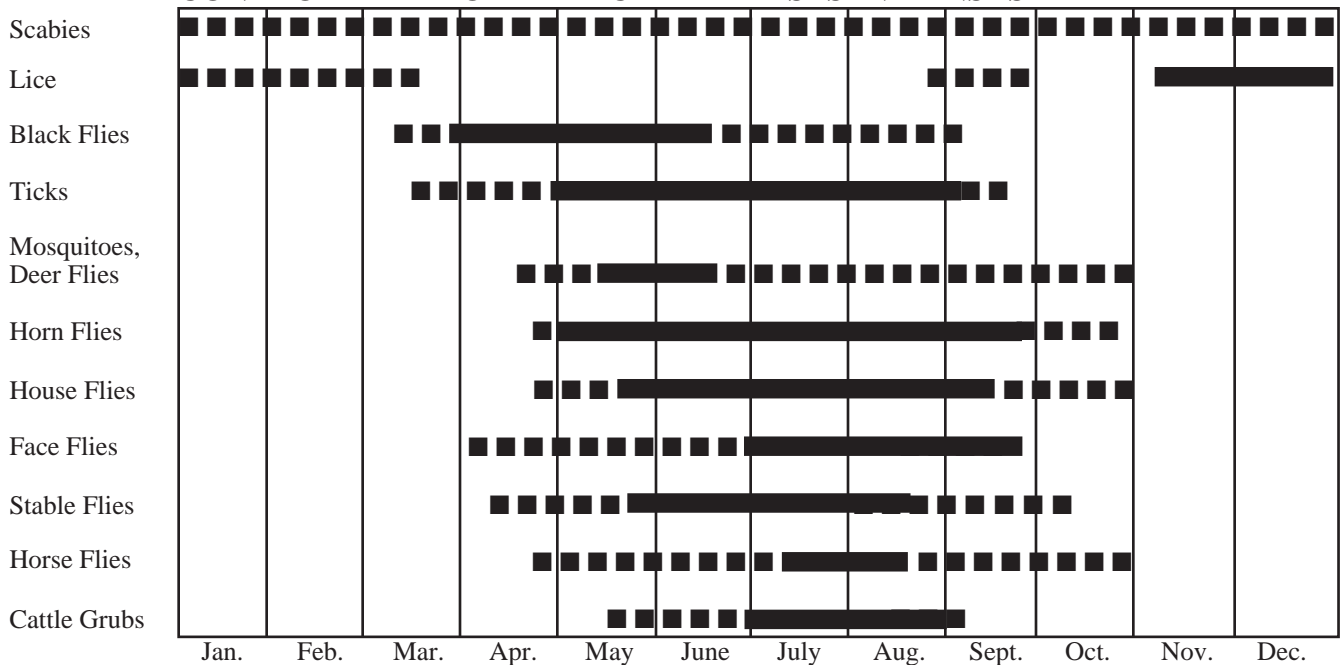
Pyrethroid ear tags provided control, i.e., culling, of 95 to 99 percent of the most susceptible horn flies. The longevity of the tags' action made them desirable from the control standpoint but also meant that selection of resistance occurred over several horn fly generations with each application of ear tags. Furthermore, the tags became so popular that few herds were

Seasonal Occurrence

= Usual Time
 = Possible Time

This chart should be helpful in planning ahead. Of course there is some variation from year to year and among different parts of Kansas. Several pest species often occur on cattle at the same time. Cost savings can be realized by selecting an insecticide that will control all of the species present, although this is not always possible. Verify the list of target insects on the insecticide label before purchasing.

CONTROL TIME FOR BEEF CATTLE PESTS IN KANSAS



left untreated. This left few subpopulations of horn flies that were not undergoing selection for resistance and that might have diluted the resistant populations.

Resistance to one pyrethroid causes resistance to other pyrethroids—a phenomenon called cross resistance.

Cross resistance is often even greater than the resistance to the initial pyrethroid. Entomologists fear that a similar problem could arise with resistance to organophosphorus compounds, as in recent years, organophosphate-containing ear tags have become popular to replace those containing pyrethroids that are no longer effective. Entomologists in several states have noted that organophosphate ear tags that provided 18 to 22 weeks of horn fly control in the first year of use now often provide control for shorter periods of time. This may be the beginning of resistance to organophosphates.

The level of resistance to an insecticide declines to a low level in a population if use of that type of material is avoided for two or three years. But it remains high enough that renewed use of that insecticide family causes renewed high resistance within a few generations.

Entomologists have learned that using a mixture of insecticides of different chemical families simultaneously often results only in resistance to both chemical families. However, **alternating insecticides from different chemical families, through time, is helpful in preventing resistance.** We recommend the use of organophosphate ear tags for two consecutive years, a pyrethroid tag the third year, and thus establish a 2-1-2-1 rotation.

The list of insecticidal ear tags below is provided for those who insist on using them despite the problems discussed above.

As with all products, follow specific label directions. When handling or applying insecticidal ear tags be sure to wear protective (not leather) gloves. This precaution is especially important with ear tags containing organophosphorus compounds.

Note: Some of the ear tags, both pyrethroid and organophosphate, contain various amounts of piperonyl butoxide (p.b.o.) which is a synergist, i.e., a compound that is not insecticidal but which increases the efficiency of the insecticide. The list below does not include the p.b.o. content of the ear tags. We do not recommend and have not listed, ear tags with permethrin and fenvalerate, nor ear tags with combinations of pyrethroid and organophosphate.

pyrethroid ear tags

- CYFLUTHRIN 10%
Cutter Gold (13.7-gram tag wt.)
- LAMBDAHALOTHHRIN 10%
Saber Extra (9.5-gram tag wt.)
Excalibur (9.5-gram tag wt.)
- ZETACYPERMETHRIN 10%
PYthon (9.5-gram tag wt.)
ZetaGard (9.5-gram tag wt.)

organophosphate ear tags

- DIAZINON 20%
Terminator (15-gram tag wt.)
- DIAZINON 21.4%
Optimizer (15-gram tag wt.)
Optimizer-Calf (9.5-gram tag wt.)
- DIAZINON 40%
Cutter 1 (15-gram tag wt.)
Patriot (15-gram tag wt.)
- DIAZINON 30% + CHLORPYRIFOS 10%
Diaphos Rx (15-gram tag wt.)
Warrior (15-gram tag wt.)
- ETHION 36%
Commando (15-gram tag wt.)
- FENTHION 20%
Cutter Blue (13-gram tag wt.)
- PIRIMIPHOS METHYL 20%
Dominator (9.5-gram tag wt.)
Rotator (9.5-gram tag wt.)

Sprays

Spraying for horn fly control usually requires corralling and crowding. It is labor-intensive and involves stress on both the cattle and the workers. However, spraying may be a useful component of an overall management program, especially if cattle need to be handled anyway for pregnancy checking, vaccinating, sorting, etc.

Cattle-activated automatic spraying devices are marketed. Such devices loaded with well-chosen insecticides may be effective and would not require a roundup. As of this writing commercially made sprayer feeders include the Mister 2000 (Dr. Scratch Co., Smith Center, KS), Cullor (R & D Equipment; Sioux City, IA), and The Protector (The Protector, Bloomsdale, MO). Compare features and prices before selecting one of these.

COUMAPHOS (Co-Ral) 0.06%

Use 1 quart of 5.8% Livestock Insecticide Spray per 25 gallons of water, or 1 pint of the **Restricted Use Pesticide**, Co-Ral 11.6% ELI per 25 gallons of water. Or use 2 pounds of 25% WP or 1 pint of 42% flowable (**Restricted Use Pesticide**) in 100 gallons of water. Repeat as needed, no pre-slaughter waiting interval. See special precautions under grub control. Do not use Co-Ral on calves less than 3 months old.

METHOXYCHLOR (Methoxychlor, Sur-Noxem) 0.5%

Methoxychlor may not control pyrethroid-resistant horn flies. Use 8 pounds of 50% WP per 100 gallons or 2 gallons of 2 EC (25%) per 100 gallons of water. Use as needed, but not more than once every 3 weeks. No pre-slaughter waiting interval after using the EC formulation. Do not use the WP formulation on animals being finished for slaughter.

PERMETHRIN EC (Atroban, Ectiban, Expar, Insectaban, Insectrin, Permethrin, others) 0.0125 to 0.025%

Use 1 quart of 5.7% EC or 1 pint of 10% EC per 100 gallons of water. The Insectaban label also allows double strength

(1 quart 5.7% EC in 50 gallons water). Similarly, a higher concentration results from the Atroban and Expar 11% EC labels which call for 1 pint of 11% product in 50 gallons of water. Use as needed, but not more than once every 2 weeks. No waiting interval before slaughter.

PERMETHRIN EC (Atroban, GardStar) 0.025 to 0.5%

GardStar 40% EC or Atroban 42.5% EC may be mixed at rates of 4 fl. oz. per 25 or 50 gallons of water and applied to animals as a high-pressure spray. Apply only 1 to 2 quarts of mixture per animal depending on dilution rate selected. The GardStar label allows mixing 4 fl. oz. in 2½ gallons of water and applying 4 to 5.3 fl. oz. (½ to ⅔ cup) of mixture per animal using low pressure in a hand pump sprayer. Apply no more often than once every 2 weeks. No pre-slaughter waiting interval.

PERMETHRIN WP (Permethrin) 0.058%

Use 1 pound of 25% WP in 50 gallons of water. Do not repeat in less than 3 weeks. No pre-slaughter waiting period required.

PERMETHRIN SYNERGIZED POUR-ON (Atroban, Back Side Plus, Expar, Permethrin) 1% and 7.4%

The synergized pour-on formulations of 1% permethrin, and Permethrin CDS Pour-On (7.4%), may be used, undiluted, as low-pressure sprays applied in very small amounts (read the labels) directly to beef cattle. Apply no more often than once every 2 weeks. No pre-slaughter interval required.

PHOSMET (Prolate, Del-Phos, Lintox-HD) 0.058%

Mix 2 quarts of 11.6% formulation with 100 gallons of water. Apply fresh mixture with high pressure. Do not repeat in less than 7 to 10 days. Do not treat calves under 3 months old. Do not use phosmet on cattle at a time of year when they may have cattle grubs in critical tissues. There is a 3-day pre-slaughter waiting period.

TETRACHLORVINPHOS (Rabon) 0.35%

Although tetrachlorvinphos is an organophosphate, some populations of pyrethroid-resistant horn flies are cross-resistant to it. Mix 4 pounds of 50% WP in 75 gallons of water. No pre-slaughter waiting interval.

TETRACHLORVINPHOS/DICHLORVOS (Ravap) 0.38%

Mix 1 gallon of 28.7% EC with 75 gallons of water. Do not use more than once every 10 days. No waiting interval before slaughter. A more dilute mixture (0.14% Ravap) also is registered to control horn flies. For this rate, mix 1 quart 28.7% EC with 50 gallons of water.

Short-Lived Sprays and Mists

Additional insecticides are registered for horn fly control on beef cattle. These are low residue or non-residual materials which must be used frequently, often daily, and are used mostly in dairy operations. Beef producers who install automatic self-spraying devices with daily forced use, or where use frequency is not controlled, should consider these materials:

DICHLORVOS (DDVP, Vapona)
PYRETHRIN

Various mixtures of these short-lived insecticides are marketed, both ready-to-use and concentrated, under many brand names.

