Livestock and Livestock Building Pest Management
Bulletin 473

Authors
The Ohio State University Extension
William F. Lyon, Extension Entomologist
Extension Entomology Building
1991 Kenny Road
Columbus, Ohio 43210-1000
Phone: 614-292-5274
Fax: 614-292-9783
Email: Extento@postoffice.ag.ohio-state.edu

Contents
• Disclaimer
• Rinse 'Em Out
• Ohio's Restricted Pesticides
• Licensing
• Livestock Pesticide Poisoning
• Safety Tips for Using Pesticides
• Integrated Pest Management
• Insect Resistance
• Repellents
• Pesticides Arranged by Chemical Class or Family
• Control of Flies in Milkrooms
• When to Treat for Cattle Grubs
• When to Treat for Cattle Lice
• When to Treat for Horse Bots
• Encephalitis in Horses
• Control of Flies In and Around Livestock Buildings
• Sanitation
• Baits
• Odor-Baited Fly Traps
• Electrocuter Light Traps and Ultrasonic Devices
• Space or Aerosol Sprays (Mist Blowers or Foggers)
• Whitewash and Fly Control Together
• Feed Additives
• Boluses, Dust Bags, Backrubbers or Self-Oilers
• Manure Treatments
Residual Surface Sprays
• Rattailed Maggots (Syrphid Fly Larvae)
• Diatomaceous Earth
• Using Fly Parasites with Chemicals
  o Pests and Treatments for Lactating Dairy Cattle (PDF format)
  o Pests and Treatments for Beef Cattle and Non-Lactating Dairy Cattle (PDF format)
  o Pests and Treatments for Swine (PDF format)
  o Pests and Treatments for Sheep and Non-Lactating Goats (PDF format)
  o Pests and Treatments for Horses, Mules, Donkeys, and Ponies (PDF format)
• Poison Information Centers

Disclaimer
This publication contains pesticide recommendations that are subject to change at any time. These recommendations are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. Due to constantly changing labels and product registration, some of the recommendations given in this writing may no longer be legal by the time you read them. If any information in these recommendations disagrees with the label, the recommendation must be disregarded. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. The author and Ohio State University Extension assume no liability resulting from the use of these recommendations.

The pesticide user is always responsible for the effects of residues on his livestock and crops, as well as for problems arising from drift of pesticides from his property to that of others. For clarity, trade names have been included in some instances. This is not intended to discriminate against similar products not mentioned or to recommend only those mentioned.

Rinse 'Em Out
New hazardous waste regulations went into effect November 19, 1980. These regulations require that empty containers, which contained chemicals classified by EPA as hazardous waste, and waste pesticides be disposed of in a designated hazardous waste site, unless triple rinsing and other requirements are followed by commercial pesticide applicators. Farmers or private applicators are exempt from the new regulations, providing they follow the disposal instructions on the pesticide label when they dispose of waste pesticides and empty containers. Triple rinsing each emptied pesticide container, using the rinse in the tank mix whenever possible or disposing of the residue on the farm is required. Triple rinsed containers may be disposed of at a sanitary landfill.

Ohio's Restricted Pesticides
Under Ohio's Pesticide Use and Applicator Law, certain pesticides are restricted and can only be obtained and used by pesticide applicators and public operators licensed by the Ohio Department of Agriculture, and by those individuals who obtain a User's Permit from their Extension agent.

Certain restricted pesticides, when used, require that notification be given to occupants of lands within 1,000 feet of the boundaries of an open area or field to be treated at least 24 hours prior to the application. They should also be informed of the precautions necessary for safety of humans and animals.

Licensing
Any person who applies a pesticide on public property must be licensed by the Ohio Department of Agriculture. This is true even if the pesticide is not restricted. For application procedures and additional information, contact:
Livestock Pesticide Poisoning
Each year, many livestock (cattle, sheep, swine and horses) are killed from consumption of pesticide granules, wettable powders and dusts accidentally spilled on the ground or left on trucks and wagons. Animals may die after eating the pesticide alone or of accidentally mixed with silage, grains or feed off contaminated surfaces. Clean up spills and store pesticides safely in locked facilities.

Safety Tips for Using Pesticides The Label is the Law!
- Read the labels and follow directions and safety precautions. (Never use pesticides inconsistent with the label.)
- Record all pesticide usage including the common name, trade name, formulation, dilution, application rate and date of treatment.
- Use face masks or respirators and protective clothing during spraying. Avoid breathing spray mist or dust.
- If pesticides are spilled on the skin or clothing, wash thoroughly with soap and water and change clothes.
- Do not eat, drink or smoke when handling pesticides.
- Provide adequate ventilation when applying pesticides.
- To prevent illegal meat and milk residues and possible harm to the animal, never exceed label rates of application.
- Never apply pesticides closer to slaughter dates than the number of days listed on the label.
- Avoid drift to adjacent cropland, yards, wood lots, lakes or ponds. Some materials may injure and kill fish or wildlife and crops.
- Avoid treatment of animals that are sick, overheated or stressed from shipping, dehorning, castration, recent weaning, etc.
- Avoid contamination of feed, mangers, water, milk and milking equipment.
- Do not spread treated manure on cropland unless label approval.
- Store pesticides in the original, labeled containers, safely locked away from children, pets and livestock.
- Dispose of empty pesticide containers promptly and properly according to specified recommendations. Stay out of the smoke if containers are burned.
- Contact a physician at once in all cases of suspected poisoning. Symptoms of organic phosphate poisoning include blurred vision, abdominal cramps and tightness in the chest. Atropine is antidotal for some organophosphorus pesticides.

