

Livestock Area Fly Control

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Fly Control in Milk Rooms

Warning: Extremely small amounts of pesticide residues can be detected in milk. For all practical purposes, the tolerance level for pesticide residues in milk is ZERO. Moreover, the presence of such residues in milk is virtually always illegal. To avoid pesticide residues in milk, dairy producers are cautioned to use ONLY those pesticides that are labeled for use in dairy operations. The following steps are suggested for managing flies in milk rooms:

- (a) Use good sanitation and only labeled insecticides in dairy barns to reduce the number of flies entering the milk room.
- (b) Use tight screens (14-16 mesh per inch) in good repair on milk room doors and windows. Screens made of copper, aluminum, bronze, plastic, or rust-resisting materials are best.
- (c) Use sticky flypaper (Lure-Fly ribbons), sex pheromone sticky paper (Fly Stik with Muscalure), or sticky foil flypaper with flies printed on it to attract other flies.
- (d) Dichlorvos (Vapona) resin strips work best in controlling flies if windows and doors are kept closed. Replace strips when they become ineffective.
- (e) **Use only labeled** space spray treatments in milk rooms when the above strips do not give adequate fly control. Avoid contaminating milking utensils, cans, bulk tanks, and containers. Remove these items from the milk room or completely cover them before spraying.

General Fly Control Methods for Livestock

Sanitation

Good sanitation practices are the basis for all fly control programs and can account for as much as 75% toward the prevention of fly breeding. **Sanitation should be the first line of defense against house flies and other filth-breeding fly species.** Under optimum conditions, house flies can complete their life cycle (egg to adult) in as few as 9 days. By adhering to a strict manure management program throughout the period of greatest fly activity (i.e., the spring and summer months) it is possible to disrupt the life cycles of these pests.

- (a) Remove all manure from livestock pens as frequently as possible. Pens with calves or bulls require special attention and should be cleaned once or twice a week. Remember, a clean livestock barn has fewer fly problems.
- (b) Manure that has been removed should be spread thinly on fields or other large outside areas to facilitate rapid drying. This will help kill developing fly eggs and larvae. Another option is to stack the manure and cover **completely** with black plastic.
- (c) Eliminate silage seepage areas, wet litter, manure stacks, old wet hay or straw bales, and other organic matter accumulations that may attract flies on the farm. Wet feed remaining at the ends of mangers also will breed flies.
- (d) Provide proper drainage in barnyards. Use clean gravel and other fill to eliminate low spots in livestock yards. Proper tiling can reduce wet barnyards.

To be successful in controlling flies it is important that producers implement a control program that best fits their particular operation. Reliance on a single practice or pesticide product is not the best approach to achieving effective and economical pest control. A better approach is to combine routine sanitation with a variety of pesticide strategies such as baits, residual sprays, space sprays, and larvicides whenever flies are a problem. Do not wait for heavy fly populations to build up. It is much easier and less expensive to prevent fly populations from increasing at the beginning of the season than to attempt to control them after they have reached unacceptable density levels. As fly populations begin to increase, take time and treat as needed.

Residual Sprays

The next line of defense is residual sprays applied to the outside and inside of buildings. Other practices such as the application of larvicides, space sprays, and baits should be considered supplementary to sanitation and residual sprays. Residual sprays

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are applied to walls, ceilings, partitions, stanchions, posts, and other fly resting places. These sprays are much more effective in stanchion barns than in loose-housing, open barns where landing and resting surfaces are minimal. Also, barn surfaces vary in the amount of spray that should be applied to them. Smooth surfaces require less spray than rough, porous surfaces. Thoroughly wet the surface to the point of runoff at low pressures of 80-100 pounds per square inch. Avoid contaminating feed, drinking water, milk, milking utensils, and milk rooms. The importance of *following directions exactly according to the label* cannot be stressed enough when using any pesticide.

Long-Term Residual Treatments

- (a) Fenvalerate [10%]. This product is labeled for use only in swine or horse buildings as a premise spray. Mix 1 quart product in 10 gal water and apply at the rate of 1 gal of spray per 750 sq ft. Remove animals before spraying. Keep animals out of treated buildings for at least 4 hours. **Do not** allow feed or drinking water to become contaminated.
- (b) Permethrin [25%]. **This product is not labeled for use in milk rooms.** Mix 6.67 oz product in 10 gal water and apply at the rate of 1 gal of spray per 1,000 sq ft. **Do not** make direct applications to animals, feed, or drinking water.
- (c) Permethrin [10%]. Mix 1 qt product in 25 gal water and apply at the rate of 1 gal of spray per 750 sq ft. Can be used in barns, dairies, feedlots, stables, and poultry houses.
- (d) Permethrin. Refer to label for directions regarding these and other permethrin products.
- (e) Tetrachlorvinphos [50%]. Follow directions according to label. Remove calves and lactating animals before spraying. Keep them out of treated buildings for at least 4 hours. **Do not** allow feed or drinking water to become contaminated. Can be used in dairy barns, poultry houses, swine buildings, and other animal buildings.
- (f) Tetrachlorvinphos [23%] and dichlorvos [5.3%]. Mix 1 gal product in 25 gal water (or 1 gal product in 12.5 gal water for extreme infestations) and apply at the rate of 1 gal of spray per 500-1,000 sq ft of walls, ceilings, or other areas where flies rest or congregate. Remove animals before spraying. Keep animals out of treated buildings for at least 4 hours. **Do not** allow feed or drinking water to become contaminated. Can be used in dairy barns, poultry houses, swine buildings, livestock sheds, and other animal buildings.
- (g) Malathion, various formulations. See label for directions.
- (h) Beta-cyfluthrin, various formulations. See label for directions.
- (i) Gardona, various formulations. See label for directions.

Medium-Term Residual Treatments

- (a) Deltamethrin [0.02%]. Controls stable flies, horn and face flies, house flies, deer flies, mosquitoes, and gnats in livestock and horse facilities. Apply thoroughly to surfaces until wet. Apply as needed, but not more than once per week. Do not spray animals or humans. Do not contaminate feed or drinking water. **Do not use in milk room or milking parlor.**

Short-Term Residual Treatments

- (a) Dichlorvos [43.2%]. Make up a 0.5% solution by mixing 1 gal product in 100 gal water and apply diluted spray as an overall premise application. Particular attention should be given to areas where flies congregate. Animals may be present during treatment. **Do not** allow feed, water or foodstuffs, milk or milking utensils to become contaminated. Apply to cattle feedlots, stockyards, holding pens, and corrals.
- (b) Naled [58%]. Follow directions according to label.
- (c) Pyrethrins [0.1%] and piperonyl butoxide [1.0%]. Follow directions according to label. Apply as a space spray for quick knockdown and kill of house flies, stable flies, and horn flies in barns, milk rooms, and dairies.
- (d) Pyrethrins [0.5%] and piperonyl butoxide [4.0%]. Controls stable flies and other flies, mosquitoes, fleas, and wasps in livestock, dairy, hog, and poultry facilities. Close all windows and doors and apply at a rate of 2 to 3 seconds/1,000 cubic feet of area. Do not remain in treated area. Thoroughly vent treated area after 15 minutes.

Bait Treatments

Although fresh baits will help control flies, results may be poor if fly breeding is excessive. It is suggested that baits be applied following the removal of all floor litter and manure. For best control, use baits liberally and repeat as needed. It may be necessary to increase amounts when flies are breeding heavily, but check label for proper use directions for any bait product. Baits are most effective when used in conjunction with other control measures. Do not use bait in areas where animals can slip and fall or where children may come in contact with the bait.

- (a) Methomyl [1%]. No mixing required. Bait can be used only around the outside of feed lots, broiler houses, livestock barns, and on walkways in caged layer houses. Scatter bait (do not put in piles) at rate of approximately 0.25 lb per 500 sq ft of fly feeding area, keeping 1- to 2-inch intervals between particles. **Do not** allow food-producing animals to have access to treated areas. **Do not** allow contamination of feed or drinking water.
- (b) Methomyl [1%] and (Z)-9-Tricosene [0.025%]. See label for use directions.

Space Treatments

Space sprays or aerosols can be effective for rapid knockdown and kill of adult flies. It is important to reduce air movement as much as possible. Follow directions according to label.

