1980

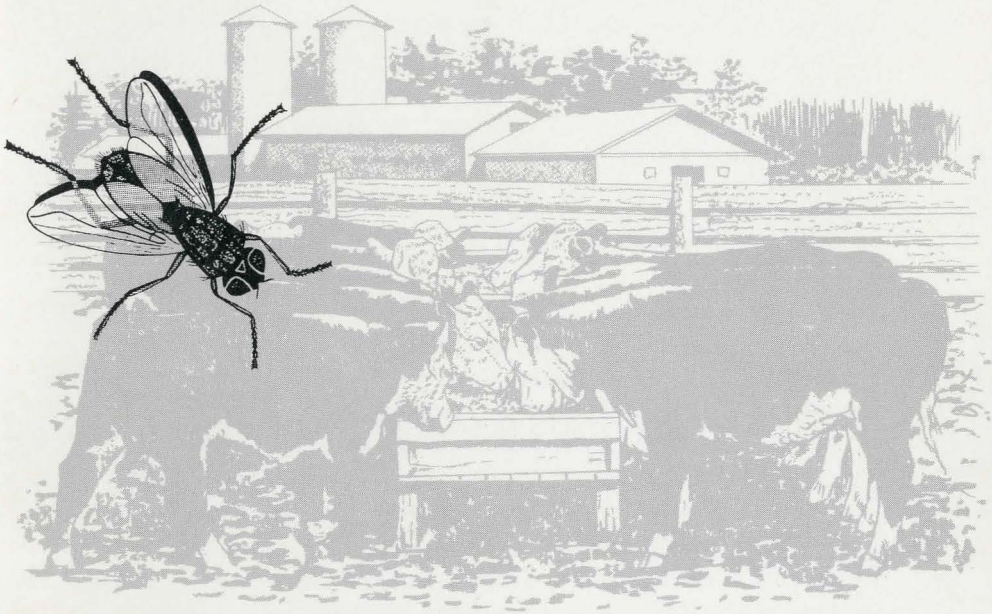
# EC80-1536 A Guide to Integrated Pest Management at Feedlots and Dairies

J. B. Campbell

C. D. McNeal

EC 80-1536

# A Guide to Integrated Pest Management



# at Feedlots and Dairies

Extension work in "Agriculture, Home Economics and subjects relating thereto," The Cooperative Extension Service, Institute of Agriculture and Natural Resources, University of Nebraska–Lincoln, Cooperating with the Counties and the U.S. Department of Agriculture
Leo E. Lucas, Director

## *Acknowledgments*

The authors gratefully acknowledge the following persons for their contributions during the preparation of this guide:

Charlene Warneke, secretary, North Platte Station, IANR, University of Nebraska, for photography, layout, typing and other valuable general assistance.

DeLores Clouse, Professor, Agricultural Communications, IANR University of Nebraska, Lincoln, NE for cover design.

Dr. Ed Loomis, Extension Parasitologist, University of California, Davis, CA, Dr. Walter Gojmerac, Extension Entomologist, University of Wisconsin, Madison, WI, and Dr. Ivan Berry, Research Agriculture Engineer, Research Leader, Livestock Insect Research Unit, USDA-SEA, AR, Lincoln, NE for a comprehensive review and valuable content suggestions.

Major funding for this guide was a grant from the USDA SEA Extension Service with support funds from IANR, University of Nebraska.

Administrative liaison officers include:

Dr. Joe Good, Director, Pest Management Programs, USDA-SEA Extension Service, Washington, D.C.

Dr. Paul Bergman, Feedlot Pest Management Liaison Officer, Extension Entomologist, USDA SEA Extension Service, Washington, D.C.

Dr. Roger Gold, Coordinator, Environmental Programs, IANR University of Nebraska, Lincoln, NE.

# A Guide To Integrated Pest Management At Feedlots And Dairies

**J. B. Campbell[1] and C. D. McNeal[2]**

## *Introduction*

Integrated Pest Management (IPM) is rather new terminology used to describe the old art of keeping pest infestations below economic levels by utilizing a combination of control methodologies.

This guide has been prepared to assist feedlot and dairy operators and consultants in an integrated approach to the management of pests. It is our purpose to outline a combination of sanitation, chemical methods and cultural control of stable flies, house flies and—to a much lesser extent—rats and starlings. The guide may also be useful to entomology and animal science students and county agents.

