

# **Pest Management Strategic Plan**

## **For Lactating (Dairy) Cattle**

For pest management on non-lactating dairy cattle see the PMSP for beef cattle.

### **North Central Region**

**Prepared: Jan 2004**

**Submitted by**

**Dr. David R. Pike**

## Executive Summary:

The purpose of a Pest Management Strategic Plan is to provide a document that communicates the role of pesticides and pest management strategies in control of crop or animal pests from an industry perspective, with cooperation and verification from livestock pest management specialists. While this information is primarily used by the Environmental Protection Agency (EPA), it also provides to the USDA, Land Grant Universities, and pest management stakeholders a “to do” list of research, education, and regulatory issues. Strategic Plans may also be helpful to the livestock industry as a means of evaluating progress on those issues.

This document has been prepared to convey to the reader the pest management challenges confronting Midwestern livestock producers. Though it is not all-inclusive, it is meant to be generally representative of livestock pest management in the North Central Region.

This initial version of the Dairy Animal Pest Management Strategic Plan is based on information assimilated from production documents from various states in the region. The document was further developed from input gathered from producers and extension specialists attending the workshops. Workshops were held at Harmony, Minnesota on 21 November, 2003, at Greenville, Illinois on 16 January, 2004, and at Charlestown, Indiana on 30 January, 2003. In addition to providing input on pests and pest control methodologies, attendees identified research, education and regulatory issues that impact producer profitability and environmental quality.

### **Data completeness and accuracy:**

The intent of this report is to provide the EPA with the pest management perspectives of livestock producers. As such, it primarily reflects the comments and inputs of those individuals who attended the workshops. As with any group of individuals, the scope of knowledge as well as opinions of participants vary greatly, and in its current form this document captures that scope and diversity.

The editor has taken care to excise faulty or misleading information, but it has not been our intent to remove or alter information which was provided at the workshops that does not harmonize with “conventional wisdom”. This Strategic Plan should be viewed as a work in progress; future versions will undoubtedly result in an improved product.

### **Regional differences:**

Although particular attention was paid to obtaining broad geographic representation for input into this document there were no significant differences that, to date, were worthy of separate notation.

### **Efficacy ratings for pesticides:**

Pest control ratings for insecticides are difficult to determine due to few direct comparisons being available. Those practices that are listed as being ‘common’ could be interpreted as having a ‘good’ or ‘fair’ level of control. Products with no indication of relative use may have good or fair levels of control but may be seldom used due to problems with treatment convenience, cost, or other non-efficacy related issues.

Priorities the growers expressed were:

### **RESEARCH**

Please list items of information you would like to know about any livestock insect or insect control that you don’t know and that could be addressed through research programs.

1. Is resistance caused by reducing insecticide rates?
2. Does a heavy dew affect the effectiveness of an insecticide like Tempo?
3. If a producer has resistant insects, will the level of resistance in a population drop the next season if the insecticide is discontinued?

### **REGULATORY**

List here any pipeline pesticides you would like to see registered or any current products you would like to see have their label expanded. Also list any other actions you would like to see the EPA take with regards to product registration or use.

4.

### **Education**

Please list items of information you would like to know about any livestock insect or insect control that you don’t know and that could be addressed through education or extension programs. (I.e. the information

probably already exists, you just don't have ready access to it.)

5. We need a comprehensive, up-to-date, searchable web site database of currently registered products for use on lactating and non-lactating cattle. (Search by insect or product)
6. Could use a dairy day (in MN) that helped producers identify insects early.
7. Need an educational program to explain cost effectiveness of treating mites/lice.
8. Do insects cause sores on animals or reduce healing of existing sores?

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## General Production Information

The North Central Region is a strong dairy region in the United States. Four states rank in the nation's top ten for number of dairy animals and raw milk production, and six are in the top ten for number of dairy operations. In 1997, this region had 38% of all US milk cows, produced 36% of the milk, and was home to 54% of the dairy operations. Milk, cheese, butter, yogurt, and creams are some of the consumable milk products produced and sold within the region, while other products include replacement heifers, feeder calves, meat, leather and animal by-products. The total value of all North Central Region Dairy Products sold is \$ 6,738,895,000.