- (a) Pyrethrins [0.1%] and piperonyl butoxide [1.0%]. Before spraying, close doors and windows. Apply as a fog or fine mist, directing spray toward ceiling and upper corners until area is filled with mist. Use about 0.5 oz solution per 1,000 cu ft. Allow mist to settle on animals. Leave room closed for 5 minutes after treatment, remembering to ventilate area before reoccupying. Repeat as needed. Wash teats of dairy animals before milking. Avoid breathing fumes by wearing mask or respirator of a type recommended by the U.S. Bureau of Mines.
- (b) Dichlorvos [23.4%]. Apply by fogging or misting at rate of 1 quart of 0.5% solution per 8,000 cu ft. Reduce air movement as much as possible before applying. **Do not** use in areas where animals have received a direct application within 8 hours. **Do not** allow feed, water, milk, or milking utensils to become contaminated.
- (c) Dichlorvos resin strips. Suspend from ceiling as directed on label. Use 1 strip per 1,000 cu ft. These strips work best in closed rooms. **Do not** place over water or feed. Keep strips away from animals and children.
- (d) Spinosad [2.46%]. Dilutable spray for control of stable and house flies on animal premises, including in and around poultry, beef, dairy, horse, swine, and sheep premises. **Do not** apply product in milking parlor or milk room. Mix 20 oz product per 5 gal water and apply at a rate of 1 gal solution per 500-1,000 sq ft. **Do not** use in overhead sprinkler system. Refer to label for more directions.

Larvicides

Oral Treatments

The use of oral larvicides such as cyromazine, tetrachlorvinphos, and diflubenzuron [9.7%], is not legal in all states. These feed additives and boluses often are not the answer to fly control unless used very extensively. All manure must be treated within an area in order to effectively reduce the fly population. In many cases the area must be very large because flies rapidly move from one herd to the next over large geographic regions.

Oral larvicides work by preventing the development of flies in manure. They are not effective against existing adult flies, and should be used in conjunction with a regular manure sanitation practice. Supplemental fly control often is needed where flies breed in manure from untreated animals or other organic sources.

- (a) Cyromazine [1%]: See Poultry section.
- (b) Diflubenzuron [9.7%]. This product is a controlled-release bolus for beef and dairy cattle that aids in the suppression of house and stable flies. Administer 1/2 bolus to cattle weighing 300-550 lb, and 1 bolus to cattle weighing 550-1,100 lb or more. **Do not** administer to cattle weighing less than 300 lbs. NEVER administer more than 1 bolus to any animal.
- (c) Tetrachlorvinphos [97.3%]. Follow directions according to label. For beef cattle and lactating dairy cattle, feed at the rate of 70 mg product/100 lb of body weight. Start feeding in early spring before flies begin to appear, and continue through the summer and fall until cold weather restricts fly activity.

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Manure Treatments

- (a) Tetrachlorvinphos [23%] and dichlorvos [5.3%]. Mix 1 gal product in 25 gal water and apply at the rate of 1 gal of spray per 100 sq ft of droppings. Repeat at 7- to 10-day intervals until droppings begin to cone up, then treat only “hot spots” (small areas found to have large numbers of maggots). Can be used in poultry and livestock facilities. **Do not** spray animals directly. **Do not** contaminate feed or drinking water.
- (b) Tetrachlorvinphos [50%]. Apply at the rate of 1 gal of 1% solution per 100 sq ft of poultry droppings, manure piles, etc. Repeat every 7-10 days until control is achieved. **Do not** spray animals directly. **Do not** contaminate feed or drinking water.

Mineral Mixtures and Feed Additives

- (a) S-methoprene [10.5% and other formulations]. The AI in Altosid Cattle Custom Blending Premix is an insect growth regulator (IGR) that interrupts the development of the horn fly (and possibly other species of filth-breeding flies) in the manure of treated cattle. Begin use in the spring before horn flies appear on cattle and continue feeding until cold weather restricts horn fly activity. Product is safe for beef and dairy cattle, including breeding cattle, lactating cattle, and calves. Product can be fed up to slaughter and to lactating dairy cows without withholding milk. Refer to label for details on proper feed to weight blending ratios.

Perimeter Area Treatments

- (a) Citric Acid and crystalized propanetricarboxylic acid [100%]. Apply 1/8 cup per sq ft of treatment area. Treatment area should have a moderately salted appearance after application. Apply every 7 days during fly season. See label for specific area applications.

Poultry Area Fly Control

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There are several species of flies commonly found around caged layer poultry houses. The most common species are the house fly and the lesser house fly. Other annoying flies are blow flies (which breed on bird carcasses, broken eggs, and other garbage), soldier flies, fruit flies, gnats, and rat tailed maggots.

The house fly is by far the most important problem in caged layer operations. Not only are they a nuisance but they also are carriers of diseases. With the spread of non-farm residences into rural areas near poultry operations, egg producers are faced with increasing pressures from non-farm residents and health officials to control house flies. Also, the shift to large poultry operations has resulted in heavy concentrations of manure, a major source of fly breeding. According to workers in Georgia, as many as 1000 flies can develop in one pound of suitable breeding media. They are difficult to control, especially when the population becomes extremely high. A dedicated effort involving integrated pest management (IPM) will be needed to maintain house flies at a low level.

Fly Biology

All flies pass through four life stages: egg, larva (maggot), pupa, and adult. During its life cycle, which is about 30 days, a house fly female can lay up to 1000 eggs. These eggs are deposited on moist manure or any type of moist rotten or decaying organic matter. The eggs hatch in 10-12 hours and the maggots move into the wet manure. Fly maggots mature in 4-5 days under warm moist conditions. Pupation occurs in the drier parts of manure with the adult flies emerging in 3-5 days. Under ideal conditions a house fly can complete its life cycle in 9-14 days. The life cycle can be much longer in cooler temperatures. Although capable of movement up to several miles, house flies normally move no more than one half to three quarters of a mile from their breeding sites.

An IPM Program to Control House Flies

Step 1. Population Monitoring

It is essential to know as early as possible which houses are the major sources of fly breeding. The simplest and quickest method of taking quantitative fly counts is the moving tape method. A roll of ordinary sticky fly tape is carefully extended full length and held by the top loop so that the cardboard carton is almost touching the floor. The operator then walks at a normal pace up and down a standardized number of rows (at least 2 full rows) holding the tape by his or her side and slightly in front. At the end of the circuit, the number of flies that have stuck on the tapes is counted and recorded on a chart. These counts should be made in each house twice a week. Population increases and decreases can then be seen and compared from each house. The problem houses can thus be determined early enough to begin supplemental control measures before the fly population gets out of control. The producer also has quantitative evidence of the progress of his or her IPM program to present to interested neighbors or health officials.

The producer has to judge, based on the population dynamics in each house, when to apply supplementary control measures (**treatment threshold**). This decision is based on application costs and the nuisance situation to the surrounding residents.

Step 2. Sanitation and Manure Management

Inside: Manure is usually removed once a year in high-rise egg houses. It is allowed to cone up under the cages and kept as dry as possible. If at all possible, this manure should be removed during the cooler months of the year. Do not disturb the manure during the summer months. When it is spread on fields it is important to scatter the manure thinly so that the eggs and larvae are killed by drying. It is best to plow or disk it under immediately after spreading. In shallow pit houses, frequent removal of manure once or twice a week reduces fly breeding. It is important to make sure that spilled manure is not left in wet piles around the disposal equipment and in areas that the disposal equipment does not reach. If manure has to be stored, be sure to cover it completely with a heavy grade of black plastic. Cover the edges of the plastic with soil to prevent house flies from entering. House fly eggs need relative humidity levels of 90% or higher to develop successfully.

Flies normally breed in wet manure (above 40% moisture). **Leaking waterers are a major source of wet manure.** Thousands of house flies can breed in just one leaking water spot. Daily inspection and repair of all leaking waterers is essential. Provide abundant cross ventilation by the use of fans above the cages and in the manure pits, especially in hot weather.

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Outside: All garbage, leaking feed, spilled manure, bird carcasses, eggs, and miscellaneous trash should be removed regularly. Vegetation, weeds, and grass should be kept trimmed around the houses. Junk, trash, and rusting equipment which provide resting sites for flies should be removed. Install proper eave troughs and down spouts on houses to carry rain water away from buildings. Provide proper drainage in poultry yards and roadways.

Step 3. Biological Control

Natural fly predators (insects and mites that actively feed on fly eggs and larvae) and parasites (small, stingless wasps that lay their eggs in and kill the pupae of house flies) can build up in manure accumulations. They can significantly reduce house fly breeding. Biological control is more effective if the sanitation and manure management as listed in Step 2 is conscientiously applied. In high-rise houses, never clean out a house completely of manure. Leave at least a fourth of the manure undisturbed so that the natural enemies can survive and move into the new manure. Biological control is not as effective in shallow-pit houses; however, if manure is kept dry, the natural enemies are more effective.

Several commercial companies sell parasites for release in poultry houses. These parasites are supposed to be self-propagating in the process of controlling flies; however, quality control of these commercially available parasites is quite variable. Often, only a small percentage of the parasites are actually alive by the time the producer receives them. Producers intending to use these parasites are advised to set aside a small sample of them to check for emergence before releasing them in the houses.