Pour-ons and Spot-ons

CYFLUTHRIN (CyLence) 1%

Apply this ready-to-use product at the rate of 4 ml per 400 pounds of animal weight or fraction thereof, not to exceed 12 ml per animal. Apply along top of the back and top of the head. Treat no more often than every 3 weeks. No pre-slaughter withdrawal period.

FENTHION (Lysoff) 0.84%

Slowly add 8 parts water to 1 part Lysoff (not vice versa) carefully, according to specific mixing directions on the label. Apply the resulting mixture to the animals' backlines at the rate of 1 ounce of mixture per 100 pounds of body weight. Do not treat calves less than three months old. Cattle may be treated no more than three times at not less than 14-day intervals. Pre-slaughter waiting interval is 21 days after one treatment, or 35 days after the last treatment if two or three applications have been made.

IVERMECTIN (Ivomec Pour-on) 5 mg/ml

Apply this ready-to-use product at the rate of 1 ml/22 lb. of beef animal body weight. Apply along topline in a narrow strip from withers to tailhead. 48-day pre-slaughter withdrawal period.

LAMBDAHALOTHHRIN (Saber Pour-On) 1%

Apply this ready-to-use product down the backline at the rate of 10 ml per animal under 600 pounds or 15 ml per animal over 600 pounds. Do not apply to faces. Do not apply more often than every 2 weeks nor more than four times in any 6-month period. No pre-slaughter withdrawal period.

PERMETHRIN EIL (Permethrin II) 0.14%

Mix 2 ounces of 10% emulsifiable in 1 gallon of diesel fuel or clean water. Apply ¾ to 1 cupful of the diluted mixture along the backline of each animal. Do not re-treat in less than two weeks. No waiting interval required for beef before slaughter.

PERMETHRIN POUR-ON (Atroban*, Back Side*, DeLice*, Durasect, Expar*, Ectiban, Hard Hitter, Permethrin* in 1% formulations; Boss, 5%; Permethrin (CDS, 7.4%; CD, 10%)*; Brute, 10%. An asterisk indicates availability both in unsynergized "classic" formulations and as synergized products.)

For cattle and calves. Do not treat with any of these products more often than once every 2 weeks. No pre-slaughter waiting period is required. For the 1% formulations (except for Durasect) apply ½ ml per cwt. (100 pounds of body weight) but not more than 5 fl. oz. (about ⅓ pint) per animal, along back and down face. Apply Durasect at the same rate, but apply in two strips along each side of midline from shoulder to tailhead. For Boss (5%) apply 3 ml per cwt. to backline and down face, but no more than 30 ml (1 ounce) per animal. Apply Permethrin CDS (7.4%) at the rate of 2 ml per cwt., over animal's shoulders and down midline of back, but no more than 20 ml (⅔ ounce) per animal. Apply Brute (10%) or Permethrin CD (10%) at the rate of 1.5 ml per cwt., over animal's shoulders and down midline of back, but no more than 15 ml (½ ounce) per animal.

PERMETHRIN WP (Permethrin) 0.08%

Add 1 pound of 25% WP to 36 gallons of water. Apply 16 ounces (1 pint) of this mixture to the back of each animal. Do not repeat in less than 3 weeks.

Backrubbers, Self-Oilers

A backrubber offers a convenient method to control horn flies and also will aid in control of face flies (see section on face flies).

Forced use of backrubbers is required for effectiveness. Enclose salt licks or mineral stations and hang backrubbers in gateways so that cattle must use the backrubber in getting to the mineral and upon leaving.

In general, use 1 gallon of mixed material to 25 feet of cable. Or fill reservoir of backrubber according to directions. Mix each insecticide only with the specific kind of oil named on the insecticide label. Specially refined "livestock grade" mineral oil should be used if the label does not specify something else. Mineral oil does not evaporate as rapidly as kerosene or diesel fuel and does not have the skin-irritating qualities that they do. Example sources include Corcoran Chemical Products, Inc., of Topeka, KS; and Livestock Backrubber Oil available from Farmland Co-Op. Do not overfill the backrubbers. Do not let cattle use a backrubber that is dripping with insecticide mixture.

Do not use used motor oil, transformer oil, or oil of unknown origin.

COUMAPHOS (Co-Ral) 1%

Mix 1 gallon of 11.6% ELI (**Restricted Use Pesticide**) or 2 gallons of 5.8% Livestock Insecticide Spray in 13 gallons of No. 2 furnace oil or No. 2 diesel fuel. No pre-slaughter interval.

METHOXYCHLOR (Methoxychlor, Sur-Noxem) 5% in oil

Methoxychlor may not control pyrethroid-resistant horn flies. Use 1 gallon of 2 EC with 5 gallons of stove oil or light grade fuel oil. Or use Sur-Noxem ready-to-use Backrubber Insecticide. No pre-slaughter waiting interval.

PERMETHRIN (Atroban, Ectiban, GardStar, Insectaban, Insectrin, Permethrin, others) 0.125 to 0.14% in oil.

Use 1 quart of 5.7% EC, 1 pint of 10% E, or 11% EC, or 118 ml (about 4 oz) of 40% EC in 10 gallons of diesel oil. No pre-slaughter waiting interval. For horn fly control, permethrin in backrubbers should be used in rotation with organophosphate backrubber insecticides.

PERMETHRIN POUR-ON products (see Pour-On section above)

The synergized 1% permethrin pour-on products (but not the "classics") listed above and Permethrin CDS Pour-On (7.4%), have label directions for use in backrubbers. Dilute 1 pint of 1% product or 64 ml (2.1 oz) of Permethrin CDS Pour-On per gallon of mineral oil (some labels allow use of No. 2 diesel as the diluent). There is also a ready-to-use 0.125% permethrin product, Gordon's Backrubber and Pour-On, that may be used, without diluting, to charge backrubbers. For horn fly control, permethrin in backrubbers should be used in rotation with organophosphate backrubber insecticides.

PHOSMET (Del-Phos, Lintox-HD, Prolate) 0.25%

Use 1 pint of 11.6% product in 6¼ gallons of suitable carrier oil. No pre-slaughter waiting interval.

TETRACHLORVINPHOS/DICHLORVOS (Ravap) 1.15%

Mix 1 quart of 28.7% EC in 6 gallons of No. 2 diesel oil or other approved backrubber oil. No withholding period prior to slaughter.

Dust Bags, Dust Dispensers

Dust bags and cattle-activated dust dispensers provide excellent control of horn flies where properly installed and maintained. Place dusters near—but not directly over—mineral or salting stations; in alley ways, in loafing pens, or in holding sheds. Protect bags from weather by placing them under shelter, and suspend them where they will hang 4 to 6 inches below the top line of cattle. Use directions for a product may differ according to whether the dust bag is for forced use or free choice. Read specific labels if interested in hand dusting.

COUMAPHOS (Co-Ral) 1%

No pre-slaughter waiting interval is required.

PERMETHRIN (Ectiban, Gordon's Dairy & Livestock Dust, Insectrin, Permethrin) 0.25%

Permethrin dust products are not reliable for control of horn flies in Kansas, although they are legally registered for horn fly control. They are registered and effective for face fly control. No pre-slaughter waiting period.

TETRACHLORVINPHOS (Rabon) 3.0%

Although not a pyrethroid, tetrachlorvinphos may not control some pyrethroid-resistant horn flies. No pre-slaughter waiting interval.

Oral Larvicides, Boluses

Oral larvicides are insecticides administered through mineral mixes or blocks, or in feed mixes or with a bolus. They act by killing fly larvae (maggots) developing in the manure. They do not protect cattle from adult flies. Because of fly migration from surrounding pastures, eliminating larval development in your own pastures may not satisfactorily reduce the number of flies on your cattle.

The success of most oral larvicides depends on the consumption of it by the animals. Salty vegetation in some areas, calves in a cow/calf herd and variability of intake among mature animals in a herd generally result in erratic fly control. In general, the feed additives work better on steer or heifer herds than on cow/calf herds.

Note: As of this writing, the Ivomec SR Bolus label bears no claim of horn fly control.

DIFLUBENZURON (Vigilante) 9.7% bolus

Controlled-release bolus lasts all fly season (5 months) with one application. Administer with a standard balling gun. Not for cattle under 300 pounds. Dose rates: ½ bolus for cattle 300 to 550 pounds, 1 bolus for 550 pounds or greater. Do not give any animal more than one bolus. No pre-slaughter waiting period.

METHOPRENE (Altosid)

This is an IGR (insect-growth regulator), but the end result of its use is death to developing immature insects. Methoprene is available from Moorman's in mineral mixes and blocks. Use as directed on labeling. No pre-slaughter waiting interval.

TETRACHLORVINPHOS (Rabon Oral Larvicide)

Available as premix, loose mineral, or in blocks. Mix and feed as directed on labeling. No pre-slaughter waiting interval.

Face Flies

Face flies are abundant and troublesome pests of cattle and horses in eastern Kansas. They diminish to low or insignificant numbers in western Kansas.

The face fly is not a blood sucker. Unlike the horn fly, both sexes of the face fly spend a great deal of time away from animals. They feed on nectar of flowering weeds and wild flowers. Face flies, especially females, also feed on animal secretions such as tears, saliva, nasal mucus, and blood and serum oozing from wounds, including bites where blood-sucking flies have fed. Female face flies require such animal fluids containing proteins for their eggs to develop.

Cattle are greatly bothered by face flies clustering to feed at the eyes, nostrils and muzzle. When face flies are abundant, cattle huddle closely together trying to brush the flies away and do not feed. Surprisingly, experiments throughout the country have failed to show loss of production from the direct effect of face fly nuisance.

However, face flies are important in spreading *Moraxella bovis*, the bacterium which causes pinkeye (also known as IBK or infectious bovine keratoconjunctivitis) in cattle. Severe weight loss and blindness in one or both eyes can result from pinkeye.

Face flies have sharp microscopic teeth on the end of their sponge-like "tongue." As the flies feed on mucoid fluid from cattle's eyes, these teeth irritate the eye tissue and cause tears to flow, allowing easier feeding for the flies. These tiny wounds also allow penetration of the pinkeye organism. The more active cases of pinkeye occurring in the herd, the more bacteria are present to be carried by face flies as they move from animal to animal.

Face flies feed only on animals that are outdoors in natural light. They avoid darkened buildings or windy areas. Females lay their eggs in fresh cow manure where the larvae develop. The life cycle is completed in 15 to 25 days. Several generations may occur from late March through October. This species overwinters as adults, hiding in protected places under loose tree bark, within the siding of buildings, and in attics and lofts.

Chemical Control

Because face flies spend only a fraction of their time on cattle, they are difficult to reach with insecticides. Insecticidal control measures must provide good coverage to the cow's face, especially around the eyes. **Face fly control has seldom been complete enough to significantly reduce the incidence of pinkeye except**

on confined cattle that can be treated frequently. Cattle producers are urged to work with a veterinarian to develop pinkeye prevention (vaccination and antibiotic mineral mixes) and pinkeye treatment programs.

Insecticidal Ear Tags

All tags listed on previous pages under "Horn Flies" are registered for face fly control. Two ear tags per animal (including cows, calves and yearlings) are necessary to be effective against face flies. Even two tags typically provide only 50 to 70 percent reduction in the number of flies on animals, yet this is generally considered better than the results obtained by other methods. Tests of some of the newer kinds of pyrethroid ear tags, conducted in other states, have shown 85 to 95 percent control of face flies. We do not know if such good performance will occur consistently or with high numbers of face flies present.