Acknowledgments
Contributions are greatly appreciated from individual members of Pesticide Companies for providing product labels and expert advice. Special thanks is given to Jeannette Janszen for her assistance in computer entry and editing, also to Jean Steva for her editing. Thanks to Dave Scardena for producing this publication and to Beneficial Insectory, Maurice Eastridge, and Communications and Technology for color photos on the cover.

Copyright © The Ohio State University 1995
**Integrated Pest Management**

Integrated Pest Management (IPM) is a systems approach that combines a wide array of livestock production practices with careful monitoring of pests and their natural enemies. Practices and methods often vary among types of livestock and among different regions of the country. In some regions, an increasingly used method is the introduction of wasp parasites for fly control in and around livestock buildings. In other areas, rotational grazing, livestock birth and market dates, breeding pest-tolerant animals, manure management and strict sanitation are used in combination with other methods to manage pests before they reach damaging levels. It is important to realize that insecticides will not work alone for pest control. They should be considered only as supplements, not replacements, for sanitation and sound IPM practices. Complete reliance on pesticides alone allows pests to become difficult to control since they usually develop resistance over time.

**Insect Resistance**

Insect resistance to insecticides is an increasing problem. It happens as individually resistant insects survive, breed and pass on their resistant genes to their offspring. (A population of insects becomes resistant over a period of several generations.) Resistance develops more quickly under heavy doses of insecticides or very frequent application. The type of insect pest makes a difference on how fast resistance can develop. With social insects, such as ants, resistance is seldom a problem since usually only the queen is reproductive. With nonsocial insects such as flies, each individual is reproductive and can allow resistance to develop more quickly. The time needed to become a reproductive adult also determines the development of resistance. The life cycle of the house fly is only 8 to 14 days compared to an ant of about 10 to 12 months.

Different classes of insecticides provide different ways for resistance development. (Insecticides are broken down in bodies of resistant insects). With carbamate and organophosphate insecticides, resistance occurs by one mechanism. With pyrethroid insecticides, three mechanisms of resistance have been identified, making resistance development more possible. Also, insect resistance to one insecticide can be cross-resistant to other insecticides of the same class or even of other insecticides having a similar mode of action. With pyrethroids, the mechanism of cross-resistance is complex, but common. While no resistance has been identified for insect growth regulators (IGRs), the potential exists. An ideal application will kill as many insects as possible, without underdosing or overdosing. THE ONLY PROVEN SOLUTION TO RESISTANCE PROBLEMS IS TO ROTATE THE USE OF DIFFERENT CLASSES OF INSECTICIDES.

**Pesticides Arranged by Chemical Class or Family**

*Pests are killed by different modes of action often according to Chemical Class. Pesticide rotations minimize problems of building up resistant pests.*

- CHLORINATED HYDROCARBONS- lindane, methoxychlor
- ORGANOPHOSPHATES- chlorpyrifos, coumaphos, diazinon, dichlorvos, dimethoate, dimethrin, naled, phosmet, pirimiphos- methyl, tetrachlorvinphos, trichlorfon
- CARBAMATES- methomyl
- PYRETHROIDS- cyfluthrin, cypermethrin, fenvalerate, lambda-cyhalothrin, permethrin, zetacypermethrin
- DIAMIDIDES- amitraz
- AVERMETINS - ivermectin
- INSECT JUVENILE HORMONE ANALOGS - methoprene
- SUBSTITUTED UREAS - diflubenzuron
- SYNERGISTS - piperonyl butoxide
- TRIAZINES - cyromazine
- BORATES - boric acid
- DIATOMS - diatomaceous Earth
- BOTANICALS - pyrethrins
Control of Flies in Milkrooms

Extremely small amounts of pesticides can be detected in milk, and their presence is often illegal. Check with sanitary codes (federal and state) regarding legality of a pesticide in the milkroom. It is illegal to use baits, residual surface sprays or space sprays other than those containing pyrethrins plus synergist or permethrin. For best fly control and to avoid illegal residues, use the following steps:

1. Reduce the number of flies entering the milkroom by practicing strict sanitation and use recommended insecticides in dairy barns and premises.
2. Make sure good, tight-fitting screens are on the milkroom doors and windows. Use screens, 14 to 16 meshes to the inch, made of copper, aluminum, bronze, plastic or rust-resisting materials. Keep spring-loaded doors shut at all times. Electric-powered "air-curtain" fans will discourage flies from entering doorways.
3. GardStar 40 percent EC Livestock and Premise Insecticide can be used as a 0.469 percent permethrin, water based, space spray when used as a fog or fine mist using 2.0 fluid ounces per 1,000 cubic feet. Use a mist or aerosol space spray of 0.06 to 0.1 percent pyrethrins plus piperonyl butoxide oil-based fly sprays when other methods fail to give adequate control. To prevent milk contamination, cover milk, milking utensils, cans, bulk tanks and containers before spraying. (Follow label directions and safety precautions.)
4. Use sticky fly strips where appropriate, such as Lure Fly ribbons, Fly Stik with Muscalure or aluminum foil sticky fly trap paper (fly illustrations on paper to attract other flies).