A specific biological control program for house flies in high-rise poultry houses has been developed for Virginia. A predaceous fly larva, *Hydrotaea aenescens*, is mass-reared and released, resulting in a low house fly population with a reduced need for chemical control. (For more information, see VCE publication 444-769, "Instructions on Insectary Establishment, Mass Rearing, and Release of *Hydrotaea aenescens*: a House Fly Predator")

Step 4. Chemical Control

Insecticides should be used to supplement steps 2 (sanitation) and 3 (biological control). Insecticides can be used to attract and kill those flies that survived the larval stages. They should be applied so that they will not contact and kill house fly predators and parasites. Other insecticides can be used as an emergency control measure when fly populations threaten to overwhelm IPM control measures.

Fly Baits: These are designed to kill flies that have escaped the natural enemies in the manure and should be a regular part of the house fly IPM program. They are inexpensive and simple to use. They should be put out at the beginning of the fly season and renewed at least once a week through warm weather. Baits should be placed in containers (i.e., egg cartons) or glued onto cardboard panels so they will not fall into the manure pits.

Contact Sprays: If the moving tape counts indicate that the fly population in a house is threatening to overwhelm the natural controls, contact sprays can be used. As the name implies, these sprays kill flies on contact and are effective as a quick knock down treatment. Contact spray insecticides have a short residual life and will not prevent a later reinfestation. Do not spray in the manure pits or directly on the birds, eggs, feed, or water.

Residual Sprays: These insecticides have a longer residual life and can be used both inside and outside where flies congregate. In darkness, flies tend to "roost" on the upper walls and ceilings of layer houses, so residual insecticides should be concentrated in these areas. Because insecticide resistance is possible, residual sprays should be applied only to problem houses and areas where the moving tape counts indicate that the population growth is becoming serious.

Step 5. Feed-Through Larvicides

When the moving tape counts indicate that the fly population is about to explode, or when equipment failure has caused a temporary build up of wet spots in the manure, application of larvicides in the feed is a practical option. It should be applied until the tape counts indicate that the flies have been significantly reduced.

These syrphid fly larvae live in highly polluted water such as livestock lagoons, polluted abandoned fish pools, foul pools, and streams associated with barnyards. The maggots are able to live in the water if sufficient solids are present as food. The adult flies resemble honey bees and are often seen "hovering" near the ground in the barnyard vicinity. Because the rattailed maggot breeds and feeds in highly polluted water, an effort must be made to keep the lagoon in optimum condition. Usually, the lagoon becomes "out-of-balance" when the water level is not in proper relationship with the solids. Never allow accumulations of manure above the water line, either floating or sticking to the sides, because these conditions promote fly development. Keep the banks steep and the weeds under control.

Use loose soil and construct a soil barrier between the milk house and the rattailed maggot source. As maggots migrate to the soil barrier, they will dig into it to pupate rather than move into the milk house.

Try to agitate the pit contents frequently during the spring and summer by pumping the pits routinely (at least once a week) to disrupt maggot development. Always maintain a waterline above the manure solids. Clean out the pit contents on a routine basis, if possible.

Usually the occurrence of rattailed maggots is a management problem directly related to improper care of the lagoon or a poorly constructed lagoon. The Environmental Protection Agency (EPA) is very concerned with run-off and over-flow leading to pollution. It is very important to coordinate with agricultural designers and Health Department officials before constructing new liquid manure tanks and lagoons. Plans are available from these agencies for constructing tanks to prevent manure seepage and polluted waters, thereby avoiding a rattailed maggot problem.

Table 2.1 - Some Commercial Insecticides Registered for Control of House Flies in Poultry Houses

Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)¹	Mixing and Application Information
Fly Baits	
Methomyl [1%]	Ready-to-use bait.
Contact Sprays	
Pyrethrins [0.1% - 0.6%] + Piperonyl Butoxide [1% 6%]	Ready-to-use oil spray; apply as mist or fog. Spray at a rate of 1-2 seconds per 1,000 cubic feet. Close windows and doors for 15 min. or double dosage if area can't be closed.
Dichlorvos [43.2%]	Mix with water as instructed on label, apply as mist or fog.
Tetrachlorvinphos [50%] walls and ceilings	Mix with water as instructed on label, apply to inside or outside
Permethrin [5.7% to 25%]	Check label for specific application instructions.
Tetrachlorvinphos [23%] and Dichlorvos [5.3%]	Check label for specific application instructions.
Dibrom 37% EC	Check label for specific application instructions.
Cyfluthrin	Check label for specific application instructions.
Fenualerate	Check label for specific application instructions.
Stirophos	Check label for specific application instructions.
Imidacloprid	Check label for specific application instructions.
Lambda-cyfluthrin	Check label for specific application instructions.
Feed-Through Larvicides	
Cyromazine [1%] ton of feed. Follow directions according to label.	feed to egg-laying hens only. Mix 1 lb product per label.

¹Trade names are used for clarity only in this publication and do not imply endorsement of the product.

Rattailed Maggots (Syrphid Fly Larvae)

Frequently during the warm summer months, rattailed maggots are reported as a nuisance pest migrating from livestock lagoons and manure pits. These insects are not a problem as long as they remain in the liquid manure pit. However, they have been known to move out of the pit or lagoon in large numbers contaminating livestock feed, accumulating in electrical boxes causing short circuits, and congregating in stacks of egg cartons and other unwanted places. The maggots migrate in search of drier places in which to pupate.

Rattailed maggots, known as the larval or immature stage of syrphid flies, are about 1 1/4 inches long. The body portion is about 3/4 inch long and the tail portion (breathing tube) is about 1/2 inch long. These maggots are white in color and semi-transparent with the body portion being an elongated, oval, cylindrical shape. What appears to be a long tail is actually a breathing tube.

These syrphid fly larvae live in highly polluted water such as livestock lagoons, polluted abandoned fish pools, foul pools, and streams associated with barnyards. The maggots are able to live in the water if sufficient solids are present as food. The adult

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flies resemble honey bees and are often seen “hovering” near the ground in the barnyard vicinity. Because the rattailed maggot breeds and feeds in highly polluted water, an effort must be made to keep the lagoon in optimum condition. Usually, the lagoon becomes “out-of-balance” when the water level is not in proper relationship with the solids. Never allow accumulations of manure above the water line, either floating or sticking to the sides, because these conditions promote fly development. Keep the banks steep and the weeds under control.

Use loose soil and construct a soil barrier between the milk house and the rattailed maggot source. As maggots migrate to the soil barrier, they will dig into it to pupate rather than move into the milk house.

Try to agitate the pit contents frequently during the spring and summer by pumping the pits routinely (at least once a week) to disrupt maggot development. Always maintain a waterline above the manure solids. Clean out the pit contents on a routine basis, if possible.

Usually the occurrence of rattailed maggots is a management problem directly related to improper care of the lagoon or a poorly constructed lagoon. The Environmental Protection Agency (EPA) is very concerned with run-off and over-flow leading to pollution. It is very important to coordinate with agricultural designers and Health Department officials before constructing new liquid manure tanks and lagoons. Plans are available from these agencies for constructing tanks to prevent manure seepage and polluted waters, thereby avoiding a rattailed maggot problem.

Beef External Parasites

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Beef External Parasite Control

Table 2.2 - Dust Bags

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
horn flies, lice (aids in control of face flies)	Coumaphos [1%] Dust Permethrin [0.25%] Dust Gardona (lis-isomir)	No mixing is necessary. Install burlap bags or commercial ready-to-use bags of dust in areas where animals must come in contact. Keep bags in place during winter months to aid in control of lice. DUST BAGS MUST HANG 4-6 INCHES BELOW TOPLINE OF CATTLE.	Do not contaminate feed or water.

Table 2.3 - Hand Dusting

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
horn flies, face flies, lice	Tetrachlorvinphos [3%]	Read label before use. Wear rubber gloves and apply approximately 2.0 oz of dust to the upper portions of the back, neck, and poll, and to the face as an aid in the control of face flies. Rub in lightly to carry the dust beneath the hair.	Do not contaminate feed or water.
	Permethrin [0.25%]	Apply 2.0 oz (6.0 tbsp) of dust per animal by shaker can. Repeat as necessary.	Do not contaminate water, food or feed by storage or disposal. Keep container sealed when not in use.
	Malathion Dust [4%]	For horn flies: apply 4 tbsp on the back and neck. Repeat at 10-14 day intervals. Dust calves lightly. For lice and ticks: dust animal thoroughly. Repeat treatment after 2-3 weeks if needed.	Do not treat calves under 1 month of age. Do not contaminate water.
	Coumaphos [1%]	No mixing is necessary. Apply not more than 2.0 oz per animal. Dust evenly into the hair over the head, neck, shoulders, back, and tailhead. Repeat as necessary but not more than once every 10 days.	Do not contaminate feed or water.
	Zeta-Cypermethrin [0.075%] + Piperonyl Butoxide [0.15%]	Check label for specific application instructions.	