Of all agricultural production enterprises, dairying remains one of the least concentrated geographically.<sup>1</sup> According to Robert Jacobson of Ohio State University, "The largest 10 percent (of farms) in the U.S. accounted for 38.2 percent of milk sales; the smallest 10 percent accounted for only 0.8 percent of milk sales. If these numbers sound like a concentrated farm sector, they are much less so than other farm enterprises. For example, the largest 10 percent of fed cattle operations accounted for 83.5 percent of production; the smallest 10 percent of fed cattle operations accounted for only 0.3 percent of production. Thus, the largest dairy farms are not nearly as dominant as large fed cattle operations, and the smallest dairy farms have a market share a bit larger than the smallest fed cattle operation. The dairy industry reflects a family farm structure more than most agricultural sub-sectors.

## Markets

For an excellent discussion of consumption and changes in domestic<sup>2</sup> and foreign markets<sup>3</sup> please see the references at the end of this document.

### Table 1. Production Statistics: Milk Cow Inventory

Source: National Agricultural Statistic Service, January, 2002, (last year for which statistics are available for individual states)

Rank	State	(1,000 Head)	Production (mil lbs)	Total Operations	Average herd size
1	Wisconsin	1,290	22,074	17,800	72
5	Minnesota	510	8,458	7,200	71
7	Michigan	303	5,945	3,200	95
9	Ohio	260	4,475	5,100	51
11	Iowa	210	3,804	3,200	66
13	Missouri	144	1,946	3,500	41
16	Illinois	116	2,051	1,800	64
18	Indiana	153	2,601	2,600	59
22	S. Dakota	100	1,404	1,200	83
29	Kansas	92	2,010	1,200	77
32	Nebraska	72	1,170	1,000	72
34	N. Dakota	46	585	760	61
United States		9,141	169,758	91,990	99

<http://jan.mannlib.cornell.edu/reports/nassr/dairy/pmp-bb/2003/mkpr0203.txt>

### **Production Practices:**

There is great diversity in the style and size of dairy operations in Midwestern states. Historically, dairy farms consisted of family operations with a bull and a few cows that were milked twice per day. In between milkings, the animals grazed on summer pasture and were provided hay or silage in winter quarters. Young heifer calves, which were bred to produce calves and begin lactation in their third year, replaced aging milking cows. Whereas the bull calves were raised as breeding stock or castrated and raised as steers for slaughter. Retired cows were also butchered.

By the 1950's, many dairies were automating their milking systems and parlors to reduce labor while allowing for increased herd size. Cows were housed in tie-stall or stanchion barns, where milking was done with transportable machines connected to in-line milking systems. With parlor systems, cows were moved from pastures, dry-lots, or barns through the milking parlor in assembly line fashion. Production efficiency was also greatly increased through artificial insemination, grain and mineral supplements, controlled environment housing, and improved herd health. More recently, some operations have specialized in seasonal dairying with summer grazing alone, others are producing replacement heifers, and others are intensive milking operations with dry-lot cows milked three times per day. Today, most large dairy operations import feed, nutritional supplements and replacement stock, and hire herdsman, nutritionists, managers, milkers, and seasonal laborers to run the operations.

One reason why so much of the dairy industry is concentrated in the North Central region is that temperatures and rainfall are suitable for grass, alfalfa and silage production. Temperatures for much of the year are also within the cow's thermo-neutral zone (5-25 °C). Thus, dairies in the region can make efficient use of summer forages and pasture while maintaining cows in outside lots most of the year. However, regardless of type of operation, dairy stock in the North Central region need shelter during the coldest part of the winter. In the North Central region, young calves are often housed separately in small hutches, whereas older stock are grouped in barns or other buildings with windows and fans that regulate temperature and provide ventilation. Some barns have flexible walls that can be rolled up and down as needed. Straw or sawdust are common bedding materials. Accumulated manure and soiled bedding at smaller operations are commonly scraped and hauled daily to open fields for use as fertilizer. In larger operations, manure is scraped and flushed into liquid storage systems such as above ground storage bins, lagoons or slurry-stores. These structures are later emptied when fields become available for manure spreading and incorporation.