## Stable fly, *Stomoxys calcitrans* (L.)

The stable fly (Fig. 1) has several common names including "the biting house fly" and the "dog fly." It is about ¼ inch long, is dark gray and the abdomen has a series of dark irregular spots on it. The proboscis (mouthparts) protrude bayonet-like in front of the head. The larvae are typical whitish fly maggots. The pupae (stage of change from maggot to adult) is chestnut-brown and ¼ inch long.

[1]Research and Extension Entomologist, University of Nebraska North Platte Station, North Platte, NE 69101

[2]Cooperative Extension Service, Twin Falls, ID 83301

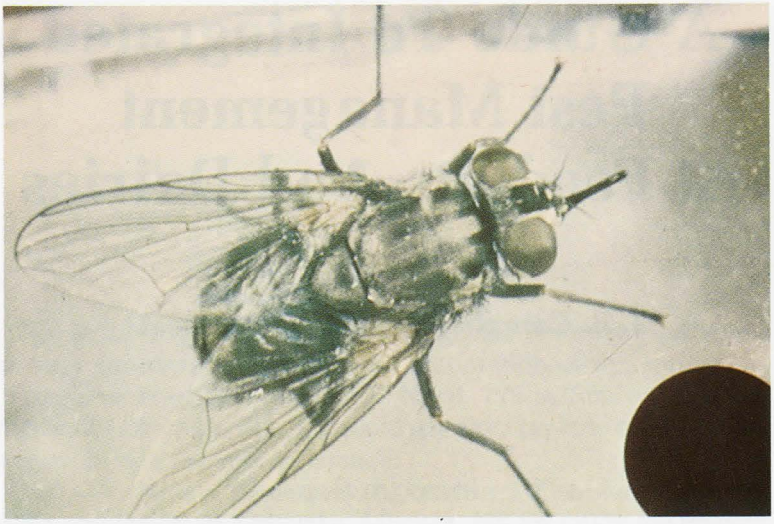


*Fig. 1.—Stable fly*

## *Life Cycle*

The life cycle of this fly from egg to adult is about 24 days in the summer. The female fly deposits eggs in fermenting organic matter mixed with animal manure, dirt and moisture. Females live about 25 days and deposit 200-600 eggs during their lifetime. In warm geographical areas, the life cycle may be continuous; while, in colder areas, they overwinter as larvae and/or pupae.

## *Economic Importance*

Data in the literature (although somewhat conflicting) would suggest that, in the geographical range of the stable fly, it is the most important pest of feedlot and dairy cattle. The fly feeds by inserting its mouthpart into the skin of an animal, primarily on the lower front legs, and sucking blood. The flies stay on the animal until engorged then seek a shaded area to rest and digest the meal.

The bite of the fly is painful—causing cattle bothered by flies to bunch (each animal trying to keep their front legs in the circle of animals for protection). Reactions of cattle to heavy fly populations include stamping, head-throwing and tail switching in attempts to dislodge the flies (Fig. 2). Dense fly populations cause cattle to go off feed and the bunching increases animal danger when the weather safety index (hot,

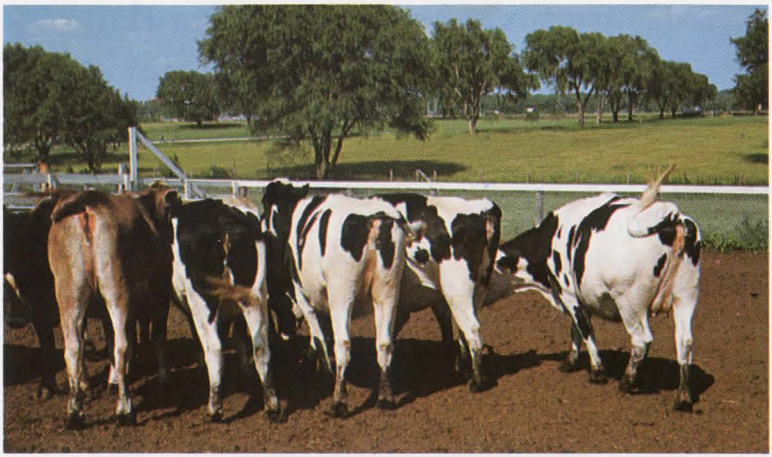


*Fig. 2.—Reactions of cattle to bite of stable fly*

humid) is critical. Weight gain reductions of 0.48 lbs/day (Table 1) and milk production decreases of 30-40 percent (Fig. 3) have been documented as a result of this fly. These production decreases also imply decreased feeding efficiency.