When to Treat for Cattle Grubs

Proper timing of treatment is important when using systemic grubicide pour-ons, spot-ons, or sprays on beef and non-lactating dairy cattle. Summer time treatments for cattle grubs usually provides two to three weeks of horn fly control. For most effective results, cattle should be treated as soon as possible after heel fly activity ceases, but at least six weeks before grubs appear in the back, i.e. from July to the first killing frost (October). In Ohio it may be best to treat after September 1 to avoid the risk of reinfestation. Do not treat after November 1 for cattle grubs. Do not treat on extremely hot days. Host-parasite reactions such as bloat, salivation, staggering and paralysis may sometimes occur when cattle are treated, especially in November and December when the common cattle grub, Hypoderma lineatum, is in the gullet, or when the northern cattle grub, H. bovis, is in the area of the spinal cord. Cattle should be treated either before or after these stages of grub development to prevent toxic reaction complications.

Safe and Effective Treatment Dates

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 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 organophosphate pour-ons & spot-ons and ivermectrin pour-on & injection for lice control on beef and non-lactating dairy cattle are convenient because Ohio winters are often very cold, preventing spraying or dipping. Grub treatment before Ohio's November 1 cutoff date will often not take care of cattle lice problems. Louse eggs are not susceptible to insecticides and therefore animals should be reexamined about three weeks after treatment to determine if viable lice eggs have hatched and reinfected the herd.

Do not use grubicides such as coumaphos (Co-Ral), famphur (Warbex), fenthion (Tiguvon), fenthion (Spotton), phosmet (Prolate, GX-118) or trichlorfon (Neguvon) during November and December on Ohio cattle not previously treated for grubs due to possible host-parasite reaction. After January 1, grub larvae have migrated from the spinal canal, or esophagus, and usually encyst in the back and cattle may then be safely treated 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.

There are spot-ons and pour-ons such as cyfluthrin (Cylence), fenthion (Lysoff, Lice-Chek), ivermectin (Ivomec), lambdacyhalothrin (Saber), and permethrin (Brute, Delice, Expar, Hard-Hitter, Permectrin) registered for lice control and applied any time throughout the autumn and winter months because they do not kill grubs. However, fenthion has a warning of rare (but possible) host parasite reactions. Be sure to follow instructions on the label for any safety precautions.

**When to Treat for Horse Bots**

Traditionally, the most effective treatments for the control of horse bots have been applied at least 30 days after the first killing frost. Some authorities believe a second midwinter treatment is needed to "clean" the animal from bots possibly missed earlier. (Your veterinarian can best advise you on a workable program to fit your circumstances.)

Bots, not true worms, are the larval stage of bot flies. Bot flies are active from midsummer until the first killing frost. Adult bot flies, resembling honey bees in appearance, may cause animals to instinctively fear them. Females, unable to feed or bite, lay 150 to 300 eggs in a life span of 7 to 10 days. Eggs (pale yellow, pinhead sized) are deposited on the forelegs, chest, neck, belly, and occasionally flanks or hind legs of the animal. Eggs accumulate until adults are killed by frost and can remain viable for several months. Eggs incubate in 1 to 2 weeks and hatch only if licked or eaten.

Sponging the animal with warm water (104 deg F to 120 deg F) on cool days (less than 60 deg F) will cause eggs to hatch and then die of exposure. (Firm rubbing is important.) Also, clipping hairs infested with bot eggs will aid in control. Some states recommend coumaphos (Co-Ral) 0.06 percent or tetrachlorvinphos (Rabon) 6.5 percent warm water solution to be sponged on the animal. (Use rubber gloves during applications and follow label directions and safety precautions.)

Currently available commercial products are very effective for control of bots. The use of sponging or mechanical/clipping removal of bot eggs should be viewed only as a supplement to your bot control program.
**Encephalitis in Horses**

Encephalitis is a virus disease affecting horses, mules, donkeys and humans. It is usually transmitted by the bite of mosquitoes but possibly by other insects. In horses, the central nervous system is affected, often resulting in high death losses, whereas in humans the infection usually produces a mild to severe respiratory illness.

Signs of encephalitis in horses include a rapid rise in body temperature, up to 106 deg F, with rapid pulse, loss of appetite and depression. The animal displays a "drifting gait." It may hang its head, appear drowsy, press its head against objects and assume a cross-legged stance. Commonly, the animal may circle continuously until prostrated with death occurring in six to eight days.

For suspected cases of encephalitis, contact your local practicing veterinarian, who will draw blood samples in order that the Ohio Department of Health can analyze for this disease. Do not wait until the animal dies before action is taken.

Consult your veterinarian regarding an equine vaccination program for protection against encephalitis.

**Control of Flies In and Around Livestock Buildings**

Good sanitation is the basis for all fly control programs. Sanitation is at least 75 percent of the fly control program preventing fly breeding. Nevertheless, it is often necessary to supplement sanitation practices with pesticides.