Sprays

PERMETHRIN EC or EIL (Atroban, Ectiban, Expar, Insectaban, Insectrin, Permethrin-10, Permethrin II) 0.0125 to 0.058%

Use 1 quart of 5.7% EC or 1 pint of 10% EC per 100 gallons of water. The Insectaban label calls for 1 quart of 5.7% EC per 25 gallons of water. Atroban and Expar 11% EC labels indicate 1 pint of product per 25 gallons of water. Use as needed, but not more than once every 2 weeks. No pre-slaughter waiting interval.

PERMETHRIN WP (Permethrin) 0.058%

Use 1 pound of 25% WP in 50 gallons of water. Do not repeat in less than 3 weeks. No pre-slaughter waiting interval.

TETRACHLORVINPHOS (Rabon) 0.30%

Use 4 pounds of 50% WP in 75 gallons of water. Spray treatment may be repeated in 2 weeks. No pre-slaughter waiting interval.

TETRACHLORVINPHOS/DICHLORVOS (Ravap) 0.38%

Mix 1 gallon of 28.7% EC with 75 gallons of water. Do not use more than once every 10 days. No waiting interval before slaughter.

Note: Also see discussion of automatic spraying devices under "Sprays" in Horn Fly section.

Short-Lived Sprays and Mists

Direct the spray to the animal's face. Sprays directed toward the sides and top line give less control.

DICHLORVOS (Vapona) 0.8% fine mist

Mix 5 ounces of 43.2% concentrate in 2 gallons of water. Apply fine mist to cows' faces daily if needed. Do not wet the hide. Do not apply to calves under 6 months old nor to Brahman or Brahman cross cattle. There is a one-day pre-slaughter interval.

Pour-Ons

Face fly control is claimed, also, by the labels of all the 1% permethrin products (both "classic" and synergized) listed under Pour-Ons in the section on Horn Flies. Face fly control is also claimed on the labels of Boss (5% permethrin) and

CyLence (1% cyfluthrin). The Saber Pour-On (1% lambda-cyhalothrin) label claims “aids in control of face flies.”

Spot Treatment

PERMETHRIN EC or EIL (Ectiban, Insectaban, Permethrin II, Permethrin-10) 0.10 to 0.15%

Mix 2 ounces of 10% EIL in 1 gallon of diesel fuel or clean water. Apply 2 to 4 ounces (¼ to ½ cup) of this mixture per face. Do not treat more than once every 2 weeks.

Or mix 1 pint Permethrin-10 or 1 quart of Ectiban or Insectaban 5.7% EC per 2½ gallons water. Apply 1 to 2 ounces per face per day.

PERMETHRIN WP (Permethrin) 0.08%

Add 1 pound of 25% WP to 36 gallons of water. Apply 2 to 4 ounces (¼ to ½ cup) of this mixture per face. Do not repeat in less than 3 weeks.

Face Rubbers, Self-Oilers with Face Mops

Face fly control is poor with backrubbers or self-oilers set up for horn fly control. Face fly control is enhanced by the use of “mops” or other extensions dangling from the main unit. Commercial lines of such elements include Face Flyps which are flat strips of wicking and Fly Bullets which are absorbent cylinders 2 feet long by 5 inches wide. Cattle get insecticide on their faces as they “play” with such devices.

COUMAPHOS (Co-Ral) 1%

Mix 1 gallon of 5.8% Livestock Insecticide Spray in 6½ gallons of No. 2 furnace oil or No. 2 diesel fuel. Or, mix 1 gallon of 11.6% ELI (**Restricted Use Pesticide**) in 13 gallons of No. 2 furnace oil or No. 2 diesel fuel. No pre-slaughter interval.

PERMETHRIN EC (Ectiban, Insectrin, Permethrin II) 0.125 to 0.14% in oil

Use 1 quart of 5.7% EC or 1 pint of 10% E in 10 gallons of diesel oil. No pre-slaughter waiting interval.

TETRACHLORVINPHOS/DICHLORVOS (Ravap) 1.15%

Mix 1 quart of 28.7% EC in 6 gallons of No. 2 diesel oil. No withholding period prior to slaughter.

Dust Bags, Face Dusters

Some reduction of face fly numbers can be achieved with dust bags or face dusters. Use may be forced by using commercially made duster-feeder combination devices. Otherwise, place dusting devices as described in the section on **Horn Flies**.

COUMAPHOS (Co-Ral) 1% dust

No pre-slaughter waiting interval.

METHOXYCHLOR 3%, 10% or 11% dust

No pre-slaughter waiting interval.

PERMETHRIN (Ectiban, Gordon's Dairy & Livestock Dust, Insectrin, Permethrin) 0.25% dust

No pre-slaughter waiting interval for treated cattle.

TETRACHLORVINPHOS (Rabon) 3% dust
No pre-slaughter waiting interval.

Oral Larvicides, Boluses

The same constraints apply to the use and effectiveness of oral larvicides for face fly control as for horn fly control (see Oral Larvicides in section on Horn Flies). Tetrachlorvinphos (Rabon Oral Larvicide) and diflubenzuron (Vigilante) are registered for control of face fly larvae.

Stable Flies

(See following pages for explanation of stable fly problems in feedlots. Stable flies are generally thought of primarily as pests associated with confined livestock operations. But, they often are abundant on pastured cattle, especially in tall grass regions where rainfall may be abundant. Stable flies cause an estimated \$20 million or greater annual loss in Kansas rangeland operations. Their fierce biting on the legs often drives cattle to stand for hours in the deep water of creeks and ponds. **Because stable flies feed on animals' feet and legs, many people confuse them with heel flies which do not bite but are the adults of cattle grubs (see introductory paragraph under Cattle Grubs).**

Research suggests that stable flies on pastured animals originate primarily from confined livestock operations. Around feedlots the key to stable fly control is sanitation coupled with biological control or appropriate insecticide use. Stable flies in open country also may breed in such sites as grass trampled into muddy foot tracks, old manure packs where cattle shade up, and other decaying plant material where traditional sanitation measures are impractical. Spoiled bottoms of large round hay bales provide additional breeding sites for stable flies on the range. Store large bales on well drained sites to save hay and reduce stable fly populations.

Sprays

If pastured cattle are sprayed to control horn flies, making sure the feet and legs are thoroughly soaked also should provide temporary relief from stable flies. However, insecticide residues cannot be expected to last long on the feet and legs of cattle walking through vegetation and wading in creeks. **The materials of choice for stable fly control on pastured cattle would be the permethrin formulations listed in the Horn Fly section.** Under optimum conditions, permethrin may protect cattle from stable flies for two weeks or longer. A number of short-lived sprays also are registered for application to cattle for stable fly control.

Backrubbers, Self-Oilers

This application method has little effect on stable flies where the device is suspended near the animals' back height as for optimal horn fly control. The long, low-slung type of self-oiler **may somewhat reduce** stable fly annoyance if the low

part of the device is below knee level, but the unreliability of this method is reflected in the fact that no insecticide manufacturer's label suggests backrubber/self-oiler application for stable fly control.

Horse Flies and Deer Flies

Many species of these blood sucking flies cause annoyance and weight-gain loss in beef cattle. Deer flies have spotted wings and brown or black bodies with yellow or tan markings. They range from $\frac{1}{4}$ to $\frac{3}{8}$ inch in length. Horse flies range from small gray flies about $\frac{3}{8}$ inch long to large black horse flies over an inch long.

Males do not suck blood, but the females are fierce biters; the large species cause blood to literally well out of a bite and trickle down the animals' sides. Such wounds were a frequent site of screwworm invasion prior to screwworm eradication. The female horse fly's habit of intermittent but frequent feeding makes her an efficient carrier of blood-borne diseases, including anaplasmosis in cattle and equine infectious anemia (swamp fever) of horses.

Horse flies and deer flies have one generation per year. Most species lay their eggs on vegetation above water; newly hatched larvae drop into the water and then burrow into mud. Larvae prey on soil-dwelling insects (including each other). Control in the larval stage is not practical.

In most years at most Kansas locations, horse flies and deer flies cause only minor-to-moderate annoyance to cattle. However, occasional heavy outbreaks occur, especially in the eastern half of Kansas, from mid-July through early September. During such outbreaks, the numerous painful bites cause rapid reduction in milk production, and calves already beleaguered by horse fly bites are faced with a diminishing level of nutrition.

Dark-colored cows often are attacked most heavily but light-colored animals are far from immune. The two species of horse flies causing most damage to cattle in Kansas are the large **black horse fly** and the slightly smaller, brown-colored **autumn horse fly**. The black horse fly bites almost exclusively on animals' backs. The autumn horse fly bites mostly in a saddle-shaped area, including back, shoulders and ribs, but also may bite legs, neck, belly, etc.

Chemical Controls

Insecticides may not kill these flies quickly. Even though many will die after feeding on treated cattle, others may come to the cattle and no control will be immediately evident. However, producers may perceive a shorter horse fly season on treated cattle.

Backrubbers, Self-Oilers

PERMETHRIN (Atroban, GardStar, Permethrin, others) 0.121 to 0.137%

Because these flies bite mostly on the back and upper body, considerable protection is afforded by insecticidal dusts from dust bags and oils from backrubbers (see listings under **Horn Flies**).

The permethrin products, Atroban 11 EC, GardStar 40% EC, Permethrin II 10% EIL, and Permethrin CDS Pour-On, have label claims for horse fly control using the products in backrubbers. See **Backrubbers** in the **Horn Fly** section, or read product label for mixing instructions.

Sprays

PERMETHRIN (Atroban, Expar, Ectiban, GardStar, Insectaban, Permethrin) 0.0121% to 0.058%

Dilute 1 quart Ectiban or Insectaban 5.7% EC, or 1 pint Atroban or Expar 11% EC, with 25 gallons of water, or 1 pint Atroban 42.5% EC, Permethrin II EIL, or GardStar 40% EC in 100 gallons of water, or mix 1 pound of Permethrin 25% WP in 50 gallons of water. Spray thoroughly on back and sides or whole body.

Do not re-treat in less than 2 weeks after using emulsifiable formulations nor less than 3 weeks after using wettable powder. No pre-slaughter waiting interval.

PERMETHRIN (Pro-Tech Horse and Stable and Multi-Use Spray) 0.5%

This ready-to-use product may be used to treat cattle, applying 2 ounces per animal daily, if necessary for control of horse flies and deer flies. No pre-slaughter waiting interval.

Note: Also see discussions of automatic spraying devices and of Permethrin Synergized Pour-On formulations used as sprays, both under "Sprays" in Horn Fly section.

Also, be aware that, if treating cattle for grubs during horse fly season, many of the grubicidal pour-ons are effective in repelling or killing horse flies; although horse flies are not listed as target pests on the labels of such products.

Pour-on

PERMETHRIN POUR-ON (Atroban*, Back Side*, DeLice*, Durasect, Expar*, Ectiban, Hard-Hitter, Permethrin* in 1% formulations; Boss 5%, Brute 10%, Permethrin CDS 7.4%, Permethrin CD 10%. An asterisk indicates availability both in unsynergized "classic" and in synergized formulations.)

Ready-to-use products. See application directions on specific product label or preview directions under Permethrin Pour-On in the section on Horn Flies. Do not re-treat in less than 2 weeks. No pre-slaughter waiting interval.