### **General pest control comments:**

Pests of dairy cattle predominantly affect livestock through annoyance. Face flies, horn flies, lice, and others cause itching, biting, and buzzing. This irritation translates into cattle movements such as tail switching, stamping, and milling which reduces production efficiency. However, with the exception of lice, these pests are usually only a problem during warm weather. In addition, as described in the appendix, some of the more important pests have rather narrow environmental habitat requirements. As a result, although nearly every pest can be found in a herd at some time or other during the season, few will reach levels of economic importance. Producers can often reduce pest levels through sanitation, destruction of weeds in adjacent lots, and by keeping cattle away from areas frequented by such pests.

### **Synthetic chemical free production:**

Although small herd dairy production without pesticides is not difficult it can raise issues of sanitation, animal health, and humane treatment of animals. Beyond this, the challenge to producers who wish to maintain large dairy herds without pesticides can be considerable. As the size of the herd increases pest problems can multiply and the simple sanitation methods employed for smaller herds become ineffective. Since sanitation techniques only work for stable and house flies many pests will be unaffected by manure removal practices.

### **Pest resistance issues**

House flies have shown some resistance to organophosphates and carbamates while face flies have occasionally shown resistance to pyrethroids. Other insects and mites have not shown a propensity to develop resistance for dairy producers using current pest management practices.

## **Worker exposure issues**

### **General/applicator/mixer**

A recent survey of pesticide use on dairy animals in the North Central Region indicated that 13 percent of lactating animals were treated with sprays and/or aerosols. Permethrin and pyrethrin coat sprays were the principal products applied, and they were used an average of 68 and 55 times per year respectively. Coumaphos and dichlorvos were also applied with some regularity, being used 14 and 37

times per year respectively. The frequent use of these compounds suggests that when a herd was treated by the producer, such treatment was often done on a daily, or every-other-day basis during the part of the season insects were present. The method of spray application, whether by hand or automated sprayers is not reported, nor is the propensity for producers to rotate their choice of insecticides during the season. Although smaller herds are most likely treated by small hand held sprayers, larger operations favor automated systems that trigger sprays as animals enter or exit the milking parlor. When hand held sprayers are used, some inhalation of aerosol compounds is inevitable unless a filtered breathing apparatus is used. Contact with the skin of bare arms, hands, face, and neck will also occur. It is estimated that of those applying insecticides via spray or aerosol, exposure occurs approximately 50 times during the spring, summer, fall seasons. The length of each exposure is estimated at 10 minutes per application.

Pour-ons were applied to approximately 37 percent of all dairy animals. The principal pour-on products used include: eprinomectin, ivermectin, cyfluthrin, and permethrin. Eprinomectin and Ivermectin were used 1.2 and 1.4 times per year, whereas cyfluthrin and permethrin were used 2.9 and 2.8 times per year respectively. The method of application of pour-ons typically involves pouring the insecticide along the back of the cow using a long-handled dipper. Dippers are usually provided by the insecticide manufacturer.

### **Handlers/ milkers**

Workers who milk cows in stanchion barns are most likely exposed to greater amounts of insecticide than workers in milking parlors. Although the amount of time they have in contact with the animals may be less, due to fewer animals, their contact is probably much closer as a result of the need to work between the cows. This is especially true during the summer when workers are most likely to wear short sleeved shirts. Exposure includes all insecticides applied as sprays and aerosols, oiler/scratchers, and dust bags. For herds in stanchion barns the expected length of exposure to cattle which have been treated with insecticides, ranges from 2 to 4 hours per day with the mean estimated at 3 hours. For milking parlors the exposure time ranges from 2 to 7 hours a day with an estimated mean of 4 hours contact time. Dehorning, castration, and pharmaceutical injections are a few of the other activities that can bring handlers in contact with treated cattle. These activities are typically one-time events during a year and seldom would extend handler exposure to treated animals beyond 8 to 16 hours within a year. These operations also tend to take place during the spring or fall when insect populations are low and insecticide use is minimal.