For successful fly control, organize a control program that best fits your farm. A single pesticidal product rarely gives the most effective and economical control. It is normally best to use a combination of pesticide applications such as residual wall sprays, space or aerosol sprays, baits, etc. during the fly season. Because fly resistance is always a possibility, it is best to rotate different chemical class insecticides, especially when one group begins to lose its effectiveness. One may alternate synthetic pyrethroids such as permethrin or fenvalerate to organophosphates such as tetrachlorvinphos, dimethoate or fenthion to insect growth regulators (IGRs). Do not wait for heavy fly populations. It is much easier and less expensive to prevent heavy fly buildup than to control heavy fly populations after buildup. As fly populations begin to buildup, take time and treat regularly.

**Sanitation**

(a) Remove all manure from livestock pens as frequently as possible. Calf and bull pens with animals in them require special attention. It is best to clean these pens once a week. Using sawdust instead of other materials for animal bedding reduces fly development. A clean livestock barn has fewer fly problems.

(b) Spread the manure thinly outdoors in order that fly eggs and larvae will be killed by drying, or stack this waste and cover with a black, plastic tarp.

(c) Eliminate silage seepage areas, wet litter, manure stacks, old wet hay or straw bales and other organic matter accumulations that may attract flies anywhere on the farm. Wet feed remaining at the ends of mangers will breed flies.

(d) Provide proper drainage in barnyards. Use clean gravel and other fill to eliminate low spots in livestock yards. Proper grading and tiling can reduce wet barnyards. Keep water troughs and hydrants leak-free.

**Baits**

Fly resistance to certain chemical sprays means more reliance on baits or space sprays of other chemical classes. Although fresh bait will help control flies, results may be poor if fly breeding is excessive. Apply baits (moist)
after floor litter and manure have been removed. Use baits liberally for best control. Apply a minimum of 4 ounces of bait per 1,000 square feet of floor area. Increase amounts when flies are breeding prolifically. Some insecticide formulations used in residual surface sprays have label directions for mixing a sweetener (sugar, molasses or corn syrup) to make your own fly baits or bait sprays. (Follow label directions and safety precautions.) Most commercially packaged baits include sugar and a nonfood fly aggregate attractant called Muscalure (Fly Stik, Muscamone). Baits are most effective when used in conjunction with other control measures. However, do not apply baits where livestock, poultry, dogs, cats, wildlife, birds or children may eat them. Do not contaminate feed or water.

(a) diazinon (Dryzon). Mix one half pound 50 percent WP with one pound sugar (two cups of syrup or molasses) in 2.5 gallons of water and spot treat areas frequented by flies including cracks, crevices, doorways around windows or other areas where flies congregate.

(b) methomyl (Stimukil, Apache, Improved Golden Malrin, Fatal Attraction, Fly Bait Plus, Tail Spin, Fly Patrol) 1 percent Dry Bait kills by contact and/or ingestion.

(c) trichlorfon (Dipterex) one percent Dry Bait kills by contact and/or ingestion.

These commercial "ready-to-use" dry sugar baits can be scattered in areas where flies congregate or applied in empty gallon plastic jugs with four two one-inch-diameter holes cut around the top to hold the bait (one to two ounces per jug). Hang jugs from ceiling by wire. Pour out dead flies and replace bait weekly.

**Odor-Baited Fly Traps**

Commercial fly traps, using feeding and sex attractants or homemade fly traps using decaying meat or other foods, will capture large quantities of adult flies. However, these fly traps are limited in their usefulness and, when used alone, are not an effective method of controlling flies outside in livestock feedlots and premises over wide areas. Such traps sold commercially include Final Flight, Apache, Magnum, Big Stinky, Fly Terminator and others. Some Fly Relief Disposable Fly traps require additions of water only. Commercial traps usually consist of a 1 to 2-1/2 gallon break-resistant, plastic jug with a one-way giant-size baffle on top of the screw-type cap or lid for easy opening and closing. Some have a bright yellow top above the baffle as a visual fly attractant. A four ounce bottle of attractant is sufficient for two baittings in the Magnum Fly Trap or four batings in the Fly Terminator trap. Some producers report success around calf pens and building perimeters when several traps are used collectively. In spite of enormous numbers of flies trapped, usually fly populations at the livestock facilities are not significantly reduced. Attractant traps placed between livestock housing and surrounding residences help reduce migration of flies to the residences. Many flies are trapped and even more remain in the area of the trap rather than continuing on to residences.

**Electrocuter Light Traps and Ultrasonic Devices**

Many types and styles of fly and mosquito traps appear and are sold on the market each year. Some traps employ ultraviolet energy (black light) with an electrically charged grid to kill insects. These electrical fly and mosquito "zappers," when frying insects on the grid, can result in rather high electrical costs. Many kinds of insects, both harmful and beneficial, are attracted and killed that normally would fly out of the area if no light trap was present. One should judge a trap by the population of flies and mosquitoes remaining in the area and not by the amount caught. These traps should never be placed in doorways, windows, loading docks or other areas where concentrating these insects can become a nuisance. These traps may be helpful in small, tight, enclosed areas, especially indoors such as egg rooms, corners and stairwells where good sanitation practices are followed. However, outdoors in feedlots, open-air sheds, barns and other livestock buildings, and in areas of heavy insect and mosquito populations, traps are not effective in reducing numbers to satisfactory
levels. These traps are more of an insect survey or monitoring tool than a control device. When used alone, they are not effective in and around livestock operations.