Table 1.—Losses in Beef Cattle Due to Stable Flies

| | Growing ration | Finishing ration |
|---|---|---|
| Reduction in daily gains | .20 lb. | .48 lb. |
| Reduction in feed efficiency | 13% | 11% |

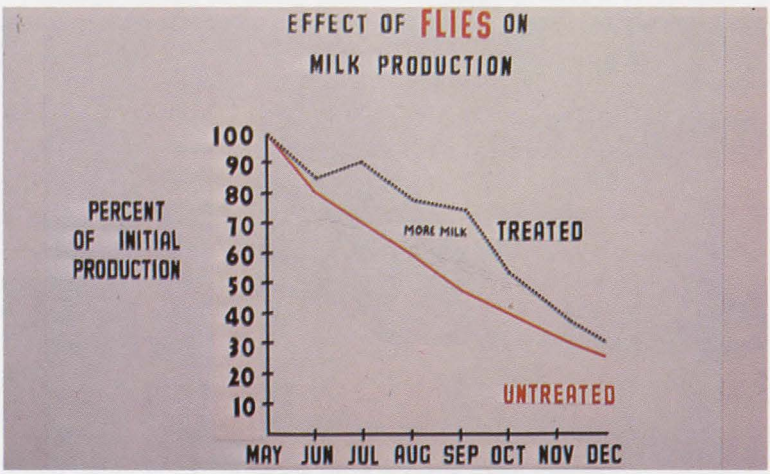



*Fig. 3.—Effect of flies on milk production*

## House Fly, *Musca domestica* (L.)

The house fly (Fig. 4) is about the same size as the stable fly but is dull gray with four distinct stripes behind the head, and the abdomen is pale without darker spots. The larvae and pupae are similar in appearance to the stable fly.

### *Life Cycle*

The life cycle is similar to the stable fly except it can be completed from egg to adult in about 14 days. One other difference is that the house fly may breed in fresh manure as well as the materials in which the stable fly breeds.

### *Economic Importance*

There is no data available indicating economic losses to feeder or dairy cattle as a result of the house fly. However, we have seen cattle with dense house fly infestations react similarly to cattle being bothered by stable flies. The house fly has been incriminated as a vector of numerous animal and human diseases. This, of course, makes public health and dairy inspection officials very conscious of flies. Lawsuits have been instigated citing a house fly nuisance. It is thus difficult to adequately evaluate the economics of house flies as pests.

### *Stable and House Fly Control*

Since these flies are usually found conjunctively in areas

*Fig. 4.—House fly*

within the geographical range of the stable fly, both shall be considered in this section on control.

## *Sanitation*

Since both species breed in a mixture of organic matter, dirt, moisture and manure; it is logical, in terms of an integrated pest management system, to start with sanitation. Feedlot or dairy pens can be kept free of fly breeding areas if they are properly maintained.

Cleaning in the spring and fall makes maintenance of the pens much easier. During the summer, simple machinery such as scraper blades, old grader blades made into a drag, or harrows can be pulled through wet areas which incorporates dry dirt into the wet area and moves the wet dirt out into the lot for drying.

The following areas are those we have found within a feedlot or dairy supporting fly breeding:

*Feedbunks* (Fig. 5)—Both stable and house flies will breed in wet grain, silage, haylage and fermenting green-chopped material. Wooden and concrete feedbunks are often raised off the ground, which allows spilled feed to accumulate under the bunks. Moisture drains from the bunks and mixes with the feed causing a fly-breeding situation. To correct this situation, there are at least two courses of action. One is to clean in, under and around the bunks at about weekly intervals. Cleaning under concrete bunks is somewhat difficult, which suggests the second option; that of closing off the areas under the bunks. Openings under concrete bunks are usually only 6 to 12 inches above the ground and can be filled with dirt to solve the problem permanently. Wooden bunks usually have open areas 1 to 3 feet above the ground and, thus, creates a more difficult situation to correct. If the bunks are placed permanently, the front and back sides should be sealed. Cleaning becomes easier if moveable bunks are used within the lot.

*Sick pens, calf pens and horse pens* (Fig. 6)—Most feedlots and some dairies have a pen close to cattle working facilities, usually with a shed in it, that is used as a sick pen. Often, straw or hay is used as bedding that can, when wet, become an ideal fly breeding area. The same situation can exist for dairy calf pens and horse pens. The bedding should be removed at least every 10 days.