### **Environmental exposure issues**

There are few environmental issues associated with insecticide applications on dairy cattle. One possible concern might be localized areas of contamination near sites where pour-ons, whole body sprays, or animal dips are used and around dust bags. These sites can be of particular concern if wells are nearby or if the runoff from these sites wash into ponds or streams that provide a source of drinking water for cattle.

### **Registration and Critical Alternative issues**

Consistent pest control for dairy animals rests on three classes of compounds: avermectins, pyrethroids, and organophosphates. Although organophosphate use on dairy cattle accounted for only about 19% of all treatments, such compounds are useful for resistance management programs and can be critical in forestalling newly invasive insects. However, in the absence of a specific pest resistance problem or invasive insect, organophosphate insecticides are considered of Level C significance to dairy production. Permethrins and avermectins as independent groups of insecticides could be considered of Level B significance. Their loss at this point in time, would cause significant shifts in production practices, probably with an increase in the use of organophosphates for coat sprays. No single compound can be classified as of Level A significance, and with the exception of pyrethrin, which is a Level B, most are Level C.

*Issues regarding retention of a specific pesticide or group of pesticides are given a rating of A, B, or C according to their level of significance to the commodity. It is recognized that for some commodities, non-chemical or organic methods of pest management may be employed. However, our intent is to focus on commercial agriculture, which generally involves conventional pesticides.*

*Level A: product critical, no acceptable alternatives, loss of product would cause regular and drastic changes in production, safety, or commodity price.*

*Level B: product essential, alternatives limited in application, loss of product would cause significant changes in production, safety or commodity price.*

*Level C: product fundamental, alternatives exist, loss of product would cause few changes in production, safety, or commodity price.*

**Pipeline products**

No new products were known at the time of this writing.

**Co-occurrence**

There are no detailed records indicating what insecticides are used in combination or in sequential applications. However, the greatest opportunity for sequential uses would be with the aerosols and sprays and the pour-ons. This suggests that sequential uses are primarily those occurring with some formulation of a pyrethrin being used followed by other pyrethrins (of the same or different formulation). Although dichlorvos is also used as an aerosol the few cattle treated would not indicate much use preceding or following a insecticidal compound from another class.

**Insecticide formulations:**

Many different formulations of active ingredients are available for use against lice, mites, internal parasites and flies. Some formulations are available for use on lactating cows, whereas others are restricted to growing animals or their premises. Widely used formulations include topical pour-ons and sprays, slow-release ear tags, residual premise sprays, and knockdown aerosols. Some ingredients can also be delivered internally through injection or as feed additives.

The most widely used barn and space sprays contain short lived pyrethrins, organophosphates (stirophos, dichlorvos), and synergists (PBO). Some organophosphates (coumaphos, dichlorvos) and one of the pyrethroids (permethrin) are formulated for topical use, whereas others are used as premise sprays (stirophos, cyfluthrin). House flies developed resistance to DDT within the first five years of commercial use in the late 1940s, and this species is known to have developed resistance to most of the other compounds in commercial use, including the most recent pyrethroids. Resistance to pyrethrins is spotty, despite over fifty years of commercial use. The most recently developed class of compounds is the avermectins (ivermectin, doramectin, eprinomectin), which have a broad spectrum of activity against lice, mites and internal parasites.