Also, strategically placed outdoor lighting can concentrate unwanted insects elsewhere. Mercury vapor lamps 150 to 200 feet away from buildings can divert nuisance insects away from high-traffic areas. By replacing a 100-watt mercury vapor light (ultraviolet energy) with a 50-watt high pressure sodium vapor light, insect concentrations are effectively reduced.

Ultrasonic pest repellers are worthless in controlling insects. These devices generate ultrahigh frequency sound waves (ultra sound) that is claimed to be disruptive to the living, mating and survival of pests. Research indicates that this sound, inaudible to the human ear and most insects, will not penetrate walls. In fact, the sound is high only at the source of output, falling off sharply beyond 15 feet and gone completely in 30 feet. Some studies have revealed that mosquitoes bite more frequently when the machine was turned on than when it was turned off. There is no difference in pest movement whether the machine is plugged in or unplugged from an electric source. Also, many insects cannot even hear the sound.

**Space or Aerosol Sprays (Mist Blowers or Foggers)**

Space sprays or aerosols can be effective for rapid knockdown and kill of adult flies present during the application. Daily use of mist blowers or foggers may be necessary when used as the sole treatment. However, this will then quickly lead to resistance. For best control results, reduce air movement as much as possible by closing doors and windows. Animals may be present (only if product is so labeled) during application, but not directly treated. If animals were treated directly with a pesticide 24 hours earlier, do not treat. Avoid contamination of feed, water, milk, and milk utensils or use in milkrooms (except certain pyrethrins and permethrin labeled products).

(a) Mix one quart of naled (Dibrom) 36 percent EC in 40 gallons of water. Apply throughout the building. Mix five pints Dibrom 58 percent EC in 200 gallons of water. Apply five gallons prepared spray per acre of premise. Apply one fluid ounce of naled (Dibrom) one percent ready-to-use formulation per 3,000 cubic feet of area. Spray around and above animals, but not directly at them.

(b) Mix one quart permethrin (Ectiban, Hard Hitter) 5.7 percent EC in 12.5 gallons of fuel or mineral oil "overhead system" or undiluted "misting" at the rate of four fluid ounces per 1,000 cubic feet.

Mix four fluid ounces permethrin (GardStar) 40 percent EC to 10 gallons mineral oil for "overhead system." Apply four fluid ounces of spray per 1,000 cubic feet of air (do not use in milkroom). Mix one half fluid ounces to one gallon of water. Apply as a fog or fine mist using two fluid ounces per 1,000 cubic feet of air (can be used in milkroom).

Mix one quart permethrin (Permectrin II) 10 percent EC in 12.5 gallons of fuel or mineral oil "overhead system" or undiluted "misting" at the rate of four fluid ounces per 1,000 cubic feet.

(c) Apply one to two fluid ounces of pyrethrins and synergist 0.1 percent to 0.2 percent ready-to-use formulation per 1,000 square feet of area. Apply as a fog at the rate of five to six seconds per 1,000 cubic feet when adult flies are present. Keep room closed 15 minutes following application.

To reduce possible fly resistance, alternate applications of pyrethroids (permethrin) and organophosphates (naled) throughout the season.
**Whitewash and Fly Control Together**

Never mix insecticides in ordinary lime whitewash. Lime whitewashes are very alkaline and cause insecticides to become ineffective in controlling insects. There are non-alkaline whitening agents available that may be used with insecticides. Check with your milk inspector or dairy association for a supply source.

**Feed Additives**

Certain states do not recommend the use of oral larvicides or insecticides given through the feed such as tetrachlorvinphos (Rabon), methoprene (Altosid, Moorman's IGR) and phenothiazine. These feed additives often are not the answer to fly control unless used very extensively. All feces must be treated within an area in order to effectively reduce the fly population on the livestock. The area must usually be many miles across because flies do move very readily from herd to herd over an area of several miles within a day or two. This treatment is usually more effective against the horn fly than for the face fly. We have had little success in controlling the face fly by this method. Feed additives do not control house fly and stable fly larvae that develop in sites other than fresh manure.

Oral larvicides, when fed, prevent the development of flies in the manure. They are not effective against existing adult flies. These oral larvicides should be used in conjunction with good manure sanitation. Supplemental fly control is needed where flies breed in manure from untreated animals such as indoor penned young stock or other organic sources.

Rabon 7.76 percent oral larvicide is fed at the rate of 70 mg/100 lbs. body weight (dairy cattle and beef cattle per day) as a premix, loose mineral or block from May through September. Animals must consume the recommended dosage for the feed additive to be effective. This method provides reduction of fly larval development only in manure from treated animals. Follow label directions and precautions.

**Boluses, Dust Bags, Backrubbers or Self-Oilers**

See appropriate recommendations in the following tables.

**Manure Treatments**

Manure treatment (larviciding), applied directly to the manure surface to control fly maggots, is discouraged because beneficial arthropods associated with the manure can be killed. Also, adding extra moisture to the manure can result in additional fly breeding with potential fly resistance increased. (Effort should be made to keep all manure as dry as possible, less than a 30 percent moisture level, to greatly reduce or halt fly breeding.) However, if manure cannot be kept dry or removed on a weekly basis, it is possible to use manure sprays.

(a) dimethoate (Cygon): Mix one half pint of Cygon 23.4 percent EC in five quarts of water. Apply finished spray as a coarse spray.