*Feed mix areas* (Fig. 7)—Both stable and house flies will breed in most cattle feeds which have been spilled or scattered around wet feeding areas, even grain that is ground or cracked.

*Fig. 5.—Feedbunk*

*Fig. 6.—Sick pen*

*Fig. 7.—Feedmill*

Bi-weekly feed cleanup should be part of the routine management system.

*Feedbunk aprons* (Fig. 8)—Many feedlots and dairies have a concrete apron on the cattle side of the feedbunks which is usually 10 feet wide and slopes away from the bunks to drain moisture. A wet area about 2 feet wide usually results, causing cattle to step over the wet edge of the apron and trampling (which would help dry it out) does not occur. This area should be scraped at about weekly intervals with a blade or front-end loader. The materials can be spread in a thin layer in the lot to dry or removed and used for fertilizer.

*Mounds* (Fig. 9)—Mounds are built in many feedlots and dairies to facilitate lot drainage and to provide a dry area within the lot for cattle as bedding ground during times of rain or, more particularly, of snow. The mounds should be constructed for easy repair and should be finished before the winter freeze. If this area is not packed, moisture will penetrate and provide an ideal fly breeding area.

The edges of the mounds may also become breeding areas if water runoff accumulates there. These areas can be scraped or dragged with a harrow to keep them dry. Rear-mounted scrapers or front-end loaders can be used to clean wet areas. The wet material can be moved out into the lot to dry and then used for mound repair or to fill low areas in the pens.

*Fences and gates* (Fig. 10)—The areas under fences and at the edges of gates are often neglected when pens are cleaned. It

takes only a small breeding area to provide a great many flies; for instance, we have collected over 8,000 flies from an area approximately 1 square meter in size. The material under fences can be shoveled out to facilitate cleaning with a front-end loader. In many cases, the bottom wire, board or rod of the feedlot fence can be raised high enough to make cleaning easier while still containing cattle.

Often machinery create ruts in gateways and force fly breeding material to both sides of the main tracks. These can become breeding areas and should be cleaned with front-end loaders.

*Fig. 8.—Feedbunk apron*

*Fig. 9.—Construction of a mound*

*Fig. 10.—Fenceline fly breeding area*

*Potholes and pen corners* (Fig. 11)—Low spots in pens and fenceline corners often accumulate water and become fly breeding areas. Part of this problem can be accredited to poor drainage and part to poor pen maintenance. The low areas should be filled and the fence corner areas cleaned. A management practice that can be used to alleviate this problem is to stock the pens to capacity. In fully stocked pens, cattle trample the wet areas more which helps dry them faster.

*Fig. 11.—Breeding area in pen corner*

*Waterers or tanks* (Fig. 12)—If waterers or tanks are not built or maintained properly (sticky floats covered with iron screen to prevent damage), water spillage or runoff occurs; and, when mixed with the feedlot material, this becomes excellent for fly breeding.

Cleaning around moveable tanks and waterers is easy; but, if tanks and waterers cannot be moved, shoveling the wet area into the lot to dry prevents fly breeding. In stanchion dairy barns, considerable fly breeding occurs in feed accumulated under drinking cups. This area should be cleaned at regular intervals.

*Drainage areas* (Fig. 13)—Most feedlot or dairy pens of any size are constructed so that water drainage will occur. Many lots meet EPA water pollution standards, but even these can cause fly breeding problem areas. Debris basins, in particular, are fly problem areas. Although generally designed with a 0.3 percent runoff slope, in time, some low spots develop in the basin which prevents complete drainage. The edges of low areas become ideal for fly breeding in debris basins as they dry. Corrective measures are often difficult because debris basins may be too wet for long periods of time to allow use of cleaning equipment. If irrigation water is available near these basins, they can be flooded occasionally to a depth of 3 or 4 inches which will drown fly maggots.

*Fig. 12.—Water tank runoff*

*Fig. 13.—Debris basin*

## *Chemical Control*

*Precautions*

1. All insecticides may be poisonous to man and animals if not used properly.
2. Insecticides should be kept in a locked storage area, out of reach of children and irresponsible people.
3. Always read, understand and follow label recommendations.
4. Observe the animal treatment-slaughter interval.
5. Observe label restrictions in treating sick or stressed animals.
6. Note and follow label restrictions for treatment in conjunction with use of other medications.
7. Never use a crop insecticide on livestock.
8. Do not use two animal insecticides mixed together unless the mixture is labeled. Ravap, for example, is available as a mixture. It is Rabon and Vapona (a residual and a knockdown).