Feedlot Fly Control

Summertime fly numbers reach astonishing levels in feedlots, unless specific management practices are employed to control them. The major breeding grounds of flies in feedlots are moist, untrampled sites where manure is mixed with wasted straw, hay or grain. One square yard of such a site may contain 10,000 maggots which mature into adult flies every 8 to 21 days!

Two fly species predominate in feedlots: the common house fly and the stable fly. Both species can easily fly several miles. Feedlot operators must be concerned about public-nuisance aspects of having too many flies as well as about reduced gain of cattle attacked by flies.

Stable Flies

Stable flies are fiercely biting, blood-sucking flies. They attack man, cattle and horses primarily on the legs and attack the ears of dogs and swine. Although present throughout the warm months, populations are often highest from late May through June, especially after rainy periods.

Even a few stable flies biting will cause some foot stamping and other signs of discomfort, but five or more per leg cause dramatic behavioral changes in cattle, accompanied by seriously affected feeding performance. Cattle bunching up tightly in a corner of the pen, switching their tails, and stamping their feet may be the sign of a bad stable fly problem. Fifty to 100 stable flies per animal are not uncommon during outbreaks.

Weight gain reductions of 0.2 to 0.5 pounds per day and feed efficiency reduction of 11 to 13 percent have been documented in feedlot cattle as a result of stable fly attack. Stable flies are estimated to cause \$22 million annual loss in Kansas feedlots.

The stable fly is similar to the house fly in size and general appearance. Close inspection reveals a slender, black, piercing-sucking mouthpart projecting forward or downward from the head. The back and abdomen are gray with a distinct pattern of black spots.

Stable flies often cluster about the feet or knees of cattle while feeding. They generally feed with their heads upward. Stable flies feed only during daylight hours. When not on cattle or other livestock, stable flies rest in the shade on fence posts, wooden fences, feedbunks, on buildings, or in the lower part of shrubs, trees or weeds.

Female stable flies lay eggs on moist decaying organic matter, and the maggots (larvae) develop beneath the surface of such materials. Soggy hay or straw, wet and decaying spilled grain, fermenting piles of green chop (including weed or grass cuttings), ensilage, and manure mixed with such materials are typical stable fly breeding areas. A complete generation from egg to egg-laying adult typically requires three to four weeks.

House Flies

House flies are a familiar pest of man and animals throughout the world. Equipped only with a sponging mouthpart, they cannot bite and suck blood. Rather, they feed by salivating and regurgitating on feedstuffs, manure, garbage and other organic material to dissolve nutrients which they ingest by sponging and swallowing. The house fly is dull gray with four distinct stripes behind the head, and the abdomen is pale gray to cream colored without the darker spots of the stable fly.

Although house flies do not bite, they can become numerous enough to bother cattle greatly. They also are a great nuisance to feedlot workers, and sometimes to surrounding neighborhoods. House flies can spread disease organisms from animal to animal and from manure to feed.

House fly larvae develop in either fresh or aged manure, and in the same materials utilized by stable flies. The life cycle from eggs to egg-laying adults usually requires from 10 to 14 days but, under ideal conditions, can occur in as little as eight days. When not feeding, house flies sun themselves or "roost" for the night on manure, contaminated soil surfaces, fences, buildings, trees, and shrubs ranging from ground level to several feet up.

Non-Chemical Control Sanitation

A good sanitation program denies the flies effective breeding sites and keeps fly numbers at a minimum.

Locate pens on a sloping surface with a good drainage system. Construct mounds with smoothly arching tops and keep them well packed. One end of the mound should abut the feedbunk apron so cattle can go back and forth between feed and resting areas without wading in mire during wet seasons. Remove manure regularly. Clean around feedbunks and feed aprons, under fences and gates, around water systems, in corners, and at the edges of mounds. Fill potholes and low areas to maintain good drainage. A harrow can be used to aid in keeping the pens dry.

Clean sick pens, horse pens, and feed storage and preparation areas at least every 10 days. Keep spilled grain, unused hay, straw and ensilage cleaned up. Fix leaky faucets and water troughs.

Drainage ditches and debris basins outside the pens can become fly-breeding sites as the edges partially dry. If irrigation water is available near these basins, they can occasionally be flooded with 3 or 4 inches of water to drown the maggots.

Keep weeds under control around feedlots. This forces flies to rest on more exposed surfaces where they are vulnerable to insecticidal control. A useful variation is to leave a narrow strip or two of weeds as a limited resting site that can be sprayed frequently.

Biological Control

Several species of gnat-sized parasitic wasps that destroy fly pupae occur naturally in feedlots. These, and predatory and parasitic beetles, help keep fly populations from reaching their highest potential. Parasitic wasps are available from commercial firms to augment the natural controls.

Stable flies often are abundant in June and early July. Later in the summer they are largely replaced by house flies, although stable flies persist in wet, cool years. For effective biological control, this seasonal change in fly species calls for a change in parasitic wasp species. Parasites that attack stable fly pupae are different than those which attack house fly pupae.

Muscidifurax zaraptor primarily parasitizes house fly pupae, whereas *Spalangia nigroaenea* mostly parasitizes stable fly pupae. *S. nigroaenea* is the predominant natural species in feedlots on the High Plains and is the parasite of choice for biocontrol of stable flies. *S. nigroaenea* releases have provided up to 50 percent reduction in stable fly numbers in cattle feedlot tests conducted by Kansas State University.

Two other species, *Muscidifurax raptor* and *Spalangia cameroni*, each make up about 10 percent of the total parasite numbers whether or not wasp releases are being made.

As with chemical control, biological control must be accompanied by good manure management, elimination of wet spots, and general sanitation if one expects a successful outcome.

Chemical Control of House Flies and Stable Flies Space or Area Sprays or Mists

For effectiveness and cost, the first line of defense after sanitation should be the use of short-lived (knock-down) insecticides. These may be applied with foggers, mist blowers, or hydraulic sprayer handguns. Mist blowers generally prove most satisfactory, and can be used effectively even under fairly breezy conditions. Fogs often disperse upward too rapidly and are difficult to direct. Hydraulic sprayers may be useful in small operations where the cost of a mist blower cannot be justified. Adjust the nozzle to apply a fine, misting spray.

Apply knockdown treatments at a time of day when flies are relatively inactive but when the temperature is 70°F or higher. These materials may be applied over the entire lot, but economy can be gained without loss of efficacy by selectively treating areas where flies are resting. Be sure to treat tree windbreaks and similar fly resting sites outside the pens. Treatments may need to be made every three to seven days, depending upon the vigor with which sanitation is pursued.

Mix only the amount of insecticide that you will apply at one time. Insecticides deteriorate when mixed for more than a few hours. Rotate between insecticide families (see table of **Insecticide Names** inside back cover) once or twice each fly season to retard insecticide resistance in fly populations.

DICHLORVOS (Vapona) 0.43%

Mix 1 gallon of 43.2% concentrate in 100 gallons of water. Five gallons of mixture treats one acre with mist. No pre-slaughter waiting period.

NALED (Dibrom) 0.3 to 0.5%

Mix 3 to 5 quarts of 36% naled in 50 gallons of water and apply at the rate of 0.1 to 0.25 pound technical naled per acre (1½ to 2½ gallons treats one acre with mist). Or use 1 quart of Dibrom 8 (58% EC) in 40 gallons of water and apply 0.25 pound technical naled (approx. 5 gallons of diluted mixture) per acre. No pre-slaughter waiting period.

NOTE: Some permethrin products (e.g., Ectiban 5.7% EC, GardStar 40% EC, Permethrin II 10% EIL) also are registered for mist applications to cattle feedlots. Because these products have long residual action when applied at higher concentrations, they are generally reserved for residual spray applications. However, these pyrethroids currently represent the only alternatives to organophosphates for use in a rotation.

Residual Sprays

This method utilizes insecticides which do not break down rapidly. Applications leave residues on surfaces which kill flies for from 1 to 5 weeks. High temperatures, bright sunlight, and the chemistry of concrete surfaces cause breakdown, and rain washes the material off. Generally speaking, wettable powder (WP) and microencapsulated (M or ME) formulations have longer residual action than emulsifiable concentrates (EC or EIL). Residual sprays should be applied to surfaces to the point of runoff.

Residual sprays should be targeted to known fly resting sites such as windbreaks and the sides of buildings, fences and feedbunks; but care should be taken to keep all insecticide out of feed and feed bunks.

Caution: Some of the materials listed below are not meant for direct application to livestock. Others may be applied to livestock, but not at the concentrations prescribed for residual surface treatment. Also see the note following the list, pertaining to the asterisked materials.

*CHLORPYRIFOS (Double Shift MEC) 0.45%

Caution: Do not spray or allow spray drift on animals, feed or water. The label specifies application with a compressed-air sprayer or cold-mist fogger adjusted to deliver coarse, wet spray.

Mix 3 fluid ounces of Durvet Double Shift MEC (microencapsulated chlorpyrifos 20% concentrate) per gallon of water. One gallon of mixture covers 750 to 1,000 sq. ft. of surface. Repeat as needed.

CYFLUTHRIN (Countdown) 0.1%

Mix two 9.5-gram packets of Countdown 20% WP or 16 ml (about 1 Tablespoon) of Countdown 24.3% EC per gallon of water. Apply 1 gallon of mixture per 1,000 sq. ft. of surface, using low pressure.

*DIAZINON (Diazinon, Dryzon) 0.5%

Caution: Do not allow spray to contact feed, water or animals. Keep animals away from treated premises for at least 4 hours.

Mix 2 pounds of Diazinon 50 W (**Restricted Use Pesticide**), Diazinon 50 WP, or Dryzon WP with 25 gallons of water. One gallon of spray covers 350 to 750 sq. ft. of surface. Repeat as

needed. Four pounds of product per 25 gallons of water is permitted for longer residual control. Improved house fly (not stable fly) control may be obtained by adding of sugar according to label.

DIMETHOATE (Cygon 2-E) 1%

Labeled for house fly control. *Do not use inside farm buildings without first removing all animals.* Mix 1 gallon of Cygon 2-E in 25 gallons of water. One gallon of mixture treats 500 to 1,000 sq. ft. of surface. Repeat as needed.

*LAMBDAHALOTHHRIN (Grenade ER) 0.015 to 0.03%

Caution: Do not allow spray to contact feed, water or animals. Keep animals away from treated premises until sprayed surfaces are dry. Mix 6 to 12 ml (1 to 2 teaspoons) of Grenade ER per gallon of water and apply under low pressure to wet the surfaces being treated.

METHOXYCHLOR (Marlate) 2.0%

Mix 4 pounds of 50% WP in 10 gallons of water. One gallon of this mixture covers about 500 sq. ft. of surface. Repeat as needed.

PERMETHRIN (Atroban, Ectiban, Expar, GardStar, Hard Hitter, Permethrin, Permethrin, Pounce) 0.1 to 0.25%

One gallon of any of these mixtures (depending on label) treats 750 to 1,000 sq. ft. of surface. Repeat no more often than every 2 weeks.

For a 0.1% residual spray, mix any of the following: 1 quart of Ectiban, or Hard Hitter, 5.7% EC in 12.5 gallons of water; or 6 ounces of Ectiban, Hard Hitter, or Pounce 25% WP—or Pounce WSB—in 11 gallons of water; 1 quart of Permethrin II 10% EIL or Permethrin-10 in 25 gallons of water; or 1 pint of Pounce 3.2 EC in 50 gallons of water.