(b) tetrachlorvinphos (Rabon): Mix four pounds of Rabon 50 percent WP in 25 gallons of water. Apply one gallon of finished spray per 100 square feet of manure.

(c) tetrachlorvinphos and dichlorvos (Ravap): Mix one gallon Ravap 28.7 percent EC per 25 gallons of water. Apply one gallon of finished spray per 100 square feet of manure.

Use a hoe or trowel to sample the larvae present in the manure before treatment. Any "hot spots," where water has laid in the manure and containing many fly eggs and maggots, can be spot treated with a low pressure knapsack sprayer or sprinkling can. Apply to wet the manure surface (not soak), and repeat applications as necessary but not more often than once every seven days. Avoid widespread use of manure sprays. Treating the
edges of stacked manure before covering it with plastic can be helpful. Do not apply where animals or birds will come in contact with the manure. Do not apply treated manure to crops not approved on the insecticide label.

**Residual Surface Sprays**

Residual sprays applied to walls, ceilings, partitions, stanchions, posts and other fly resting places are still the "mainstay" of fly control on livestock farms. These sprays are much more effective in stanchion barns than in loose-housing management where surfaces on which flies alight are minimal and buildings are very open. 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 to 100 pounds per square inch using a power sprayer or good proportioned type sprayer. Avoid contamination of feed and water. Cover drinking cups and mangers during spraying. Never spray in the milk house. Do not contaminate milk and milk utensils. Follow label directions.

(a) cyfluthrin-use 19 grams Tempo 20 percent WP per 1,000 square feet as a general surface spray in sufficient water to adequately cover the area being treated (normally two gallons), but which will not allow dripping or runoff to occur. Remove animals before spraying. Keep all animals out of treated buildings for at least four hours.

(b) diazinon-mix one half pound Dryzon 50 percent WP in 6.25 gallons of water. Apply one gallon per 350 to 750 square feet of area, depending on the surface treated, as an overall spray to ceilings and walls of barns and animal sleeping quarters (except dairy barns, milkrooms and poultry houses). Longer residual control may be obtained by increasing the rate to 1 pound per 6.25 gallons of water.

(c) dimethoate-mix one gallon Cygon 23.4 percent EC per 25 gallons of water. Apply one to two gallons of finished spray per 1,000 square feet of interior and exterior surfaces. Remove animals before spraying. Keep animals out of treated buildings for at least four hours.

(d) fenvalerate-mix one quart Ectrin 10 percent WDL in 10 gallons of water. Remove animals before spraying. Do not contaminate feed or water.

(e) lambdacyhalothrin-mix one water soluble packet Grenade 10% WP in sufficient water (see label). For use in dairy barns, poultry buildings, swine buildings, animal hospital pens and dog kennels. Reapply at 21 day intervals if necessary.

(f) methoxychlor-mix one pound Marlate 50 percent WP in 2.5 gallons. Apply one gallon of finished spray per 500 square feet of surface. Dairy animals should not be present while spraying. Do not use in poultry houses.

(g) permethrin-mix 6.67 ounces Atroban or Permaban 25 percent WP per 10 gallons of water. Mix six ounces Ectiban or Insectrin 25 percent WP per 11 gallons of water. Apply one gallon of finished spray per 750 square feet of surface as a coarse, wet spray.

- permethrin-mix one quart Ectiban, Hard Hitter, Insectrin 5.7 percent EC per 12.5 gallons of water. Apply one gallon of finished spray per 750 square feet of surface as a coarse, wet spray.

- permethrin-mix four fluid ounces GardStar 40 percent EC to 10 gallons of water. Spray surface until wet or 1 gallon per 750 to 1,000 square feet.
- permethrin-mix one quart Permectrin II 10 percent EC per 25 gallons of water. Apply one gallon of finished spray per 750 square feet of surface as a coarse, wet spray.

- permethrin-mix one pint Atroban, Expar or Permaban 11 percent EC to 10 gallons of water. Apply finished spray to surfaces where flies rest at the rate of one gallon per 750 to 1,000 square feet or to the point of runoff. Do not apply more often than once every two weeks.

(h) tetrachlorvinphos-mix four to eight pounds Rabon 50 percent WP per 25 gallons of water. Apply one gallon of finished spray per 500 to 1,000 square feet of surface to the point of runoff. Keep all animals out of treated building for at least four hours.

(i) tetrachlorvinphos and dichlorvos-mix one gallon Ravap 28.3 percent EC per 25 gallons of water. Apply one gallon of finished spray per 500 to 1,000 square feet of walls, ceilings or other areas where flies rest or congregate. Keep all animals out of treated buildings for at least four hours.

(j) Trichlorfon - Mix 3 pounds of Dipterex 80 SP in 24 gallons of water. Apply one gallon of finished spray per 500 square feet, or to the point of runoff (for use in dairy and cattle barns and poultry houses.) Remove animals from facility before making applications. Allow spray to dry before re-stocking facility. Do not contaminate feed, water, feed handling equipment or milk handling equipment. Repeat applications every one to two weeks or as needed.

**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 creatures are not a problem as long as they remain in the liquid manure pit. However, they are known to move out of the pit, or lagoon, in large numbers, contaminating livestock feed, accumulating in electrical boxes and causing short circuits and congregating in stacks of egg cartons and other unwanted places. The maggots migrate to a drier place for pupation.