Understand the difference in the insecticide formulation you are using. Dusts (D) are generally used as purchased and may be preferred when only a few animals are to be treated or during extremely cold weather. Wettable powders (WP) are soluble and are mixed with water. It is usually necessary to weigh the insecticide to get proper mixture. Soluble powders (SP) also are mixed with water. Some type of agitation is necessary to keep

WPs and SPs in suspension. Emulsifiable concentrates (EC) may be mixed with water fuels or oils. Solutions (S) are not mixed with water. Some insecticides can be purchased mixed.

Generally, the same insecticides and application methods used for stable fly control are effective for the house fly as well. However, a difference in the adult behavior of the two species will require residual and knockdown spray applications at different locations for best results.

*Area or knockdown sprays* (Fig. 14)—These are short residual sprays that are applied around the lots with foggers, mist blowers, aircraft or hydraulic sprayers set to deliver a fine spray. Whatever the method of application, the objective is the same; to kill adult flies by applying many fine droplets of insecticide into a fly infested area. Foggers, cold or hot, dispense fine droplets of a concentrated insecticide. For optimum effectiveness, the insecticide fog should drift slowly (less than 5 MPH) across the lots. Wind or warm air updrafts hinder the effectiveness of the fog.

Mist-blowers are usually tractor-powered p.t.o. units. They have a squirrel cage fan which creates an air blast into which insecticide droplets are distributed. These units can be used despite strong winds and still be effective because they have an air blast of ca. 85 MPH.

Hydraulic sprayers are simply a hose and handgun attached to a farm sprayer. If the gun is set to deliver a fine mist, they are similar to a mist blower; except it will not deliver the spray


*Fig. 14.—Mist blower for knockdown spray*

very far. Aircraft applications follow the same principal as a mist blower. Fixed-wing aircraft are not as effective as a mist blower because the spray cannot be concentrated on fly resting areas. Our experience with helicopters indicated that the wind action off the end of the rotor causes the spray to swirl through the lots and thus gives an excellent fly kill.

For most effective use of the knockdown or area sprays, several factors should be kept in mind:

1. Mix no more insecticide spray than you intend to use on that day. Sprays lose potency at about 3 percent per day.

2. Do not spray until the temperature reaches 65°F. Most insecticides are not as effective at lower temperatures.

3. Apply sprays where the most flies are concentrated. Knowledge of fly behavior can aid in the efficient use of sprays. Stable flies rest during the heat of the day in shaded areas. The sides of buildings, windbreaks and feedbunks are favored resting areas. They will also rest in vegetation such as tree windbreaks, field crops around the edge of the pens and weeds. The use of the spray in these areas may be far more beenficial than spraying around the pens. Weed control is also beneficial because it removes that resting area and forces flies to concentrate in the remaining favored habitats.

House flies, unlike stable flies, tend to be found in sunny areas. However, they usually congregate at night inside open buildings on the ceiling and walls or outside the building under the eves. If these "roosting" areas can be located, a spray at night will be very effective.

*Residual sprays* (Fig. 15)—These sprays do not break down as rapidly as the area sprays. They are applied to fly resting areas. The insecticide residue remains on the treated surface. Resting flies absorb enough of the insecticide to kill them. As with the area sprays, knowledge of the resting behavior of the flies indicates where to apply the residual sprays.

Residual sprays may be effective for 1 to 3 weeks dependant on climatic factors. Ultra-violet radiation from sunlight and high temperatures are the major factors causing decomposition of residual insecticides. Rain, of course, will wash the insecticide deposit off a treated surface. Generally speaking, wettable powder (WP) insecticides will break down less rapidly than emulsifiable concentrates (EC).

The residual sprays can be applied with either a power sprayer or a hand pressurized sprayer. The sprays should be applied to a fly resting surface to the point of runoff. Residual sprays are not practical for larger feedlots or dairies because the

*Fig. 15.—Residual spray, fly resting areas*

fly resting areas are so extensive. Medium or smaller operations may choose to alternate area or knockdown sprays with residual sprays. The object of this system is to apply a knockdown spray which destroys most of the existing adult population. Newly emerging flies cannot deposit eggs until they are about 6 days old. Thus, a residual spray can be applied 6 or 7 days after a knockdown spray and will last long enough to delay development of another fly generation. This alternating of application methods can reduce the amount of insecticide and number of applications to keep fly populations below an economic threshold.