Table 2.4 - Backrubbers¹ and Facerubbers

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
face flies, horn flies, stable flies, house flies, black flies, mosquitoes, eye gnats, mange mites	Permethrin [11%] (Atroban 11% EC) Permethrin [10%] Permethrin [5.7%] and others	Follow directions according to labels. Use only #2 diesel oil or any approved backrubber base oil.	Read and adhere to all precautions on labels. Do not use motor oil or waste oil on backrubbers. Keep rubbing device charged. Results improve daily with forced use.
face flies, horn flies, lice	Coumaphos Tetrachlorvinphos [23%] and Dichlorvos [5.3%] Dioxathion Phosmet [11.6%] Permethrin [7.4%] + Piperonyl Butoxide [7.4%] Stirofos	Follow directions according to label. Use only #2 diesel oil or any approved backrubber base oil.	Read and adhere to all precautions on labels. Do not use motor oil or waste oil on backrubbers.

¹Backrubbers will suppress cattle lice, but usually do not result in complete control.

Table 2.5 - Sprays

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
face flies, horn flies, grubs ¹ , lice, screwworms, ticks	Coumaphos	Follow directions according to label. Apply spray at high pressure so as to wet the skin. Use only between August 1 and November 1 for grub control. ¹ Do not use after November 1 unless animals are known to be grub-free, because paralysis or suffocation may result.	Do not apply to sick animals or those less than 3 months old. Do not apply in conjunction with oral drenches or internal medications.
horn flies, lice, ticks	Tetrachlorvinphos [50%]	For horn flies and lice, mix 4.0 lbs product in 75.0 gal water. For ticks mix 4 lb product in 50.0 gal of water. Apply as coarse spray. Use 0.5-1.0 gal of spray per animal depending on size and thickness of hair coat.	Do not contaminate feed or water.
horn flies, lice, lone star ticks, face flies (aids in control)	Tetrachlorvinphos [23%] and Dichlorvos [5.3%]	Check label for proper dilution for each pest. Apply as coarse spray. Use between 0.5-1.0 gal of spray/animal depending on size and hair coat.	Do not treat more often than every 10 days. Do not contaminate feed or water.
face flies, horn flies, stable flies, lice, ticks	Permethrin [11%] Permethrin [10%]	Check labels for specific application instructions.	Do not contaminate feed or water.
Permethrin [5.7%] face flies, horn flies, lice	(Ectiban EC) and others Permethrin [7.4%] + Piperonyl Butoxide [7.4%]	Check label for specific application information.	Can be applied topically to livestock and their premises. Check label for precautions.
horn flies, lice, ticks, sarcopic mange horn flies, lice	Phosmet [11.6%] (Liquid Insecticide) Spinosad [2.46%]	See label for specific mixing and rate information Refer to label for specific mixing and rate information.	Do not contaminate feed or water. Does not control cattle grubs. Do not make more than 5 consecutive treatments with this product. Do not apply more than once every 7 days. Do not apply within 2 days of slaughter.

¹Cattle grubs - dips and sprays - Do not apply to sick, convalescent, or stressed animals or animals less than three months old. Do not dip or spray animals for 10 days before or after shipping or weaning, or after exposure to contagious or infectious diseases. Do not apply in conjunction with oral drenches, or with internal medications such as phenothiazine, or with natural or synthetic pyrethroids or their synergists, or with other organic phosphates. Do not apply in a confined, non-ventilated area. Destruction of *Hypoderma* larvae (cattle grubs) at the period when these grubs are in vital areas may cause undesirable host-parasite reactions including the possibility of fatalities. Killing *Hypoderma lineatum* when it is in the tissue surrounding the gullet may cause salivation and bloat; killing *H. bovis* when it is in the vertebral canal may cause staggering or paralysis. These reactions are not specific to treatment with Ivomec, but can occur with any successful treatment of grubs. Cattle should be treated either before or after these stages of grub development. Consult your veterinarian or Extension entomologist concerning proper timing of treatment.

Table 2.6 - Pour-ons¹

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
horn flies, face flies	Lambda-Cyhalothrin [1.0%]	Ready to use. Apply down backline at rate of 0.33 oz/animal up to 600 lbs of body weight. For animals weighing more than 600 lbs use 0.5 oz/animal.	Do not apply to face of animal. Non-systemic, will not control cattle grubs. Repeat as needed, but not more than once every 2 weeks and not more than 4 times within 6 months. Two treatments at 14- day intervals are recommended for control of sucking lice.
	Permethrin [10.0 %]	Ready to use. Apply from poll down neck to shoulders and along midline of back. Use 0.125 oz/250 lbs of body weight.	Non-systemic, will not control cattle grubs. Repeat as needed, but not more often than once every 2 weeks.
	Spinosad [2.46%]	Ready to use. Apply along back and down face. See label for complete use directions.	Repeat as needed, but not more than once every 2 weeks. Do not make more than 5 consecutive treatments with this product. Do not apply more than once every 7 days. Do not apply within 2 days of slaughter.
lice	Permethrin [1.0%]	Ready to use. Apply along back and down face. Use 0.5 oz/100 lbs of body weight, up to 5 oz/animal.	Repeat as needed, but not more than once every 2 weeks.
	Cyfluthrin [1.0%]	Rates for horn flies and face flies: 4 oz < 400 lb body wt 8 oz 400 to 800 lb body wt 12 oz > 800 lb body wt Rates for biting and sucking lice: 8 oz < 400 lb body wt 16 oz 400 to 800 lb body wt 24 oz > 800 lb body wt	Does not control cattle grubs.
	Permethrin [1.0%] + Piperonyl Butoxide [1.0%]	Apply at rate of 0.5 oz/100 lb of body wt up to maximum dosage of 5 oz/animal.	Repeat as needed, but not more often than once every 2 weeks. Check label for additional precautions.

¹Do not use any pour-ons for lice control between Nov. 1 and Feb. 1. **Apply all pour-on grub treatments after Aug. 1 but no later than Nov. 1.**

²Destruction of *Hypoderma* larvae (cattle grubs) at the period when these grubs are in vital areas may cause undesirable host-parasite reactions including the possibility of fatalities. Killing *Hypoderma lineatum* when it is in the tissue surrounding the gullet may cause salivation and bloat; killing *H. bovis* when it is in the vertebral canal may cause staggering or paralysis. These reactions are not specific to treatment with Ivomec, but can occur with any successful treatment of grubs. Cattle should be treated either before or after these stages of grub development. Consult your veterinarian or Extension entomologist concerning proper timing of treatment.

Refrain from smoking or eating when handling. Wash hands after using. Keep this and all drugs out of reach of children.

Table 2.6 - Pour-ons¹ (cont.)

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
lice (cont.)	Spinosad [2.46%]	Ready to use. Apply along back and down face. See label for complete use directions.	Repeat as needed, but not more than once every 2 weeks. Do not make more than 5 consecutive treatments with this product. Do not apply more than once every 7 days. Do not apply within 2 days of slaughter.
	L-cyhalothrin	See label.	0 days to slaughter.

Avoid using products with grubicidal activity in Virginia from Nov. 1 to Feb. 1.²

grubs, horn flies, lice, sarcopic mange, chorioptic mange See footnote ²	Eprinomectrin	Use 1.0 ml of product for each 22.0 lb of body weight. Apply along backline in a narrow strip extending from the withers to tailhead.	When used according to label, no pre-slaughter withdrawal period is required.
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¹Do not use any pour-ons for lice control between Nov. 1 and Feb. 1. **Apply all pour-on grub treatments after Aug. 1 but no later than Nov. 1.**

²Destruction of *Hypoderma* larvae (cattle grubs) at the period when these grubs are in vital areas may cause undesirable host-parasite reactions including the possibility of fatalities. Killing *Hypoderma lineatum* when it is in the tissue surrounding the gullet may cause salivation and bloat; killing *H. bovis* when it is in the vertebral canal may cause staggering or paralysis. These reactions are not specific to treatment with Ivomec, but can occur with any successful treatment of grubs. Cattle should be treated either before or after these stages of grub development. Consult your veterinarian or Extension entomologist concerning proper timing of treatment.

Refrain from smoking or eating when handling. Wash hands after using. Keep this and all drugs out of reach of children.

Table 2.7 - Spot-ons

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
ear ticks, screwworm	Coumaphos [5%]	Shake well. Squeeze container to release dust in short bursts of light clouds. Hold nozzle 2-4 inches from area to be treated and apply a light, even coat around the area.	For screwworm, treat infested wounds with light but thorough coverage. For ear ticks, dust into the area and also treat adjacent head area.