Rattailed maggots, known as the larval or immature stage of Syrphid flies, are about 1-1/4 inches long. The body portion is about three fourth inch long and the tail portion (breathing tube) one half inch long. These maggots are white-colored with the body portion an elongated, oval, cylindrical shape, which is wrinkled and semitransparent, protracting into a long breathing tube (tail).

These larvae of the Syrphid fly live in highly polluted water such as livestock lagoons, polluted abandoned fish pools, foul pools and streams associated with barnyards, etc. Maggots are able to live in the water, if sufficient solids are present as food. The adult flies resemble honey bees in appearance and are often seen "hovering" near the ground in the barnyard vicinity. These flies do not bite or sting humans, and are considered beneficial because they are predaceous on aphids, etc.

**Control Measures of Rattailed Maggots**

Non-chemical treatment—Since this maggot breeds and feeds in highly polluted water, effort must be made to keep the lagoon in the optimum condition, promoting a more nearly ideal anaerobic condition. Usually the lagoon becomes "out-of-balance" with the water level 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 enhance fly development. Keep the banks steep and 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 practical.

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 presently very concerned with runoff and overflow 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.

Chemical treatment—Unfortunately, there are no good pesticide control measures. There has been some success by layering either Ravap or Larvadex larvicide on the liquid and manure surface in the pits. Mix one pint of Ravap 23.0 percent per 3.5 gallons of fuel oil. Apply one gallon of prepared spray solution per 100 square feet of manure pit surface. Repeat as needed, but not more often than once every seven to ten days. Also, one can mix one quart of cyromazine (Larvadex) five percent SC per 25 gallons of water and apply one half to one gallon of prepared spray per 100 square feet of pit surface. (Do not agitate the pit contents after application for best results.) The pesticide in the fuel oil will clog up the long breathing tube of the rattailed maggot in the manure pit similar to oils applied to the surface of stagnant, non-moving water to kill mosquito larvae.

**Diatomaceous Earth**
No reliable scientific data exists that supports the claim of using diatomaceous earth (DE) as a feed additive to control livestock flies.

Diatomaceous earth is comprised of the mineralized "shells" of one-cell aquatic plants called diatoms. Over millions of years, these diatoms died and settled to the bottoms of bodies of water. Now, these diatom "skeletons" are mined or dug to yield diatomaceous earth.

An insect's body covering, the cuticle, contains fat layers making the cuticle nearly waterproof and preventing water loss. It is known that sorptive dusts absorb fats, disrupting the cuticle's waterproof nature. Abrasive dusts damage the insect's water barrier by actually scratching or cutting the cuticle, resulting in "dehydration," usually causing the insect's death. The most effective sorptive dusts have been the silica aerogels (ammonium fluosilicate) and acid-activated clay. Dri-die, a silica aerogel, has been used in urban pest control against ants, roaches and stored grain pests with some success. However, DE is far less sorptive than the silica aerogel with its effectiveness primarily from abrasiveness.

Although DE is labelled as a livestock feed-through for fly control, there is no scientific data to support efficacy regarding control of internal parasites and specifically fly larvae in animal manure. Nevertheless, adult horn flies and face flies could move in from surrounding untreated herds and wild animals. DE may control some of the ectoparasitic lice, fleas and some mites if applied thoroughly and repeatedly.

**Using Fly Parasites with Chemicals**
Although fly parasites are an integral part of a good Integrated Pest Management (IPM) program, insecticides will still play a role in your control program. Insecticide use should be restrained.

Fly parasites are tiny wasps that kill fly pupae. They attack only fly pupae in manure and are so small (similar in size to gnats) they go unnoticed by humans and livestock. Farmers make frequent releases of small numbers of these beneficial wasps to augment their existing populations of beneficials. The wasp females seek out fly pupae, kill them, and then lay eggs within the dead pupae. These eggs hatch and mature into a new generation
of beneficial parasitic wasps. Fly parasites are useful for the control of house flies, stable flies, blowflies, and many other fly species. They cannot sting nor bite humans or animals.

**Adulticides**

**Natural Pyrethrins**
Natural pyrethrins should be used as a "knockdown" spray. They have no residual effect and are an excellent tool in killing adult flies. If you have a serious adult fly problem now, it is recommended that you use natural pyrethrins to get the adult population under control before introducing fly parasites.

**Synthetic Pyrethroids**
Synthetic pyrethroids have a residual kill of up to two weeks or more and can be used to treat areas where adult flies roost, such as walls and columns. They should not be used as a fog or mist nor applied to manure. Permethrin is highly toxic to parasites and should be used with caution.

**Baits**
Baits such as methomyl or trichlorfon can be used to control migrating adult flies. They work by attracting the adult fly and kill it when ingested. Care should be taken when using adulticides. Avoid overuse or resistance may develop. Also, remember that these pesticides will kill fly parasites as well. Use these pesticides wisely and sparingly.

**Larvicides**
Larvicide use should also be limited. Again, most larvicides will kill beneficial insects as well. However, if you have a "hot spot" of heavy fly larvae, larvicides can be used without inflicting much damage on the overall beneficial insect population. Insect Growth Regulator (IGR), such as cyromazine (Larvadex), approved for poultry operations does not affect beneficial insects. It only kills the fly larvae. This is the only larvicide that does not harm beneficial insects and can safely be applied to the breeding site without fear of destroying the beneficial insect populations.