*Synthetic pyrethroids*—There is some hope that the synthetic pyrethroid will provide one insecticide system that will have both residual and knockdown properties and can be applied by area spray equipment. This would reduce labor requirements necessary for residual applications and greatly reduce the number of area sprays necessary to keep fly numbers below the economic threshold.

*Feed additives*—Insecticides fed to cattle through mineral supplements or mixed directly in feeds are called feed additives. The insecticide passes through the animal system and is available in manure to destroy developing fly maggots.

The feed additives may be effective in feedlots and dairies in the drier areas of the southwest. House flies will deposit eggs in fresh manure and, thus, maggots would be destroyed. However, in the wetter areas of the country, much of the fly breeding

occurs in material other than fresh manure. Stable flies rarely breed in fresh manure so the feed additives would have little effect on them. Most studies indicate that feed additives are effective in manure for about 3 weeks. Since fly breeding occurs in a mixture of manure, moisture, dirt and spilled feed accumulated over a longer period than 3 weeks, a breakdown of the insecticide makes it incapable of killing fly maggots. Our studies in Nebraska indicated that much of the total fly breeding area is outside the cattle pens and was primarily manure which had accumulated from fall, winter and spring moisture runoff.

*Larvicides* (Fig. 16)—Larvicides are insecticides applied to fly breeding areas. The sprays destroy the developing fly maggots. Many of the insecticides used as residuals are also effective as larvicides. There is some reluctance on the part of entomologists to recommend the use of larvicides. This is because of the fear of the development of insecticide resistance in the fly populations. There is a tendency for resistance to develop faster when insecticides are used against immatures than if they are used against adults.

However, there are fly breeding situations where the use of larvicides seem justified. If debris basins are too wet for cleanup operations, larvicides can be used until these areas dry out. When feedlots and dairies are cleaned after crops are growing, the material may have to be stored until it can be spread on the fields after fall harvest. Wet weather can cause the stored manure to become a prime fly breeding area. In this situation, the use of larvicides may be a practical solution to the fly problem. Another solution may be to cover the manure with black plastic causing enough heat to kill developing larvae.

*Fig. 16.—Larvicide*

*Baits* (Fig. 17)—Baits are insecticides mixed with a fly attractant, such as sugar. Even though only a small number of flies may be attracted to the bait, the fly attractant factor causes flies to congregate for feeding. It should be noted that stable flies feed only on blood of warm-blooded animals and the baits have no effect on them. Although baits can be used to reduce house fly populations within buildings such as dairy barns and beef loafing sheds, they are generally ineffective by themselves as a fly control agent.

*Dust bags, oilers and animal sprays*—Occasionally, dust bags and oilers (self-treatment devices) are used at feedlots and dairies for fly control. These are also generally ineffective for house and stable fly control. Stable flies feed primarily on the lower front legs of cattle, which makes it difficult to apply