Table 2.8 - Mineral Mixtures and Feed Additives

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
face flies, horn flies, house flies, stable flies	Tetrachlorvinphos [7.6%]	Follow directions according to label. Start feeding in early spring before flies begin to appear, and continue throughout the summer and fall until cold weather restricts fly activity.	Check label for precautions.
horn flies (and possibly other species of filth-breeding flies)	s-Methoprene [10.5%]	Refer to label for details on proper feed to weight blending ratios.	S-Methoprene is an insect growth regulator (IGR) that interrupts the development of the horn fly (and possibly other species of filth-breeding flies) in the manure of treated cattle. Begin use in spring before horn flies appear on cattle and continue feeding until cold weather restricts horn fly activity. Product is safe for beef and dairy cattle, including breeding cattle, lactating cattle, and calves. Product can be fed up to slaughter and to lactating dairy cows without withholding milk.

Table 2.9 - Ear Tags

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
face flies, horn flies	Pyrethroid Class Tags Beta-Cyfluthrin insecticide, Cyfluthrin insecticide, Cypermethrin insecticide & Piperonyl Butoxide synergist, Permethrin insecticide, Permethrin insecticide & Piperonyl Butoxide synergist, Fenvalerate insecticide, Lambda-Cyhalothrin insecticide & Piperonyl Butoxide synergist	Follow directions according to labels. Apply with recommended applicator.	Carefully read instructions to avoid ear damage. Remove tags before slaughter.
	Organophosphate Class Tags Diazinon insecticide, Ethion insecticide, Diazinon & Chlorpyrifos insecticide, Fenthion insecticide & Piperonyl Butoxide synergist, Pirimiphos-methyl insecticide	Follow directions according to labels. Apply with recommended applicator.	Carefully read instructions to avoid ear damage. Remove tags before slaughter.
	Pyrethroid & Organophosphate Class Tags Cypermethrin & Chlorpyrifos insecticide & Piperonyl Butoxide synergist, Lambda-Cyhalothrin & Pirimiphos-methyl insecticide, Permethrin and Chlorpyrifos insecticide & Piperonyl Butoxide synergist		

Table 2.10 - Injectables¹

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
lice (sucking): (<i>Linognathus vituli</i>), (<i>Haematopinus eurysternus</i>), (<i>Solenopotes capillatus</i>) grubs: (<i>Hypoderma bovis</i>), (<i>H. lineatum</i>) mange mites: (<i>Psoroptes ovis</i>), (<i>Sarcoptes scabiei</i>) See footnote ¹	Ivermectin [1%] Dectomax [1%]	Ivermectin should be given only by subcutaneous injection at the recommended dose level of 200 mcg ivermectin/kg of body weight. Each 10 mg of ivermectin is sufficient to treat 110 lb (50 kg) of body weight. Use of a 16 gauge, 1/2 to 3/4" needle is suggested. Inject under the loose skin in front of or behind the shoulders.	Do not treat cattle within 35 days of slaughter. This product is not for intravenous or intra-muscular use. Animals should be appropriately restrained to achieve the proper route of administration. Use sterile equipment and sanitize the injection site by applying a suitable disinfectant. Clean, properly disinfected needles should be used to reduce potential injection-site infections.

¹Observe cattle for injection site reactions. Reactions may be due to clostridial infection and should be aggressively treated with appropriate antibiotics.

Ivermectin is highly effective against all stages of cattle grubs. However, proper timing of treatment is important. For most effective results, cattle should be treated as soon as possible after the end of the heel fly (warble fly) season.

Destruction of *Hypoderma* larvae (cattle grubs) at the period when these grubs are in vital areas may cause undesirable host-parasite reactions including the possibility of fatalities. Killing *Hypoderma lineatum* when it is in the tissue surrounding the gullet may cause salivation and bloat; killing *H. bovis* when it is in the vertebral canal may cause staggering or paralysis. These reactions are not specific to treatment with ivermectin, but can occur with any successful treatment of grubs. Cattle should be treated either before or after these stages of grub development. Consult your veterinarian or Extension entomologist concerning proper timing of treatment.

Cattle treated with ivermectin after the end of the heel fly season may be retreated with ivermectin during the winter for internal parasites, mange mites, or lice without danger of grub-related reactions. **A planned parasite control program is recommended.**

Transitory discomfort has been observed in some cattle following subcutaneous administration. A low incidence of soft-tissue swelling at the injection site has been observed. These reactions have disappeared without treatment. Divide doses greater than 10 ml between two injection sites to reduce occasional discomfort or site reaction. Protect from light.

CAUTION: Ivermectin injection for cattle has been developed specifically for use in cattle and reindeer only. This product should not be used in other animal species because severe adverse reactions, including fatalities in dogs, may result.

Refrain from smoking or eating when handling. Wash hands after using. Keep this and all drugs out of reach of children.

Table 2.11 - Bolus

Pests	Active Ingredient [Percent A.I. in Product] (Trade Name)	Insecticide Mixing and Application Information	Precautions
face flies, horn flies, house flies, stable flies	Diflubenzuron [9.7%]	This product is a controlled-release bolus for beef and dairy cattle that aids in the suppression of house and stable flies. Administer 1/2 bolus to cattle weighing 300-550 lb, and 1 bolus to cattle weighing 550-1,100 lb or greater.	Do not administer to cattle weighing less than 300 lb. Never administer more than 1 bolus to any animal.

When to Treat for Cattle Grubs

Proper timing of treatment is important when using systemic grubicide pour-ons and spot-ons on beef and non-lactating dairy cattle. For most effective results, cattle should be treated for grubs after the end of heel fly activity in September. Host-parasite reactions such as bloat, salivation, staggering and paralysis may sometimes occur when cattle are treated while the common cattle grub, *Hypoderma lineatum*, is in the gullet, or while the northern cattle grub, *H. bovis*, is in the area of the spinal cord. Therefore, avoid using products with grubicidal activity on cattle in Virginia from Nov. 1-Feb. 1.

Follow Instructions on the Label

If it is impossible to determine the origin of the cattle, and thus the exact stage of the grubs is unknown, it is recommended that the cattle receive only dry hay or a maintenance ration of low energy feed a couple of days before and during the treatment period. This lessens the likelihood of severe bloat, which may occur in cattle on full feed when the common grub is killed in the gullet.

When to Treat for Cattle Lice

Systemic pour-ons and spot-ons for lice control on beef and non-lactating dairy cattle are convenient. Grub treatment before the November cutoff date often will not take care of cattle lice problems. Louse eggs are not as susceptible to insecticides as the lice themselves and therefore animals should be re-examined about three weeks after treatment to determine if viable lice eggs have hatched and reinfested the herd.

Do not use grubicides such as coumaphos (Co-Ral), famphur (Warbex - registration cancelled), fenthion (Tiguvon or Spotton - registration cancelled) or phosmet (Prolate) from November through January on cattle not previously treated for grubs due to possible host-parasite reactions. After February 1, grub larvae have migrated from the spinal canal, or esophagus, and usually encyst in the back; cattle may then be treated safely with grubicides. It is then safer to treat for lice to minimize the host-parasite reaction.

For cattle previously treated for grubs, a second treatment later in the season may become necessary should lice become a problem. The second treatment usually should not be applied sooner than 35 days after the first treatment. Be sure to follow instructions on the label for any safety precautions.

Systemic spot-ons and pour-ons that kill lice but not grubs can be applied anytime throughout the fall and winter months. Be sure to follow instructions on the label for any safety precautions.

Dairy External Parasites

Eric R. Day, Extension Entomologist, Virginia Tech

Insecticides should be applied with extreme caution to cows or calves in poor health. This means light applications of safer materials.

Table 2.12 - Dust Bags¹

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
horn flies, lice (aids in control of face flies)	Coumaphos [1%] Dust	No mixing is necessary. Install burlap bags of dust in doorway where cattle leave milking barn or enter loafing barn. Keep in place during winter months to aid in control of lice.	Do not contaminate feed or water.
	Ectiban		
	Gardona		
	Permethrin Rabon		

¹Closed-mesh bags must be used to prevent waste of dust.

Table 2.13 - Backrubbers¹ - Lactating Cows

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
face flies, horn flies, stable flies	Permethrin [11%]	Dilute 1.0 pt product/10.0 gal #2 diesel oil.	Use only #2 diesel oil or any other approved backrubber base oil. Do not use motor oil or waste oil. Keep rubbing device charged. Results improve with daily forced use. Install backrubbers where cattle leave the milking barn.
	Tetrachlorvinphos [23%] Dichlorvos [5.3%]	Dilute 5.0 oz product/1.0 gal #2 diesel oil.	
	Permethrin [10%]	Mix 1.0 qt product/20.0 gal #2 diesel oil.	
	Permethrin [5.7%]	Mix 1.0 qt product/10.0 gal #2 diesel oil.	
	Cumophos	1.25 cups/gal #2 diesel oil	
face flies, horn flies, lice	Permethrin [7.4%] + Piperonyl Butoxide [7.4%]	Mix 2.1 oz/gal mineral oil. Results improve with daily forced use.	