For a 0.125% residual spray, mix 1 can (6.67 oz.) of Atroban or Expar 25% WP per 10 gallons of water. Or, for a 0.14% residual spray, mix 1 quart of Insectaban 5.7% EC in 10 gallons of water.

If using Atroban 42.5% EC, dilute ¼ pint per 10 gallons of water, making a 0.128% spray. The GardStar 40% EC label allows a range of dilutions—90 to 118 ml (about 3 to 4 fluid ounces) of product per 10 gallons of water, resulting in 0.1 to 0.13% spray mixture.

For a 0.25% residual spray, mix 1 pint of Atroban or Expar 11% EC in 10 gallons of water, or 1 can (6.67 oz.) of Atroban or Expar 25% WP in 5 gallons of water.

The Permethrin-10 label allows residual application of a 0.5% mixture made by mixing 1 part of product with 19 parts of water.

PERMETHRIN SYNERGIZED POUR-ON (Atroban, Back Side Plus, Expar, Permethrin) 1% and 7.4%

The synergized pour-on formulations of 1% permethrin and Permethrin CDS Pour-On (7.4%) may be used, undiluted, in a mist spray applied to structural surfaces. One gallon treats about 7,300 sq. ft.

TETRACHLORVINPHOS/DICHLORVOS (Ravap) 1.15%

Use 1 gallon of Ravap (23% + 5.7%) EC per 25 gallons of water. Apply 1 gallon of solution per 500 to 1,000 sq. ft. of

structural surface. For extreme situations, the concentration may be doubled to 1 gallon of Ravap per 12.5 gallons of water. Repeat as needed.

*TRICHLORFON (Dylox, Dipterex) 1.25%

Remove animals before spraying either inside barns or on outside pen surfaces. Do not allow spray droplets to contact painted metal surfaces.

Mix 5 pounds of Dylox or Dipterex 80 SP in 40 gallons of water. Spray 1 gallon of mixture per 500 sq. ft. of surface. Repeat as needed. For longer control of house flies (not stable flies), add 1 pound of sugar to each gallon of spray solution.

***Note: Practical considerations in implementing the precautions for making residual treatments with chlorpyrifos, diazinon, lambda-cyhalothrin, or trichlorfon products mean that the most likely use for them in feedlots would be spraying outsides of buildings and on fly resting sites around the perimeter of, but away from, animal pens.**

Spraying Manure

Manure spraying should not be done routinely. It destroys naturally occurring beneficial mites and insects that ordinarily prevent extreme outbreaks of flies. In addition, frequent manure spraying increases the likelihood of insecticide resistance in house flies and stable flies.

However, manure spraying may be needed to supplement other fly control efforts, especially if rainy weather has disrupted manure management and other types of insecticide application. Use a coarse spray to obtain kill of larvae as well as adult flies.

DICHLORVOS (DDVP, Vapona) 0.86%

Mix 1 gallon of Vapona 43.2% concentrate in 50 gallons of water to obtain a 0.86% solution. Use 1 to 2 quarts of this mixture to treat 100 sq. ft. of surface.

DIMETHOATE (Cygon 2-E) 1.25%

Labeled for house fly maggot control. Mix 1 quart Cygon 2-E in 5 gallons of water. Do not treat general ground surface of corral. Do not allow livestock access to treated manure piles.

TETRACHLORVINPHOS (Rabon) 1.0%

Mix 4 pounds of Rabon 50% WP in 25 gallons of water. Apply 1 gallon of mixed solution per 100 sq. ft. of manure pile surface.

TETRACHLORVINPHOS/DICHLORVOS (Ravap) 1.15%

Use 1 gallon of Ravap (23% + 5.7%) EC per 25 gallons of water. Apply 1 gallon of solution per 100 sq. ft. of manure surface.

Direct Animal Spray

Direct spraying of animals in feedlots is generally an inefficient way to control flies. But many of the spray products listed under **Horn Flies** have label claims for control or “aids in control” of stable flies. Be sure to mix and apply them strictly according to label at the concentrations specified for direct application to beef cattle for stable fly control. Pyrethroid insecticides generally provide better control of stable flies when sprayed on animals than do organophosphate insecticides.

Oral Larvicides, Boluses

Oral larvicides or “feed-through” insecticides function by passing through the animal’s digestive system to kill fly larvae in the manure. Studies have shown that oral larvicides are usually effective in manure for about three weeks. House flies deposit eggs in fresh manure as well as older manure, wet spilled feed, etc.; so many house fly maggots will be destroyed. Stable flies rarely breed in fresh manure, so feed-through larvicides have little effect on them. Oral larvicide use may be helpful in conjunction with strict sanitation.

DIFLUBENZURON (Vigilante) 9.7% bolus

Primarily for horn flies and face flies. The label claims “aids in control of house flies and stable flies.” Practical degree of control on stable fly larvae is very doubtful.

TETRACHLORVINPHOS (Rabon Oral Larvicide)

Rabon 7.76% Oral Larvicide Premix should be thoroughly blended with complete rations or with concentrates to supply 70 mg Rabon per animal cwt./day. Do not use in liquid feed supplements. A 40-pound bag of premix should supply Rabon in the ration for 1,000, 1,000-pound steers for 2 days.

Rabon 97.3 Oral Larvicide, a concentrated formulation, is available to feed manufacturers. No pre-slaughter withdrawal from Rabon insecticidal feed is required.

Fly Baits (House Flies)

Fly baits are sometimes useful in supplementing other fly-control measures. However, fly baits also are toxic to animals and birds which may eat them. Protecting livestock, stock dogs, wildlife and birds from gaining access to the bait restricts where it can be placed and may call for hardware cloth or other structural shielding.

Several insecticide formulations have label directions for mixing with sugar to make your own fly baits or bait sprays. Do not attempt to make fly baits with insecticides unless the labels provide specific directions for such applications. Commercially packaged baits usually include sugar or other fly-feeding attractants. All of the baits listed below, except Fly Patrol, contain non-food house fly aggregation attractants called (z)-9-tricosene, Muscamone, or Tricolure.

In either case, the distance from which house flies can be attracted is a matter of inches or a few feet at best. Effectiveness depends on putting the bait where flies naturally congregate for feeding, breeding or resting. **Note that stable flies feed only on the blood of warm-blooded animals, and baits will have very little, if any, effect on them.**

METHOMYL (Apache, Improved Golden Marlin, Golden Muscamyl, Fatal Attraction, Fly Bait Plus, Fly Belt, Flytek, Fly Patrol, Tailspin) 1%

Methomyl kills insects by contact and/or ingestion.

Other Pests

Cattle Grubs

Cattle grubs are the larvae of heel flies. **Note: Many cattle producers in Kansas use the term “heel flies” for the flies that gather on cattle’s legs and feet where they bite and suck blood. Those flies are actually stable flies and are not related to the heel flies that produce cattle grubs.** Adult heel flies resemble honey bees in size and color. Two species are known. Northern cattle grubs are distributed mainly in the northern United States and Canada, while common cattle grubs occur throughout the United States. Common cattle grubs are found most frequently in Kansas.

The act of attempting to lay their eggs on the hairs of the legs of cattle produces an uncontrollable fear that causes the animals to run wildly. Animals being chased by heel flies have a characteristic way of holding their tails high in the air as they run. Adults of northern cattle grubs frighten animals the most.

Adult heel flies live a short time, usually less than a week. The eggs hatch in three to six days and the tiny larvae bore through the skin, then migrate through connective tissues between the muscles. As cattle grubs hatch from heel fly eggs, natural resistance prevents some of them from penetrating the host’s skin.

If cattle are deficient in vitamin A, this resistance is lowered and the cattle may have more grubs than healthy cattle. Also, calves and yearlings are more vulnerable to cattle grub infestation. Older cattle have some degree of acquired resistance.

Larvae of the northern cattle grub spend their fifth, sixth and seventh months (usually October through December) in the tissues around the spinal cord before migrating to the back.

Common cattle grub larvae spend most of their developmental time in the submucosa of the esophagus (gullet), but they have been found in connective tissues of the diaphragm, pericardium, spleen, rumen, ribs and peritoneum.

Upon reaching the back, larvae of both species cut breathing holes in the skin and remain just beneath the skin for 35 to 90 days before becoming mature grubs. After becoming fully grown, the grubs squeeze through the breathing holes, drop to the ground, and pupate in loose soil or other debris. After about four to five weeks, the adult heel flies emerge from the puparia. There is only one generation per year. When planning to treat cattle that have come from out of state, you must remember that the timing of the life cycle varies in different parts of the country.

Treatment should be applied after heel fly season, but at least six weeks before grubs appear in the back, i.e., from June to October 1. Out-of-state southern cattle should also not be treated after October 1. Treatment in October, November, December, January and February with some systemics may cause toxic reactions in cattle caused by dying grubs.

The common practice of treating in late fall “for grubs and lice” is dangerous with regard to grubs and is too early for the best effect in louse populations. Research has shown the most effective grub control is achieved by treating

shortly after heel fly season is over. Also, cattle grub treatments usually provide two or three weeks of horn fly control—even in pyrethroid-resistant populations. Therefore, summertime treatments for cattle grubs may be more worthwhile than fall treatments. Avoid treating on extremely hot days.

If cattle simply must be treated later than October 1, complications from toxic reactions to dying grubs can be somewhat minimized by treating the cattle when they are “empty” and active, rather than full of feed and resting.

Observe the following general precautions in using systemic insecticides for grub control:

1. Do not treat sick or stressed animals or calves under 3 months old. Treat animals 3 to 6 months old with minimal dose.
2. Do not apply in conjunction with oral drenches, phenothiazine medication or with other organic phosphate insecticides.
3. Do not use in conjunction with pyrethrins, allethrin, pyrethroids or synergists.
4. Take special note of warning statements on insecticide labels regarding rates, condition of animals to be treated, treatment in conjunction with other medication, and recommended time periods for treatment.

Brahman and Brahman crossbreeds are less tolerant of cholinesterase-inhibiting insecticides than other breeds.

Sprays

COUMAPHOS (Co-Ral) 0.35%

Mix 12 pounds of 25% WP or 6 gallons of 5.8% Livestock Insecticide Spray per 100 gallons of water. Or, use 3 gallons of 11.6% ELI (**Restricted Use Pesticide**) per 100 gallons of water. Use high pressure (250 to 300 p.s.i.) spray until skin is thoroughly wet. No pre-slaughter waiting period is required.

PHOSMET (GX-118) 0.25%

Mix one gallon of 11.6% emulsifiable with 49 gallons of water and stir thoroughly. Apply, freshly mixed, at high pressure to the point of runoff. There is a 21-day pre-slaughter interval.

Dips

COUMAPHOS (Co-Ral) 0.23%

Mix 8 pounds of 25% WP per 100 gallons of water. Agitate dip suspension prior to each use to ensure uniform treatment. No time limitations for slaughter stock.

PHOSMET (GX-118) 0.20%

Add water to clean vat. Add 1 gallon of 11.6% emulsifiable GX-118 for each 60 gallons of water. Add 100 pounds of triple superphosphate per 1,000 gallons of vat solution. This controls the pH and ensures vat stability. Stir vat contents thoroughly prior to each use. The required pre-slaughter interval is 21 days.

Pour-ons and Spot-ons

Apply simply by pouring specified amounts along the animal's backline with a marked dipper or calibrated dispensing device.