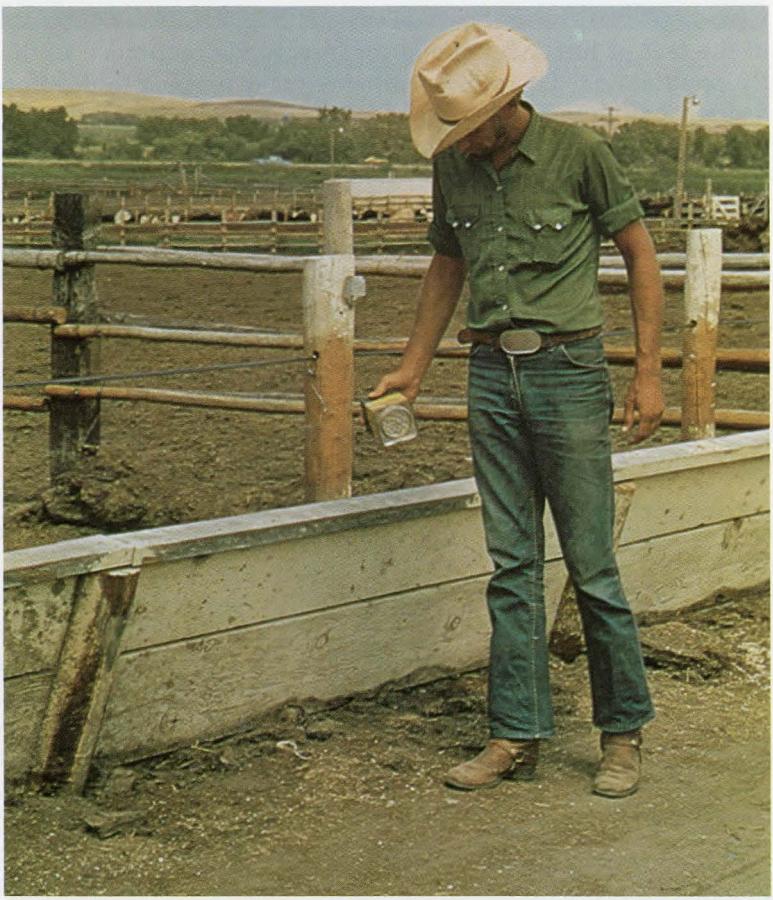


*Fig. 17.—Baits*

insecticides on the areas where stable flies congregate. House flies tend to feed on the body fluids of the animal and usually congregate around the face or tailhead. Both of these animal areas are difficult to treat with self-applicators.

Wet or animal sprays, if used often enough, could reduce house and stable fly populations. However, the stress of treatment—particularly during hot weather—renders this method impractical.

There is one situation where the use of self-applicators, animal sprays or even feed additives might be justified. Some feeders or dairy operators may feed cattle in lots and then allow the cattle to pasture during the day. In this situation, horn flies, *Haematobia irritans* (L), small blood-sucking flies, and possibly face flies, *Musca autumnalis* DeGeer, also known as "pasture flies," are pests of cattle. The self-applicators and sprays would reduce the pasture fly populations and would have some effect on the feedlot flies.

## *Fly Population Monitoring*

Stable fly and house fly numbers can be estimated by one or more methods. One of the methods would be to note cattle behavior. As indicated previously, flies cause cattle to bunch, and go off feed. Flies also cause stamping, head-throwing and tail-switching by cattle in an effort to dislodge flies. If cattle are not exhibiting this behavior but are scattered around the lots in apparent contentment, the fly population in this lot is probably not economic (Fig. 18).

*Fig. 18.—Fly-free cattle*

## *Methods of Economic Evaluation*

Sticky traps (Fig. 19) can be used to determine the effect of control methods by comparing fly populations before and after control measures are taken. The number of stable flies on the legs of cattle can be determined by using binoculars (Fig. 20) and counting flies feeding on a representative number of animals. Nebraska and Illinois research in feedlots and dairies would indicate that less than 5 stable flies per leg would be non-economic while more than five would indicate a need for treatment. There are no economic thresholds for house flies so numbers of flies cannot be correlated with economic losses. Animal behavior would be the best method of determining the need to control house flies.

*Fig. 19.—Sticky trap*

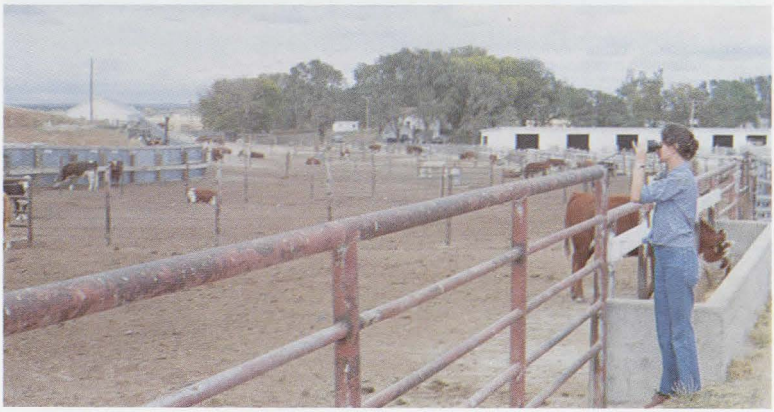


*Fig.20.—Using binoculars to count flies on cattle*

## Other Pests

The major non-insect feedlot and dairy pests are rats and starlings. We have had no experience in the Nebraska Feedlot Pest Management Pilot Project with these pests. However, the experience of Nebraska wildlife control specialists and the literature of the Department of the Interior indicates that the sanitation procedures used for fly control are beneficial from the standpoint of making a feedlot or dairy less attractive to rats or starlings. Both pests feed on grain, so spilled grain becomes an attractant encouraging these pests to establish or stay at a location which does not use sanitary management practices.

## Rats

Spilled feed, when allowed to accumulate under feedbunks, is an attractive food source for rats. To correct this situation (as in the case of fly breeding), clean in, under and around the bunks at about weekly intervals.