**Manure Management**
In the summer, the fly life-cycle takes about two weeks: one week for the larvae to develop, and one week to pupate before emerging as new adults. On many dairy farms, calf bedding is a major fly breeding site. Weekly removal and spreading of manure disrupts the fly life-cycle, and prevents new adults from emerging in and around the barn. Removing the manure also helps the parasitic wasps, which find fly pupae more easily if the depth of the manure is relatively shallow. Leaving some surface manure behind when you clean out will keep the new generation of wasps in the barn.

**Other breeding sites**
Any accumulation of wet feed or bedding is a potential fly breeding site, and should be removed weekly.

**Traps**
Sticky paper, tapes, or ribbons and bait traps will help reduce the adult fly population without hurting the natural enemies.

**Advantages**
Advantages of fly parasites are ease of application, reduces the need for chemical pesticides, prevents buildup of resistance to chemical pesticides, prevents immature flies from maturing to adult flies and is cost-effective. With application, there is no equipment, no mixing, no feed additives. Simply sprinkle them out of the bag onto the manure or staple to posts or rafters near areas where fly breeding is a problem.
**Costs**
Parasite release costs are usually offset by reduction in insecticide treatments. In research trials, dairy farmers using fly parasites have made as much as 80 percent fewer insecticide treatments with 50 percent lower fly populations than on conventional insecticide control farms. There is still much to learn on using fly parasites most effectively in fly management programs.

Prices vary from company to company on fly parasite purchase prices. Approximate costs are as follows:

<table>
<thead>
<tr>
<th>Number of Pupae per shipment</th>
<th>Price</th>
<th>Shipping and Handling</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000</td>
<td>$8.00</td>
<td>$4.60</td>
</tr>
<tr>
<td>10,000</td>
<td>13.00</td>
<td>4.60</td>
</tr>
</tbody>
</table>

**Multiple Colony Shipments**
<table>
<thead>
<tr>
<th>Number of Colonies</th>
<th>Price</th>
<th>Shipping and Handling</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-5</td>
<td>$13.00</td>
<td>4.75</td>
</tr>
<tr>
<td>6-9</td>
<td>11.50</td>
<td>5.25</td>
</tr>
<tr>
<td>10-19</td>
<td>11.50</td>
<td>6.00</td>
</tr>
<tr>
<td>20+</td>
<td>9.75</td>
<td>6.50</td>
</tr>
</tbody>
</table>

**Multiple Releases**
Flies have the ability to produce more eggs, produce a new generation in a much shorter period of time and travel much greater distances than fly parasites. Consequently, it is best to release small amounts of fly parasites throughout the fly season rather than just one large release. Make weekly releases of 250 wasps per animal from mid to late May to August or September. (Some release 200 parasites per milking cow or 1,000 parasites per calf). However, each farm is different. Commercial farms that generate large quantities of manure should import fresh parasites weekly. For small farms, choose a biweekly, triweekly or monthly schedule.

Many companies who sell parasites advertise their products in farm magazines, but not all of them sell the right species adapted for the Ohio climate. Dairy farmers should purchase *Muscidifurax raptor* and avoid *Nasonia vitripennis*. Existing data indicates that in the Midwest the recommended species are as follows:

<table>
<thead>
<tr>
<th>Fly Parasite Species</th>
<th>Flies Attacked</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Muscidifurax raptor</em></td>
<td>House and Stable Fly pupae</td>
</tr>
</tbody>
</table>

**Comments**
An outdoor species that also works indoors. *M. raptor* prefers dry, dark habitats and is active almost year-round, preferring cool temperatures and readily reproducing on late-season freeze-killed fly pupae. It has the potential to parasitize 20 fly pupae per day for one to four weeks. Early season inundatives releases have been helpful against house flies. *M. raptor* populations increase in late September and October when temperatures drop.

**Spalangia nigroaena**
Stable Fly pupae preferred. Also attacks house fly, horn fly, little house fly, dump fly, false stable fly, etc.
Comments
Works well against both stable flies and house flies. *S. nigroaenea* digs deep into manure where stable fly pupae are found. (*Muscidifurax* stays nearer the surface where house fly pupae are more commonly found.) Populations peak in summer, often July and August when fly populations peak.

<table>
<thead>
<tr>
<th><em>Muscidifurax zaraptor</em></th>
<th>House Fly pupae preferred.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Also attacks Stable Flies.</td>
</tr>
</tbody>
</table>

Comments
Often the dominant parasitoid species in Midwest feedlots. Considered best against house fly pupae. Early season spring releases show promise. *M. zaraptor* moves out evenly from release sites killing off concentrated house fly populations within 50 feet of release sites.

For additional information, contact:

**Beneficial Insectory**
14751 Oak Run Road
Oak Run, CA 96069
Telephone: 800-477-3715
916-472-3715

**IPM Laboratories, Inc.**
Main Street
Locke, NY 13092-0300
Telephone: 315-497-2063
Fax: 315-497-3129

**Fly Pro**
Box 7
Kendall, KS 67857
(produces stable fly parasites, *Spalangis nigroaena*)