FAMPHUR (Warbex) 13.2% Ready-to-Use

Apply ½ fluid ounce per 100 pounds of body weight. Use no more than 4 ounces per animal on animals larger than 800 pounds. DO NOT TREAT BRAHMAN BULLS. Do not slaughter within 35 days after treatment.

FENTHION (Spotton) 20% Ready-to-Use

Using a proper dispenser, apply this concentrated formulation to a single spot on the animal's backline. Use 8cc per 300 to 600 pound animal, 12cc per 600 to 900 pound animal, etc. as labeled. Do not use within 45 days of slaughter.

FENTHION (TIGUVON) 3% Ready-to-Use

Apply ½ fluid ounce per 100 pounds of body weight. Do not slaughter within 35 days of treatment.

IVERMECTIN (Ivomec Pour-on) 5 mg/ml

Apply this ready-to-use product at the rate of 1 ml/22 lb. of beef animal body weight. Apply along topline in a narrow strip from withers to tailhead. 48-day pre-slaughter withdrawal period.

PHOSMET (GX-118) 4%

Dilute one part GX-118 11.6% with two parts of water by stirring while slowly adding water to the product. Apply 1 ounce of the diluted mixture per 100 pounds of body weight (but not more than 8 ounces on cattle over 800 pounds). Do not apply within 21 days of slaughter.

Injection

DORAMECTIN (Dectomax) 1%

Administer *by subcutaneous or intramuscular injection* at the rate of 1 cc of Dectomax 1% per 110 pounds of body weight. May be used on calves as well as larger cattle. Do not treat within 35 days of slaughter.

Dectomax is registered for control of several species of parasitic worms, cattle grubs, scabies mites and all the three most important species of sucking lice on cattle.

IVERMECTIN (Ivomec) 1% Injection

Administer *subcutaneously* at the rate of 1 cc of Ivomec 1% per 110 pounds of body weight. May be used on calves as well as larger cattle. Do not treat cattle within 48 days of slaughter (49 days if using Ivomec-F).

Ivomec (injectable) is registered for control of several species of parasitic worms, cattle grubs, scabies mites and sucking lice. **Research also has shown that feeding on cattle (treated with Ivomec at the prescribed rate) results in death to nearly 100 percent of horn flies and *Culicoides* gnats (carriers of bluetongue virus) that feed within two weeks after the treatment.**

Bolus

IVERMECTIN (Ivomec SR Bolus) 1.72 grams ivermectin per bolus

The Ivomec SR Bolus is to be used **only on calves weighing between 275 and 660 pounds. Treated cattle should not be slaughtered within 180 days after administration of the bolus.**

Lice

Cattle lice are small but they reduce financial returns of nearly every cattle enterprise. Even moderate louse numbers can cause calves and feeders to grow more slowly and require more feed per pound of gain. Louse-infested cows produce less milk for their calves. Cattle damage fences and bruise or scrape themselves as they rub to relieve the itching caused by thousands of lice on their bodies. Blood loss from sucking lice is sometimes severe enough to cause anemia. Louse-induced anemia of heifers has caused calf abortion. There are records of calves, cows and bulls dying from the effects of extreme infestation of lice.

It is very important to control lice early in the winter before the infestations have caused serious damage. If left unchecked, highest louse populations occur in late winter, coinciding with both acute and cumulative winter stress and with a period when vitamin A is often deficient in cattle's diets. Lousy cattle are much less able to cope with these other stresses.

Lice spend their entire life cycle on host animals. Eggs are attached to the hair, and the young resemble the adults, except they are smaller. Development from egg to adult requires from three to six weeks but most commonly is in the 23- to 30-day range for all cattle louse species.

Lice are spread from one animal to another through contact. Lice can commonly be found on the heads and necks of day-old calves, the lice having transferred from the cows to the calves as they nursed. Therefore, it is important to achieve louse control on brood cows prior to calving.

There are some animals in most herds that seem to harbor infestations the year around. Such "carrier" animals include cows and steers but frequently include the bulls. **It is, therefore, important to rid the bulls of lice, although one should select insecticides carefully because some labels bear warnings against treating certain breeds or bulls of any breed.**

Infestations decline rapidly with spring warmup and shedding of hair. For this reason, late winter and early spring treatments are probably not economical except for individual treatment of "carriers." Lice reproduce and develop more slowly on cattle in the summertime. With the coming of cool weather and longer hair coats on cattle in the fall, lice resume rapid reproduction and serious infestations may develop by mid-winter.

Four species of lice are commonly found in Kansas. The first three species all suck blood:

1. The short-nosed cattle louse is commonly found on mature cattle. It may be abundant on young stock, too. This species causes the most detrimental impact on cattle. The head and thorax are yellowish brown and the abdomen is slate blue.

2. The long-nosed cattle louse occurs more on young animals and on dairy breeds. It has a longer "nose" or rostrum and narrow body, and the abdomen is bluish black.
3. The little blue louse is a smaller species, and the head is short and broadly rounded. It clusters on the head and neck and frequently is harder to control.
4. The cattle biting louse has a reddish-brown, broad, blunt head. The abdomen is yellowish with dark transverse bands. Biting lice feed on skin cells.

Louse Control

Regardless of application method, most insecticides have little effect on louse eggs. Lice hatching from eggs after a single treatment can rapidly reinfest cattle. For this reason, a second treatment two or three weeks after the first is important to kill the newly hatched lice before they can mature and lay eggs.

Sprays and Dips

If spraying or dipping, choose a warm day in fall or early winter. Unless otherwise specified, apply sprays with a pressure of 200 to 250 p.s.i. to assure soaking to the skin.

AMITRAZ (Tactic) 0.03%

Mix 1 quart can of Tactic 12.5% EC in 100 gallons of water and spray or use in spray-dipping machine within 6 hours after mixing. In spraying, make sure spray penetrates to the skin until run-off, using up to 2 gallons of spray per fully grown animal. No pre-slaughter waiting interval. (1 gallon/animal was effective in Wyoming research.)

COUMAPHOS (Co-Ral) 0.025 to 0.05%

Mix 4 quarts of 5.8% Livestock Insecticide Spray, or 1 to 2 pounds of 25% WP in 100 gallons of water. Or, using one of the Restricted Use Pesticides, mix 1 to 2 quarts of 11.6% ELI or 1 pint of 42% F in 100 gallons of water. Spray for a complete wetting to runoff.

Beef cattle may be dipped with the 2 lb./100 gal. mixture of 25% WP formulation or with the mixture of 1 pint 42% F (flowable) Co-Ral per 100 gallons of water. No pre-slaughter interval required. Do not use any Co-Ral product on animals under 3 months of age. See special precautions on label relative to grub-infested cattle.

METHOXYCHLOR 0.5%

Spray with a mixture of 8 pounds of 50% WP or 2 gallons of 25% EC per 100 gallons of water. No pre-slaughter waiting interval.

PERMETHRIN (Atroban, Ectiban, Expar, Insectaban, Insectrin, Permethrin, others) 0.0125 to 0.055%

Mix any of the following and spray to runoff: 1 quart of Ectiban 5.7% EC, 1 pint Permethrin II 10% E, or 2 pounds of Permethrin 25% WP per 100 gallons of water. Or, mix 1 pint Atroban 11% EC or 1 quart of Insectaban 5.7% EC per 25 gallons of water and spray to cover animal using about 2 quarts of mixture per animal. No pre-slaughter waiting interval required after using any of these.

PERMETHRIN EC (Atroban, GardStar) 0.05 to 0.054%

Fora 0.05 or 0.054% mixture, respectively, dilute GardStar 40% EC or Atroban 42.5% EC at a rate of 1 pint per 100 gallons of water. Apply about 2 quarts per animal with high-pressure spray. GardStar may be mixed for a much higher concentration of 0.5% and applied with low-pressure spray by diluting 1 pint per 10 gallons of water. Apply only 4 to 5 fluid ounces (about 1 cupful) per animal. Do not apply more often than at 2-week intervals. No pre-slaughter waiting period.

PERMETHRIN SYNERGIZED POUR-ON (Atroban, Back Side Plus, Expar, Permethrin) 1% and 7.4%

The synergized pour-on formulations of 1% permethrin and Permethrin CDS Pour-On (7.4%) may be used, undiluted, as low-pressure sprays applied, in very small amounts (read the label), directly to beef cattle. Apply no more often than once every 2 weeks. No pre-slaughter interval required.

PHOSMET (Prolate, GX-118, Del-Phos, Lintox-HD) 0.075 to 0.25%

When using phosmet, consult label for precautions relating to grub-infested cattle and time of year.

Mix 1 gallon Prolate, Del-Phos, or Lintox-HD 11.6% in 150 gallons of water and apply with high pressure to point of runoff. Do not treat cattle under 3 months of age. Required pre-slaughter interval of 3 days.

Or mix 1 gallon of GX-118 11.6% E with 49 gallons of water and apply with high pressure until runoff occurs. Do not treat calves under 3 months old. A 21-day pre-slaughter interval is required.

For dipping, mix 1 gallon of GX-118 11.6% E per 60 gallons of water and add 100 pounds of superphosphate per 1,000 gallons of solution. Do not treat calves under 3 months old. A 21-day pre-slaughter interval is required.

TETRACHLORVINPHOS (Rabon) 0.35%

Mix 4 pounds of Rabon 50 WP per 75 gallons water. Apply as coarse spray until cattle hair coats are soaked. No withholding period required.

TETRACHLORVINPHOS/DICHLORVOS (Ravap) 0.38%

Mix 1 gallon of Ravap 28.7% EC in 75 gallons of water. Apply as coarse spray until runoff. No withholding period required.

Pour-ons for Lice

Pour-ons or spot-ons may be used in colder weather than sprays or dips as they do not require soaking the animals.

FENTHION (Lysoff, Lice-Chek) 0.84%

Mix 8 parts of water to 1 part 7.6% product slowly adding water to the insecticide. Carefully follow special mixing directions on the label. Apply the resulting mixture to the animals' backlines at the rate of 1 ounce of mixture per 100 pounds of body weight. Do not treat calves less than 3 months old. Pre-slaughter waiting period is 21 days after one treatment or 35 days if cattle have been treated twice.

PERMETHRIN POUR-ON (Back Side*, DeLice*, Durasect, Expar*, Ectiban, Hard-Hitter, Permethrin* in 1% formulations; Boss, 5%; Permethrin CDS, 7.4% and Permethrin CD, 10%*; Brute, 10%. An asterisk indicates availability both in unsynergized "classic" formulations and as synergized products.)

For cattle and calves. Do not treat with any of these products more often than once every 2 weeks. No pre-slaughter waiting interval is required. For the 1% formulations, except for Durasect, apply ½ ml per cwt. (100 lb. of body weight) but not more than 5 fluid ounces (about ½ pint) per animal, along back and down face. Apply Durasect at the same rate, but apply in two strips along each side of midline from shoulders to tailhead. For Boss (5%) apply 3 ml per cwt. to backline and down face, but no more than 30 ml (1 oz) per animal. Apply Permethrin CDS (7.4%) at the rate of 2 ml per cwt., over animal's shoulders and down midline of back, but no more than 20 ml (⅔ oz) per animal. Apply Brute (10%) or Permethrin CD (10%) at the rate of 1.5 ml per cwt., over animal's shoulders and down midline of back, but no more than 15 ml (½ oz) per animal.

In various university tests, "classic" 1% products have given excellent control of biting (chewing) lice but unreliable results with sucking lice. Information is unavailable on louse control results from using synergized 1% products or the products with stronger concentrations of permethrin.