¹Backrubbers will suppress cattle lice, but usually do not result in complete control.

Table 2.14 - Hand Dusting - Lactating Cows

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
face flies, horn flies, lice	Tetrachlorvinphos [3%] Dust	Follow directions according to label. Wear rubber gloves to apply. Apply approximately 2 oz dust to the upper portions of the back, neck and poll, and to the face as an aid in the control of face flies. Rub in lightly to carry the dust beneath the hair.	Do not contaminate feed or water.
	Permethrin [0.25%]	Apply 2 oz (6.0 tbsp) of dust/animal by shaker can. Repeat as necessary.	Do not contaminate water, food or feed by storage or disposal. Keep container sealed when not in use.
horn flies, lice	Coumaphos [1%] Dust	No mixing is necessary. Apply not more than 2.0 oz/ animal. Dust evenly into the hair over the head, neck, shoulders, back, and tail-head. Repeat as necessary.	Do not contaminate feed or water.
	Zeta-Cypermethrin [0.075%] + Piperonyl Butoxide [0.15%]	See label for specific application instructions.	

Table 2.15 - Wetting Sprays - Lactating Cows

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
face flies, horn flies, horse flies, house flies, stable flies, lice, mites, ticks	Permethrin [11%]	Mix 1.0 pt product in 25.0 gal water. Apply 1-2 qts of coarse spray/ animal over entire body surface.	Spray lactating dairy animals only after milking is completed. Do not contaminate feed or drinking water.
face flies, horn flies, stable flies, ticks	Permethrin [5.7%]	Mix 1.0 qt product in 25.0 gal water. Apply 1-2 qts spray/ animal over entire body surface.	
lice	Permethrin [5.7%]	Mix 1.0 quart product in 100 gal water.	A second application is recommended 2-3 weeks later.
	Coumaphos [25%]	Mix 1.0 lb product in 100 gal water. Apply spray to run-off.	
face flies, horn flies, horse flies, stable flies, lice, mites, ticks, etc.	Permethrin [10%]	Mix 1.0 quart product in 200 gal water. Apply spray to thoroughly cover animal.	For lice and mites a second application is recommended 2-3 weeks later.
face flies, horn flies, lice	Permethrin [7.4%] + Piperonyl Butoxide [7.4%]	Check label for specific application instructions.	Can be applied topically to lactating dairy animals and their premises. Check label for precautions.
horn flies, lice	Spinosad [2.46%]	For lactating and non-lactating beef and dairy cows. Refer to label for specific mixing and rate information.	Do not make more than 5 consecutive treatments with this product. Do not apply more than once every 7 days. Do not apply within 2 days of slaughter.

Table 2.16 - Mist Sprays - Lactating Cows

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
horn flies, stable flies	Synergized pyrethrins	Apply 1.0-2.0 oz of product directly to animal once daily, preferably in morning.	If other mist sprays are used on lactating dairy cattle, please read label carefully.
face flies, horn flies, stable flies	Dichlorvos [40.2%]	Dilute 5.0 oz product in 2.0 gal water. Apply 1.0- 2.0 oz of diluted solution/animal daily as a fine mist. Thoroughly cover all parts of the animal, including the legs, but do not wet the skin.	Do not contaminate feed or drinking water. Do not apply in combination with trichlorfon. Do not apply to calves under 6 months.

Table 2.17 - Injectables - Males and Females Not of Breeding Age¹

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
lice (sucking): <i>Linognathus vituli</i> , <i>Haematopinus eurysternus</i> , <i>Solenopotes capillatus</i> grubs: <i>Hypoderma bovis</i> , <i>H. lineatum</i>	Ivermectin [1%]	Ivermectin should be given only by subcutaneous injection at the recommended dose level of 200 mcg ivermectin/kilogram of body weight. Each 10 mg of ivermectin is sufficient to treat 110 lb (50 kg) of body weight. A 16 gauge, 1/2 to 3/4" needle is suggested. Inject under the loose skin in front of or behind the shoulders.	Do not treat cattle within 35 days of slaughter. Because a withdrawal time in milk has not been established, do not use in female dairy cattle of breeding age. This product is not for intravenous or intramuscular use. Animals should be appropriately restrained to achieve the proper route of administration. Use sterile equipment and sanitize the injection site by applying a suitable disinfectant. Clean, properly disinfected needles should be used to reduce the potential for injection-site infections.

¹Ivermectin - Observe cattle for injection-site reactions. Reactions may be due to clostridial infection and should be aggressively treated with appropriate antibiotics.

Ivermectin is highly effective against all stages of cattle grubs. However, proper timing of treatment is important. For most effective results, cattle should be treated as soon as possible after the end of the heelfly (warble fly) season.

Destruction of *Hypoderma* species larvae (cattle grubs) at the period when these grubs are in vital areas may cause undesirable host-parasite reactions including the possibility of fatalities. Killing *Hypoderma lineatum* when it is in the tissue surrounding the gullet may cause salivation and bloat; killing *H. bovis* when it is in the vertebral canal may cause staggering or paralysis. These reactions are not specific to treatment with ivermectin, but can occur with any successful treatment of grubs. Cattle should be treated either before or after these stages of grub development. Consult your veterinarian or Extension entomologist concerning proper timing of treatment.

Cattle treated with ivermectin after the end of the heelfly season may be retreated with ivermectin during the winter for internal parasites, mange mites, or lice without danger of grub-related reactions. A planned parasite control program is recommended.

Transitory discomfort has been observed in some cattle following subcutaneous administration. A low incidence of soft-tissue swelling at the injection site has been observed. These reactions have disappeared without treatment. Divide doses greater than 10 ml between two injection sites to reduce occasional discomfort or site reaction.

Protect from light.

CAUTION: Ivermectin injection for cattle has been developed specifically for use in cattle and reindeer only. This product should not be used in other animal species because severe adverse reactions, including fatalities in dogs, may result.

Refrain from smoking or eating when handling. Wash hands after using. Keep this and all drugs out of reach of children.

Table 2.18 - Bolus

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
face flies, horn flies, house flies, stable flies	Diflubenzuron [9.7%]	Administer 0.5 bolus to cattle weighing 300-550 lb, and 1 bolus to cattle weighing 550-1,100 lb or more. Follow directions according to label.	Do not administer to cattle weighing less than 300 lb. Never administer more than 1 bolus to any animal.

Table 2.19 - Pour-ons - Lactating Cows¹

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
horn flies, lice	Permethrin [10.0%]	Ready to use. Apply from poll down neck to shoulders and along midline of back. Use 0.125 oz/250 lbs of body weight.	Non-systemic, will not control cattle grubs. Repeat as needed, but not more often than once every 2 weeks.
	Spinosad [2.46%]	Ready to use. Apply along back and down face. See label for complete use directions.	Repeat as needed, but not more than once every 2 weeks. Do not make more than 5 consecutive treatments with this product. Do not apply within 2 days of slaughter.
face flies, horn flies, lice	Permethrin [5.0%]	Apply 0.10 oz/100 lbs of body weight, up to a maximum of 1.01 oz/animal.	Non-systemic, will not control cattle grubs. Repeat as needed, but not more often than once every 2 weeks.
	Permethrin [1.0%]	Ready to use. Apply along back and down face. Use 0.5 oz/100 lbs of body weight, up to 5 oz/animal.	Repeat as needed, but not more than once every 2 weeks.
	Permethrin [1.0%] + Piperonyl Butoxide [1.0%]	Apply at rate of 0.5 oz/100 lb body weight up to a maximum dosage of 5 oz/animal.	Repeat as needed, but not more than once every 2 weeks. Check label for additional precautions.
	Cyfluthrin [1.0%]	Rates for horn flies and face flies: 4 oz <400 lb body wt 8 oz 400 to 800 lb body wt 12 oz >800 lb body wt Rates for biting and sucking lice: 8 oz <400 lb body wt 16 oz 400 to 800 lb body wt 24 oz >800 lb body wt	Does not control cattle grubs.
grubs, horn flies, lice sarcopic mange, chorioptic mange	Ivomec Eprinex	Use 1.0 ml of product for each 22.0 lb body wt. Apply along backline in a narrow strip extending from the withers to tailhead.	When used according to label, neither a pre-slaughter withdrawal period nor a milk discard time is required.