If a feedlot operator chooses to seal wooden bunks, care should be taken that the seal is in a good state of repair or this can become an ideal nesting area for rats.

Rat-proofing involves the use of various construction materials to keep these pests out of a given area. The upper teeth of rats curve inward, which makes it difficult to gnaw into a flat, hard surface. However, edges of hard surfaces formed by chipped and indented places or open joints makes a place where gnawing may start. Rats may burrow under bunks, even if the sides and ends are rodent proof, so periodical checks for these burrows may aid in detecting the problem.

If a rat problem exists, poisoning or trapping and removing the food source are the major methods of control. Rat poisons fall into two groups: single dose stomach poisons or multiple dose anticoagulant poisons. The success of either method of poisoning depends on the rats consuming enough to destroy them.

The first step of a rat poison control program is to locate the paths (runs) on which the rats travel. Once this is known, covered prebait foods can be placed in these runs until the rats are familiar with them. When the rats start feeding on these foods, poisons can be added to them. Generally, best results occur if two or three bait foods are used. There are many foods accepted by rats: ground beef or fish mixed with water; kitchen fats; lard or other shortening are recommended. Rolled oats, bread

crumbs and corn meal are recommended as extenders to the meat or fish.

Red squill, zinc phosphide, and calcium cyanide are recommended as single dose poisons. Red squill is relatively harmless to pets because it causes vomiting, but rats are unable to vomit. Zinc phosphide is deadly to all animals and should be used with great care. Calcium cyanide powder releases hydrocyanic acid gas upon contact with air and can thus be used in rat burrows. Care should be taken to assure the gas is not escaping at the ground surface.

The "anticoagulant" poisons include Warfarin, Pival, Fumarin, Diphacinone and PMP. These poisons prevent the clotting of blood and cause death by internal bleeding. Most are available in ready to use baits and some can be purchased as concentrates and used in homemade baits. The anticoagulants are most effective when fed upon in small amounts over several feedings in several days' time. It is thus necessary to have the baits available for a couple of weeks. The same baiting procedures should be used as for the single dose stomach poisons.

Trapping may be the most practical method of controlling rats. Although there are many types of traps, the old snap-trap may still be among the best. The traps, like the baits, should be placed in the rat runs. The traps could be baited with the same baits discussed in the section on poisons.

## Starlings

Starlings, at times, have become (particularly in the fall and winter when birds are concentrated) a problem at feedlots and dairies. Starlings in feedlots may cause several problems. They irritate workers, cause economic damage to field crops, small fruits and stored grain. They play a role in the spread of parasites and diseases to man and domestic animals. In addition, the impact of starlings on our native birds through competition for food and nesting places is important.

Starlings have been implicated in the transmission of TGE virus (transmissible gastroenteritis) of swine, cryptococcosis; coccidiosis and other diseases. The degree of implication of starling transmission of these diseases has not been clearly defined by research to date.

Starlings often feed on waste grain—spilled in pens or alleyways—so the sanitation practices mentioned for prevention of fly breeding would help with this problem. However, these birds will also feed directly out of the feedbunks, indi-

cating that sanitation, by itself, would not be very effective.

Starlings often flock into farm feedlots during the winter when other foods are scarce. If scaring devices can be used effectively without disturbing the livestock or poultry, this method may be more effective than trying to reduce the starling population.

Trapping or poisoning starlings can be frustrating when dealing with large numbers of birds. Since starlings will travel several miles from their roost and do not always feed in the same place daily, an operator could eliminate many hundreds of the birds without seeing a reduction in visiting birds.

Frightening devises, such as gas exploders, rope firecrackers, shellcrackers, electronic noise generators, and recorded starling distress cries are most effective when applied as soon as a problem develops. Birds which have become accustomed to feeding or roosting in a particular location are harder to disperse.

Decoy traps or toxic chemicals may be useful where large numbers of starlings are present. Traps should be placed in well-used feeding areas and must be serviced daily. Live decoy birds must be kept in the trap to entice others to enter.

A chemical control agent, "Starlicide," is registered for use around livestock and poultry operations, and is to be used only "under the direction of personnel trained in bird damage control." Starlings should be fed a clean "prebait" for several days prior to application of the toxicant. Care must be taken to avoid allowing livestock, poultry or non-target bird species to consume the poison.

Another commercial bait, Avitrol, is registered for use in feedlots but only by professional pest control operators. Where starlings are roosting in buildings, professional pest control operators can install toxic perches.