Grubicidal Pour-ons, Injections

The following insecticides with grubicidal action also are registered for control of cattle lice. As with the coumaphos and phosmet treatments listed in the preceding "Sprays" section, use such insecticides only on cattle which have been previously treated for grubs or at a time of year when cattle grubs are not in critical tissues such as the gullet linings or the spinal canal. (For Kansas cattle, the dangerous months are October through January.)

See use directions in **Cattle Grubs** section for: doramectin (Dectomax), famphur (Warbex), fenthion (Tiguvon, Spotton), phosmet (GX-118 only), and ivermectin (Ivomec and Ivomec Pour-on). Ivomec SR Bolus is registered for control of two species of sucking lice, but not the short-nosed cattle louse that is the greatest problem on beef cattle.

Note: Before using any of these materials for louse control, read label directions for required interval before a second treatment. Some of these products should not be used as the first louse treatment because a repeat treatment would not be allowed soon enough to break the louse population cycle.

Dust Bags, Back Rubbers

These devices, charged with appropriate insecticides, often help prevent lice infestations from becoming severe. They will not provide rapid clean-up of an established problem, nor will they provide complete control.

Most of the insecticides listed in this publication under the dust bag and backrubber sections of Horn Fly Control are registered for control of cattle lice. Be sure to read the introductory paragraphs regarding backrubbers in the section on Horn Flies.

Insecticidal Ear Tags

Labels on several kinds of insecticidal ear tags claim “. . . aids in controlling lice.” The OPTimizer and OPTimizer-Calf labels claim control of cattle biting lice and little blue lice. The PYthon and ZetaGard labels claim control of biting lice and short-nosed sucking lice. None claim full control of all four common species of cattle lice. Generally, better control of lice may be achieved at a lower cost by using two applications of sprays or pour-ons about two or three weeks apart.

Cattle Scabies

The terms “scabies” and “mange” often are used interchangeably but are defined by the U.S. Department of Agriculture as follows:

Mange is any skin condition of man or animals associated with a mite; **scabies** is a particularly serious, debilitating, reportable mange condition.

There are seven species of parasitic mites found on cattle in North America. Of these, three are serious enough to be classified as scabies: (1) psoroptic or common cattle scabies, (2) sarcoptic scabies, and (3) chorioptic scabies. All three are “reportable” diseases. That is, upon detection, the law requires all cases to be reported to the state veterinarian.

If interstate shipping is involved, the USDA Animal and Plant Health Inspection Service has jurisdiction, but in recent years such cases often are handled by authorities in the receiving state. The responsible agencies must quarantine psoroptic scabies and sarcoptic scabies in cattle. They have discretionary power to quarantine cases involving chorioptic scabies.

Although very few cases of psoroptic scabies have been reported in recent years, the costly, time-consuming, and reputation-damaging potential of having one’s herd or facilities quarantined has weighed on the minds of most cattle producers. Most operators of high-risk (for scabies) enterprises which receive cattle from many and unknown sources, routinely treat all incoming cattle to help prevent scabies outbreaks.

Sarcoptic scabies of cattle has become rare in the U.S. Chorioptic scabies is uncommon in Kansas and adjoining states, especially in beef cattle. Although chorioptic scabies causes itching, distress and hair loss, it is not nearly so debilitating as psoroptic scabies.

The terms “cattle scab,” “cattle scabies,” and “common scabies,” in general use, have come to mean psoroptic scabies. Psoroptic scabies of cattle has been detected east of the Mississippi River on only one or two occasions. It is most prevalent in the central plains and intermountain states.

Psoroptic scabies is caused by *Psoroptes ovis*, a parasitic mite species that spreads quickly and easily among cattle of all ages, classes and conditions. The scabies mite may attack any part of the body thickly covered with hair. The first lesions usually occur on the withers, along the back, or around the tail head—parts of the body that cattle have difficulty reaching to groom with their tongues. Infestations cause loss of weight and

failure of young stock to thrive and gain normally. Infested calves or cattle exposed to harsh weather may die.

The mite is pearly white, barely visible to the naked eye, and about $\frac{1}{40}$ of an inch long as an adult. Scabies mites normally live, mate, deposit eggs and die on the same host. Some, however, drop off or are rubbed off the skin and haircoat of the infested host and establish themselves on a new host. Cattle scabies may be borne from farm to farm on newly purchased stock and in infested cars, trucks and enclosures. Thus, scabies is highly contagious.

Scabies mites reproduce rapidly and, if unrestricted, one female could have more than a million descendants in 90 days. Climate and weather influence population expansion of scabies mites. These mites multiply most rapidly and produce the most severe skin lesions during the fall, winter and early spring.

In the summer, the lesions often clear up spontaneously when an infested herd is turned out to pasture. The shedding of long haircoats and exposure of the skin to the hot summer sun are curative. But some mites survive the summer, usually on small calves or on areas of the body protected from direct sunlight. With the return of cool weather, infestations often become serious again.

If protected by hair, skin debris, soil or straw and if the weather is damp and cool, scabies mites may survive off the host for up to one month, but direct sunlight and exposure to drying wind may destroy them in 48 hours or less. The mites and their eggs may persist on barn walls, stanchions, fence posts, railway cars, and cattle trucks, but cattle are not very likely to become infested in this way. Studies indicate that vehicles, enclosures, and pastures kept vacant for two weeks after use by animals with scabies may be regarded as safe for occupancy by clean animals. Infestations may be spread on curry combs, brushes, ropes and halters.

Chemical Control of Scabies

Scabies-infested cattle, those exposed to the disease, and those moving interstate from areas placed under federal restrictions, must meet the requirements of Title 9, Code of Federal Regulations. These regulations specify the chemicals to be used as permitted treatments. Prior to the use of any chemical, the person in charge should carefully study the label. The conventional methods of treatment are dipping or using a spray-dip machine. Ivermectin (Ivomec) is an injectable systemic pesticide which now is also approved for cattle scabies control.

In Kansas, treatments used to control diagnosed scabies must be approved by the state veterinarian. For specific information on state and federal scabies control requirements, call the State Veterinarian, Animal Health Department, Topeka, KS, phone: 913-296-2326.

AMITRAZ (Taktic) 0.06%

Mix 1 quart can of Taktic 12.5% EC in every 50 gallons of water. Apply through spray dipping machine within 6 hours after mixing. Two treatments 7 to 10 days apart are required to control scabies. No pre-slaughter waiting interval.

COUMAPHOS (Co-Ral) 0.3% Dip

Use 10 pounds of 25% Co-Ral WP per 100 gallons of water or 1 gallon of 42% Co-Ral Flowable (Restricted Use Pesticide) per 165 gallons of water. Two treatments, 10 to 14 days apart, are required in quarantine programs. No pre-slaughter waiting interval.

DORAMECTIN (Dectomax) 1%

Administer by *subcutaneous or intramuscular* injection at the rate of 1 cc of Dectomax per 110 pounds of body weight. Do not treat cattle within 35 days of slaughter.

IVERMECTIN (Ivomec) 1% Injection

The recommended dose level is 200 micrograms per kilogram of animal weight, administered subcutaneously at the rate of 1 cc of Ivomec 1% per 110 pounds of body weight. One treatment, followed by 14 days of isolation from contact with untreated animals, meets state and federal scabies control requirements. There is a 48-day pre-slaughter withholding period (49-days if using Ivomec F).

IVERMECTIN (Ivomec Pour-on) 5 mg/ml

Apply this ready-to-use product at the rate of 1 ml/22 lb. of beef animal body weight. Apply along topline in a narrow strip from withers to tailhead. 48-day pre-slaughter withdrawal period.

IVERMECTIN (Ivomec SR Bolus) 1.72 grams ivermectin per bolus

The Ivomec SR Bolus is to be used **only on calves weighing between 275 and 660 pounds. Treated cattle should not be slaughtered within 180 days after administration of the bolus.**

PERMETHRIN EC (Atroban, Expar, Ectiban, GardStar, Insectaban, Insectrin)

Mix 1 quart of Ectiban, Insectrin, or Insectaban 5.7% EC or 1 pint of Atroban or Expar 11% EC to 25 gallons of water. Or mix 1 pint GardStar 40% EC or Atroban 42.5% EC per 100 gallons of water. Thoroughly soak each animal with 1 to 2 quarts of spray. The Atroban 42.5% EC label provides for dipping cattle with the same dilution used for spraying. Repeat 14 days later. No pre-slaughter interval is required.

PHOSMET (GX-118) 0.25% Dip

Mix 1 gallon of 11.6% GX-118 with 60 gallons of water and add 100 pounds of super-phosphate per 1,000 gallons of solution. Two treatments, 10 to 14 days apart, are required in quarantine situations. A 21-day pre-slaughter interval is required.

Ticks

Ticks are most numerous in brushy, tree-infested pastures, especially where rodents and deer also are abundant. They are wingless, eight-legged, blood-sucking parasites of warm-blooded animals.

There are two general types of ticks: the hard-bodied ticks and the soft-bodied ticks. Some hard-bodied ticks have shiny white or silvery markings on their backs. Soft-bodied ticks

have no contrasting color pattern and their bodies have a granular texture. When not engorged with blood, adult ticks are $\frac{1}{8}$ to $\frac{3}{16}$ of an inch long. Engorged females become so distended that they become egg-shaped and may be as big as a pea or even a small grape.

Ticks go through three developmental stages after hatching from the egg. These are the 6-legged larva (seed tick), the 8-legged nymph (yearling), and the adult. Juvenile stages climb onto vegetation and wait for a passing animal, often parasitizing rodents, rabbits, raccoons and other small animals. After engorging on blood, they drop to the ground and molt to the next stage. Adults also gain access to animals, including deer and cattle, by climbing onto grass or shrubs. They usually mate on the host animal. The females then drop to the ground and lay several thousand tiny eggs.

Ticks not only withdraw blood, but they may transmit bovine anaplasmosis as well as a number of diseases of man.

The principal ticks on cattle in Kansas are the **American dog tick** which is found throughout the state, the lone star tick which is found in eastern Kansas, and the **Gulf Coast tick** in south central and southeastern Kansas. All are hard-bodied ticks.

Non-chemical Control Methods

During an early life stage most tick species are dependent on rodent hosts such as mice, wood rats, gophers and rabbits. Reducing the numbers of these animals also may reduce tick numbers. Where appropriate, eliminate shrubs and trees as mixed grassy and woody vegetation provides habitat for both rodents and ticks and affords climbing sites from which ticks can attach to passing people and animals.

Late spring burning of native tallgrass pastures increases grass production and livestock-carrying capacity, reduces rodent habitat, reduces tick populations directly, and can eliminate tick habitat and climbing sites. Earlier spring burning of fescue and brome pastures provides some of the same benefits but is less likely to kill as many of the ticks by fire.

Chemical Controls for Ticks (Other than Gulf Coast Tick and Spinose Ear Tick)

Note: There are no chemical tick controls registered in Kansas for direct application to pastures. Control of ticks on cattle may be accomplished by use of the following.

AMITRAZ (Tactic) 0.03%

Mix 1 quart can of Tactic 12.5% EC in 100 gallons of water. Apply within 6 hours after mixing, making sure spray penetrates to the skin until run-off. Use up to 2 gallons of spray for a fully grown animal. No pre-slaughter waiting interval.