¹Avoid using products with grubicidal activity in Virginia from Nov. 1 to Feb. 1.

Table 2.20 - Pour-ons - Non-lactating Cows¹

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
face flies, horn flies, lice	Permethrin [1.0%] + Piperonyl Butoxide [1.0%]	Pour along back at rate of 0.5 oz/100 lbs body wt up to a maximum of 5 oz/animal.	Repeat as needed, but not more than once every 2 weeks. Check label for additional precautions.
grubs ² , horn flies, lice sarcopic mange, chorioptic mange	Eprinomectrin (Ivomec Eprinex)	Use 1.0 ml of product for each 22.0 lb body wt. Apply along backline in a narrow strip extending from the withers to tailhead.	When used according to label, neither a pre-slaughter withdrawal period nor a milk discard time is required.
horn flies, lice	Spinosad [2.46%]	Ready to use. Apply along back and down face. See label for complete use directions.	Repeat as needed, but not more than once every 2 weeks. Do not make more than 5 consecutive treatments with this product. Do not apply within 2 days of slaughter.

¹Please read label carefully if other pour-ons for grub control are used on non-lactating dairy cattle.

²Avoid using products with grubicidal activity in Virginia from Nov. 1 to Feb. 1.

Table 2.21 - Ear Tags

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
face flies, horn flies	<p>Pyrethroid Class Tags Beta-Cyfluthrin insecticide, Cyfluthrin insecticide, Cypermethrin insecticide & Piperonyl Butoxide synergist, Permethrin insecticide, Permethrin insecticide & Piperonyl Butoxide synergist, Fenvalerate insecticide</p> <p>Organophosphate Class Tags Ethion insecticide, Fenthion insecticide & Piperonyl Butoxide synergist</p> <p>Pyrethroid & Organophosphate Class Tags Cypermethrin insecticide & Chlorpyrifos insecticide & Piperonyl Butoxide synergist, Permethrin insecticide & Chlorpyrifos insecticide & Piperonyl Butoxide synergist</p>	Follow directions according to labels and apply with recommended applicator.	Carefully read instructions to avoid ear damage. Remove tags before slaughter.

Table 2.22 - Mineral Mixtures and Feed Additives

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
face flies, horn flies, house flies, stable flies	Tetrachlorvinphos [7.6%]	Follow directions according to label. Start feeding in early spring before flies begin to appear, and continue throughout the summer and fall until cold weather restricts fly activity.	Check label for precautions.
horn flies (and possibly other species of filth-breeding flies)	s-Methoprene [10.5%]	Refer to label for details on proper feed to weight blending ratios.	The Ai in Altosid Cattle Custom Blending Premix is an insect growth regulator (IGR) interrupts the development of the horn fly (and possibly other species of filth-breeding flies) in the manure of treated cattle. Begin use in spring before horn flies appear on cattle and continue feeding until cold weather restricts horn fly activity. Product is safe for beef and dairy cattle, including breeding cattle, lactating cattle, and calves. Product can be fed up to slaughter and to lactating dairy cows without withholding milk.

Swine External Parasites

Eric R. Day, Extension Entomologist, Virginia Tech

Table 2.23 - Sprays

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
lice	Coumaphos [25%]	Mix 2.0 lbs product in 100 gal water. Apply to point of run-off.	Check label for details.
	Tetrachlorvinphos [50%]	Dilute 4.0 lbs in 50.0 gal water. Apply as a coarse spray, using 1-2 qts/animal.	Repeat in 2 weeks if necessary.
lice, mange mites, ticks	Amitraz [12.5%]	Mix 1 can (760-ml = 25.7 oz) in 50.0 gal water (equivalent to 0.5 oz product/gal spray solution). Use solution within 6 hr of mixing. Spray entire pen area at 70-150 psi. Spray all animals to run-off and thoroughly treat jowl, legs, inside the ears, and underside of body. If necessary, make second application in 7-10 days for mites and 10-14 days for lice.	Remove feed from pen and cover drinking bowls. Remove and destroy bedding. Hose out feces and excess feed. Do not apply to swine within 3 days of slaughter. Do not treat animals more than 4 times per year.
lice, mange mites	Fenvalerate [10%]	Mix 1.0 qt product in 50.0 gal water. Wet entire animal with up to 8.0 oz of spray.	Do not apply within 1 day of slaughter.
	Phosmet [11.6%] ¹	Mix 1.0 qt product in 25.0 gal water. Apply to run-off. Repeat if necessary after 14 days.	Check label for details. Do not apply within 1 day of slaughter. Do not apply to sick, convalescent or stressed animals. Do not apply to suckling pigs.
	Permethrin [11%] Stirofos	Follow directions according to labels.	Check labels for precautions.

¹Do not use this product in conjunction with other cholinesterase-inhibiting drugs, pesticides, or chemicals.

Table 2.24 - Dusts

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
lice	Coumaphos [1%]	No mixing is necessary. Ready-to-use. Do not use more than 1.0 oz of product/animal.	Do not use more frequently than once every 10 days.
	Tetrachlorvinphos [3%] ¹	Use 3-4 oz/animal. Repeat as necessary, but not more often than once every 14 days. In severe infestations, both animals and bedding should be treated. Use 1.0 lb/150.0 sq ft of bedding.	Check label for details.
	Permethrin [0.25%]	Apply up to 1.0 oz (3.0 tbsp) of dust to the head, shoulders, and neck. Repeat as necessary, but not more than once every 10 days.	Do not contaminate water, food or feed by storage or disposal. Keep container sealed when not in use.
	Malathion Dust [4%]	Thoroughly apply to all animals in herd, as well as pens. One treatment may be sufficient.	Do not treat calves under 1 month of age. Do not contaminate water, food or feed by storage or disposal.

¹Do not use this product in conjunction with other cholinesterase-inhibiting drugs, pesticides, or chemicals.

Table 2.25 - Pour-ons

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
lice, mange mites	Amitraz [2%] Fenualerate Fenthion Permethrin	Requires specially designed dosing gun. Apply proper dosage (consult chart on label) to the inside of each ear and along the midline of the back.	Restrain animals. Do not treat within 7 days of slaughter. Retreat in 7 to 10 days, if necessary. Check label for details.

Table 2.26 - Injectables

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
sucking lice (<i>Haematopinus suis</i>), mange mites (<i>Sarcoptes scabiei</i> var. <i>suis</i>)	Ivermectin [1%] (Ivomec)	Ivomec should be given only by subcutaneous injection at the recommended dose level of 300 mcg ivermectin/kgm of body wt. Each ml of Ivomec contains 10 mg of ivermectin, sufficient to treat 75 lb (33 kg) of body weight. Use of a 16- or 18-gauge 1/2 to 3/4" needle is suggested. The recommended route of administration is by subcutaneous injection in the neck, behind the ear. Use aseptic technique.	This product has been developed for use in swine only. Do not treat swine within 18 days of slaughter. This product is not for intravenous or intra-muscular use. Restrain animal to achieve the proper route of administration. Use sterile equipment and sanitize the injection site by applying a suitable disinfectant. Clean, properly disinfected needles should be used to reduce potential injection-site infection. Protect product from light. Keep this and all drugs out of reach of children.

Sheep External Parasites

Eric R. Day, Extension Entomologist, Virginia Tech

Table 2.27 - Sprays or Dips¹

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
lice, sheep keds	Permethrin [7.4%] + Piperonyl Butoxide [7.4%], Cumaphos, Diazinon	Check label for specific application instructions.	Can be applied topically to sheep and their premises. Check label for precautions.
	Fenvalerate [10%]	Mix 1.0 qt product in 100 gal water. Wet animal with up to 1.0 qt of solution.	For use only on non-lactating sheep or goats. Repeat application in 30 days if necessary. Do not apply more than 2 times in spring and 2 times in fall. Do not apply within 2 days of slaughter.
lice, mites, sheep keds, ticks	Permethrin [11%]	Mix 1.0 pt product in 25.0 gal water. Apply 1-2 qt of coarse spray/ animal over entire body surface.	Do not contaminate feed or drinking water. Check label for details.
lice, sheep keds, ticks, fleeceworms	Coumaphos [25%]	Follow directions according to label.	Repeat as necessary but not within 15 days of slaughter.
fleeceworms	Permethrin	Follow directions according to label.	See label.

¹May be applied as a spray or dip.

Do not apply to sick, convalescent, or stressed livestock, or to any animals less than 3 months old except in Federal and State eradication programs. Do not treat animals for 10 days before or after shipping or weaning, or after exposure to contagious and infectious diseases except in Federal or State eradication programs. Do not spray in confined non-ventilated area.

Animals must be wet thoroughly to penetrate wool for control of lice next to the skin. Dipping is the most reliable method of eliminating lice on sheep.