COUMAPHOS (Co-Ral) 0.1 to 0.23%

To spray, use 2 gallons of 5.8% Livestock Insecticide Spray, 4 pounds of 25% WP, or, using one of the **Restricted Use Pesticides**, mix 1 gallon of 11.6% ELI or 1 to 2 quarts of 42% F per 100 gallons of water.

To dip, use 4 to 8 pounds of 25% WP or 1 to 2 quarts of 42% F per 100 gallons of water. No pre-slaughter waiting interval for either dip or spray. Do not use Co-Ral on calves under 3 months old.

PERMETHRIN (Atroban, Ectiban, Expar, Gardstar, Insectaban, Insectrin, Permethrin) 0.0125 to 0.05%

Spray no more often than once every 10 days with 2 quarts of Atroban or Expar 11% EC in 100 gallons of water. Spray no more often than once every 2 weeks with 1 quart Ectiban, Insectaban or Insectrin 5.7% EC, 1 pint to 1 quart of Permethrin II 10% EIL, or 1 pint of GardStar 40% EC or Atroban 42.5% EC per 100 gallons of water. Spray no more often than once in 3 weeks with 2 pounds of Permethrin 25% WP per 100 gallons of water. No pre-slaughter waiting interval.

PHOSMET (GX-118, Prolate, Del-Phos, Lintox-HD) (Caution: Grubicide) 0.125 to 0.25%

Spray no more often than every 7 to 10 days with 1 gallon of Prolate, Del-Phos, or Lintox-HD 11.6% E in 100 gallons of water. 3-day waiting period prior to slaughter.

Spray no more often than every 7 to 10 days with 1 gallon of GX-118 in 49 gallons of water. 21-day waiting period before slaughter. For dipping, read and carefully follow GX-118 label for complex vat charging and maintenance procedures.

TETRACHLORVINPHOS (Stirofos, Rabon) 0.5%

Spray with a mixture using 8 pounds of 50% WP per 100 gallons of water. No pre-slaughter waiting interval.

TETRACHLORVINPHOS/DICHLORVOS (Ravap) 0.6%

Registered for control of lone star ticks only; mix 1 gallon Ravap 28.7% EC with 50 gallons of water. No withholding period required.

Pour-ons

Aid in control of ticks may be obtained by applying a 1% permethrin pour-on. See **Permethrin** under **Pour-Ons** in the section on **Horn Flies**. Do not treat more often than once every 2 weeks. No pre-slaughter waiting interval.

Bolus

The Ivomec SR Bolus is registered for control of lone star ticks, but no other tick species. **Use this bolus only on calves weighing between 275 and 660 pounds. Treated cattle should not be slaughtered within 180 days after administration of the bolus.**

Gulf Coast Tick, Spinose Ear Tick (and Lone Star Tick in Ears)

The Gulf Coast tick, a hard-bodied tick, commonly infests cattle brought in from eastern Oklahoma and states bordering the Gulf of Mexico. The species is now established in much of

south central and southeastern Kansas, and in those areas our native cattle are sometimes heavily infested with it from late March through June. It is a three-host tick; larvae and nymphs feed on birds or small rodents while adults prefer livestock. Large numbers sometimes cluster in the outer ear of cattle, causing intense soreness. Under severe infestations the muscles of the ears become weakened, resulting in a flop-eared condition commonly referred to as "gotch ear."

The spinose ear tick, a soft-bodied species, also inhabits the ears of cattle but only in the larval and nymphal stages. They often attach deep within the ear canal of cattle and other animals (occasionally man). The nymphs are covered with spines which make them difficult to dislodge. They cause intense pain as they puncture the skin within the ear and suck blood. Feeding wounds may become infected causing a condition known as "ear canker." Adults of this species live on the ground away from the host and do not feed.

Spinose ear ticks occur sparsely across southern and far western Kansas, but are found more frequently in cattle from southwestern states.

Lone star ticks are plentiful in brushy pastures of eastern Kansas. This species may infest the animal's entire body but sometimes concentrates in the ears and may cause a "cupping" deformity of ears of young stock. In such cases, ear treatment is indicated (see below).

Chemical Controls

Two insecticidal ear tags per animal, containing a pyrethroid, will bring most infestations under control and keep infestations at a low level for several weeks.

More rapid control of established infestations (but less lasting protection where there is danger of reinfestation) can be obtained by individual ear treatment with appropriately labeled insecticides applied into the ear. In addition to the following, various dusts and liquids are packaged in pressurized ready-to-use spray cans expressly for cattle ear treatment.

AMITRAZ (Taktic) 0.03%

Mix 1 pint can of Taktic 12.5% EC in 50 gallons of water (or equivalent ratio in smaller amounts). Use within 6 hours after mixing. Treat the head, ears, shoulder area and neck with low pressure spray. No pre-slaughter waiting interval.

PERMETHRIN (Ectiban, Insectaban, Permethrin) 0.075 to 0.08%

Mix 2 ounces of Permethrin II 10% EIL in 1 gallon diesel fuel or clean water. Apply ½ ounce into and onto each ear. Or mix 1 quart of Ectiban or Insectaban 5.7% EC in 2½ gallons of water. Apply ½ to 1 ounce of spray into each ear. Repeat no more often than every 2 weeks. No pre-slaughter waiting period.

Or mix ⅓ pound (5.3 oz.) of Permethrin 25% WP in 12 gallons of water and apply ½ ounce of the mixture to each ear. Repeat no more often than every 3 weeks. No pre-slaughter waiting interval.

PHOSMET (Del-Phos) 0.116%

For control of Gulf Coast ticks, according to label directions, mix one part Del-Phos 11.6% Emulsifiable Liquid per 100 parts of water and apply to cattle as a high pressure spray, soaking to the skin. But, be careful not to use high pressure when spraying directly into the ears of cattle where this species of tick is most likely to be aggregated. A 3-day pre-slaughter interval is required.

TETRACHLORVINPHOS/DICHLORVOS (Ravap) 0.6%

Registered for control of lone star ticks only; mix 1 gallon of Ravap 28.7% EC with 50 gallons of water. No withholding period required.

Screwworms and Other Blow Fly Larvae

Screwworms are the larvae of a blow fly species native to South America, Central America, Mexico, and parts of the southwestern United States. Female screwworm flies are attracted to wounds where they deposit eggs. Screwworms feed on the flesh and may kill animals if the wounds are not treated. Wounds from tick and fly bites, brush, thorns, barbed wire, castration, dehorning, docking, ear notching, branding, and the horns of other animals are all vulnerable. Not surprisingly, this multi-million dollar economic pest once dictated many aspects of livestock production across the southern United States, including parts of Kansas.

In 1962, the USDA launched a screwworm eradication effort that quickly reduced this threat. However, recurring invasion of these flies from Mexico continued to threaten the U.S. cattle industry, and in 1972 serious outbreaks occurred. A stepped-up joint effort between Mexico and the U.S. began in 1977 and has been highly successful. Now, screwworm flies have been eradicated all the way to Honduras, with current efforts in Nicaragua and Costa Rica. Plans are for eradicating them all the way to Panama where a continuing program will keep them from coming north again.

However, animal wounds are occasionally infested with other blow fly larvae. Although less deadly than screwworms, such infestations require treatment. Treat infested wounds and surrounding skin area thoroughly, but do not use excessive amounts. Repeat treatment as necessary but according to label instructions.

Wound Treatments

COUMAPHOS (Co-Ral)

Available as 5% dust in squeeze bottle, 3% spray in pressurized cans, or 3% spray foam in pressurized cans. No pre-slaughter waiting interval indicated.

LINDANE 3.0%

Several brands available as 3% lindane in pressurized spray cans. Do not use on calves less than 3 months old. No pre-slaughter waiting interval.

Insecticide Names—What the Trade Names Don’t Tell You

Producers sometimes switch from one product to another of a different brand name in an effort to get better results. The two products may actually have the same ingredient (by common chemical name) and will probably give similar results. It also is important to rotate use of insecticides, alternating between products belonging to different chemical families, to help prevent resistance in pest populations. When product labels do not give this information, refer to the table below.

Chemical Family	Approved Common Chemical Names	Proprietary or trade names common in Kansas	Chemical Family	Approved Common Chemical Names	Proprietary or trade names common in Kansas	
avermectin	doramectin	Dectomax	organo-phosphate (continued)	naled	Dibrom (space or area treatment only)	
	ivermectin	Ivomec		phosmet	Del-Phos, GX-118, Lintox HD, Prolate	
carbamate	methomyl	Apache, Fatal Attraction, Fly Bait Plus, Fly Belt, Fly Patrol, Flytek, Golden Muscamyl, Improved Golden Malrin, Tailspin (all are house fly baits)		pirimiphos methyl	Dominator, Rotator (ear tags only)	
				tetrachlorvinphos	Rabon	
chlorinated hydrocarbon	lindane	Lindane (some formulations are Restricted Use Pesticides)		tetrachlorvinphos + dichlorvos	Ravap	
	methoxychlor	Marlate, Methoxychlor, Sur-Noxem		trichlorfon	Dipterex, Dylox	
formamidine	amitraz	Taktic		pyrethroid	cyfluthrin	Cutter Gold Ear Tag, CyLence, Countdown
juvenile hormone analogue	methoprene	Altosid (Moorman’s IGR), Methoprene (all are oral larvicides)			lambda-cyhalothrin	Excalibur and Saber Extra Ear Tags; Grenade; Saber Pour-On
organo-phosphate	chlorpyrifos	Double Shift MEC (premise spray); an ingredient in Diaphos Rx and Warrior ear tags			permethrin	Atroban, Back Side, Boss, Brute, De-Lice, Durasect, Ectiban, Expar, GardStar, Gordon’s Dairy & Livestock Dust, Hard-Hitter, Insectaban, Insectrin, Permanone, Permethrin, Permethrin; Pounce (Restricted Use Pesticide); Pro-Tech Horse and Stable and Multi-Use Spray
	coumaphos	Co-Ral (except for the 5.8% product, liquid formulations are Restricted Use Pesticides)				
	diazinon	Diazinon, Dryzon (spray formulations, except for Dryzon WP, are Restricted Use Pesticides); Cutter 1, OPTimizer, Patriot, Terminator (ear tags); an ingredient in Diaphos Rx and Warrior ear tags				
	dichlorvos	DDVP, Vapona				
	dimethoate	Cygon (premise and manure treatment only)	pyrethrin		Dairy Insect Fogger, Fly-A-Rest, Pyrethrin, Pyrenone, Super Dairy & Stock Spray	
	ethion	Commando (ear tag only)				
	famphur	Warbex (pour-on only)	zetacyper-methrin	Python and ZetaGard Ear Tags		
fenthion	Lice-chek, Lysoff, Spotton, Tiguvon; Cutter Blue Ear Tag	substituted phenylurea	diflubenzuron	Vigilante (bolus oral larvicide)		

Note: Materials mentioned as **Restricted Use Pesticides** are for application only by Certified Private Applicators or Commercial Pesticide Applicators certified in livestock pesticide application.

In case of illness or possible human poisoning as a result of accident or handling pesticides, call:
MID AMERICAN POISON CONTROL CENTER
University of Kansas Medical Center
3900 Rainbow Blvd.
Kansas City, KS 66160

TELEPHONE: 800-332-6633
or
913-588-6633

For up-to-date information and help regarding problems with insects, you may contact your County Extension Office, Area Crop Protection Specialist, or Extension Entomology at Kansas State University in Manhattan, Kansas (913-532-5891).

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