Table 2.28 - Pour-ons

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
lice, sheep keds	Fenvalerate [10%]	Mix 4.0 oz product in 1.5 gal of water. Apply up to 4.0 oz of solution down midline of back 1-2 times in the spring.	For use only on non-lactating sheep and goats. Repeat application in 30 days if necessary. Do not apply more than 2 times in the fall pest season. One application after shearing is usually adequate for sheep ked control. Do not apply within 2 days of slaughter. Repeat as needed, but not more than once every 2 weeks.
	Permethrin [1.0%] & Piperonyl Butoxide synergist [1.0%]	Apply 0.25 oz/50 lbs of body weight, up to maximum of 3 oz/animal.	
	Permethrin [1.0%]	Ready to use. Apply along back. Use 0.25 oz/50 lbs of body weight, up to 3 oz/animal.	
	Permethrin [1.0%] + Piperonyl Butoxide [1.0%]	Apply at rate of 0.25 oz/50 lb body weight up to a maximum dosage of 3 oz/animal.	
face flies, horn flies, lice, sheep keds	Permethrin [5%]	Apply 0.05 oz/50 lbs body weight, up to 0.61 ml/animal.	Repeat as needed, but not more than once every 2 weeks

Table 2.29 - Dust

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
lice, sheep keds, ticks	Zeta-Cypermethrin [0.075%] + Piperonyl Butoxide [0.15%]	Check label for specific application instructions.	Check label for precautions.

Scabies

Sheep scabies is a disease caused by mange mites. Virginia has been declared free of this disease for several years. Nevertheless, scabies may occur occasionally on sheep in areas that have been declared free of the disease. Scabies suspected on sheep in Virginia should be reported immediately to your county Extension office or to representatives of the State Veterinarian's office of the Virginia Department of Agriculture and Commerce, Richmond, Virginia. Inspection and diagnosis is a free service. If scabies is positively identified, the necessary treatment will be applied without charge by the Virginia Department of Agriculture and Consumer Services.

Horse External Parasites

Eric R. Day, Extension Entomologist, Virginia Tech

Research conducted in Virginia indicates that petroleum jelly applied in the ears of horses will provide up to 4 days protection from black flies.

Table 2.30 - Oral

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
bots	Ivermectin [1.87%]	Administer paste with single oral syringe at the dose rate of 91 mcg/lb. Each weight marking on the plunger delivers enough paste to treat 250 lb.	Refrain from smoking or eating when handling. Avoid contact with the eyes. Wash hands thoroughly after administration. Do not contaminate ground water. Swelling and itching reactions sometimes occur with severe infections. Consult a veterinarian if condition does not improve.
	Ivermectin [10 mg]	For liquid, 10 mg will treat a 1,100 lb horse. Read label for step-by-step instructions.	

Table 2.31 - Sprays and Wipe-ons

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
horn flies, lice, screwworms, ticks	Coumaphos [25%]	For horn flies and lice, mix 2 lb product in 100 gal water. To control ticks mix 4.0 lbs product in 100 gal water. To control screwworms mix 8.0 lbs product in 100 gal water.	Check label for precautions. Do not contaminate feed or water.
face flies, horn flies, house flies, stable flies	Fenvalerate [10%]	Mix 1.0 qt product in 25.0 gal water. Apply 8.0 oz as light spray with attention to head and legs. Repeat as necessary.	Do not treat animals intended for slaughter.
deer flies, horn flies, house flies, horse flies, mosquitoes	Tetrachlorvinphos [1%] + Pyrethrins [0.09%] + Piperonyl Butoxide [0.18%] + Repellent [0.8%]	No mixing is necessary. Available in ready-to-use form. Apply 1.0-2.0 oz/ animal as a wipe-on or spray to evenly cover the flanks, belly, and back of the horse or pony.	Do not allow product to come in contact with eyes. More frequent applications may be necessary if the legs are exposed to high grass and water. Do not treat slaughter animals. Repeat as necessary on perspiring animals.
face flies, house flies	Tetrachlorvinphos [1%] + Pyrethrins [0.09%] + Piperonyl Butoxide [0.18%] + Repellent [0.8%]	Apply 1.0-2.0 oz/animal as a wipe-on preferably to the head area. Pay particular attention to area around the nostrils and eyes.	Do not allow product to come in contact with eyes. Do not treat slaughter animals. Repeat as necessary on perspiring animals.

Table 2.31 - Sprays and Wipe-ons (cont.)

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
stable flies	Tetrachlorvinphos [1%] + Pyrethrins [0.09%] + Piperonyl Butoxide [0.18%] + Repellent [0.8%]	Apply 1.0-2.0 oz/animal as a wipe-on or spray to the legs and flanks, leaving no unprotected area. More frequent application may be necessary if the legs are exposed to high grass or water. Repeat as necessary on perspiring animals.	Do not allow product to come in contact with eyes.
biting gnats	Tetrachlorvinphos [1%] + Pyrethrins [0.09%] + Piperonyl Butoxide [0.18%] + Repellent [0.8%]	Apply 1.0-2.0 oz/animal as a wipe-on preferably to the head, neck, belly, and forelegs. Be sure to apply to the inside surfaces of the ears.	Check label for details. Do not allow product to come in contact with eyes. Repeat as necessary on perspiring animals.
horse flies, house flies, stable flies, face flies, horn flies, deer flies, gnats, mosquitoes, lice, deer ticks	Cypermethrin [0.15%] + Pyrethrins [0.2%] + Piperonyl Butoxide [1.6%] + Butoxypoly-propylene glycol [5%]	Shake well before using. Shampoo and rinse dirty horses thoroughly. Wait until coat is dry before applying. For horse's face, always apply as a wipe. Use clean, absorbent cloth, towel or sponge. Spray or wipe entire body while brushing against the lay of the coat. Apply liberally. Reapply every 5-7 days initially, then every 10-14 days, and reapply each time animal is washed or exposed to heavy rain.	Wear rubber gloves or mittens when applying as a wipe. Avoid getting spray in horses eyes, nose or mouth.
lice, stable flies, horn flies, face flies, deer flies, eye gnats, ticks	Permethrin [7.4%] + Piperonyl Butoxide [7.4%]	Can be applied topically to horses and their premises. Check label for specific application instructions	Check label for precautions.

Table 2.32 - Hand Dusting

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
horn flies, lice, ticks	Zeta-Cypermethrin [0.075%] + Piperonyl Butoxide [0.15%]	Check label for specific application instructions.	
horn flies, lice	Permethrin [0.25%] (horse lice duster)	Ready to use. Apply 2.0 oz dust per animal to the head, neck, shoulders, and back and tailhead.	Avoid getting dust in the animal's eyes. Wear face mask respirator when applying dust formulations.

Poultry External Parasites

Eric R. Day, Extension Entomologist, Virginia Tech

Table 2.33 - Caged Layer Treatments

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
northern fowl mite ¹	Permethrin [5.7%]	Mix 1 qt product in 25.0 gal of water. Apply 1.0 gal of diluted spray/100 birds. Be sure to treat vent area thoroughly.	Check label for precautions.
lice, mites	Tetrachlorvinphos [50%]	Mix 8.0 lb product in 100 gal of water. Apply at a rate of 1.0 gal solution/100 birds. Spray, vent, and fluff areas from below. Repeat when necessary. For northern fowl mite, use a power sprayer at 100-125 psi.	Do not repeat more often than once every 14 days. Treat roosters carefully and individually to avoid reinfestation of breeding flocks.
	Tetrachlorvinphos [23%] & Dichlorvos [5.3%]	Mix 1.0 gal product in 50.0 gal of water. Apply 1.0 gal of solution/100 birds under high pressure (no less than 100-125 psi) to the vent and fluff areas from below.	Repeat as needed but not more often than once every 14 days. Treat roosters carefully and individually to avoid reinfestation of breeding flocks.
lice, mites	Cumaphos	3.0-6.0 oz/5 gal of water.	3.0-oz rate for mites. 6.0-oz rate for lice.
	Sevin	Mix 4.0 oz/5 gal of water. Use 1 gal/100 birds.	See label.

¹This treatment will aid in the control of adult house flies.

Table 2.34 - Litter Treatment

Pests	Insecticide Active Ingredient [Percent A.I. in Product] (Trade Name)	Mixing and Application Information	Precautions
lice, mites (including northern fowl mite), litter beetles	Tetrachlorvinphos [50%]	Mix 4.0 lbs product in 50.0 gal of water. Apply 1.0-2.0 gal of spray/100 square feet. Can be used as a dry dust. Use 0.75 oz product/100 sq ft. Use a rotary, mechanical or electrostatic duster.	Wear a face mask when applying.
lice, mites	Sevin, Rabon	Follow label	Check label for precautions.