**Table 2. Dairy Herd Pesticide Application Method Summary**

<b>Application Method</b>	<b>Percent of Animals Treated</b>
Pour-ons	37.1
Sprays and Aerosols	12.8
Dusts and Dust bags	8.7
Feed/Mineral Additive	7.2
Oilers/ Scratchers	3.8
Injection	2.9
Ear tags	1.3
Oral	0.4

**Table 3. Top Ten Insecticide Active Ingredients Used for Dairy Animals in the North Central Region**

<b>Rank</b>	<b>Active Ingredient</b>	<b>% of Animals</b>	<b>Classification of Active Ingredient</b>
1	permethrin	16.6 %	Pyrethroid
2	eprinomectin	10.2 %	Avermectin

3	pyrethrins	6.8 %	Botanical
4	coumaphos	6.7 %	Organophosphate
5	cyfluthrin	6.7 %	Pyrethroid
6	ivermectin	6.6 %	Avermectin
7	morantel tartrate	2.4 %	Acetylcholine mimics
8	stirophos	2.2 %	Organophosphate
9	dichlorvos	1.4 %	Organophosphate
10	doramectin	1.2 %	Avermectin

**Table 4. Dairy Pesticide Use by Class**

Pesticide Class	Active Ingredients	% of Animals Treated	Target Pests
Pyrethroids	cyfluthrin fenvalerate flucythrinate lambda-cyhalothrin permethrin pyrethin zeta-cypermethrin	31.1	all flies lice ticks mosquitoes mites
No Pesticide Applications		22.1	
Avermectins	doramectin eprinomectin ivermectin moxidectin	18.7	grubs scabies lice internal worms lungworms mites lice horn fly
Organophosphates	chlorpyrifos clorsulon coumaphos diazinon dichlorvos enthion famphur fenthion malathion pirimiphos-methyl stirophos trichlorfon	14.6	grubs mites all flies lice ticks mosquitoes
Other		4.7	
Acetylcholine mimics (Imidothiazoles, Pyrimidines)	morantel tartrate levamisole	3.1	roundworms lungworms
Benzimidazoles	albendazole fenbendazole thiabendazole oxyfendazole	1.2	tapeworms lungworms liver flukes roundworms
Growth Regulators	methoprene diflubenzuon	0.9	all flies
Chlorinated Hydrocarbons	methoxychlor	0.4	horn fly face flies lice mites
Multiple Products		0.2	

# Insect Pests

Different kinds of invertebrate pests are associated with dairies in the North Central Region. These include parasitic and nuisance insects, mites and ticks, any of which can reduce the comfort of the animals, affect their appearance, or reduce their rates of growth, lactation and feed conversion efficiency. Although chemical insecticides are commonly used a number of non chemical controls are effective in reducing pest populations and reducing the need for insecticides.

## Sanitation

The life cycle of stable and house flies requires egg laying or larval development in or on manure or decomposing plant material. To interrupt the life cycle it is important to clean feedlots, stalls, pens, feed troughs, gutters, and all other areas where manure, wet feed, or plant matter accumulates. Effective sanitation requires cleaning every 7 to 10 days during fly season. With proper sanitation populations can be significantly reduced over time. Drainage can also be used to reduce mosquito biting fly larvae development in puddles or standing water.

Sticky tapes, paper, ribbons can be used inside buildings. They can be very effective for reducing flying insect populations if they are changed regularly to expose new areas of tacky surfaces.

Maintaining a fly-free zone in the milkroom can be done by installing tight screens and windows and by carefully controlling air movement via exhaust fans. Reducing traffic in and out of milkrooms can also help.

## Biological Control Practices:

Parasitic wasps and other biological controls can possibly be employed. However, high cost, lack of convenience, and poor reliability plague some of these approaches.

## General Comments from producers

The most convenient treatments are those with long residual activity. Since cattle are difficult to corral, the best times for treatments to the animals are during the spring or fall as the animals are moved to or from pasture.

Although the concept of back rubbers, face oilers, and other self application devices is good, seldom do all animals utilize these devices, and some have a distinct aversion to them. Producers indicated that for these devices to be most effective the animals have to be familiarized with them and 'trained' to use them.

A significant number of producers indicated that they relied on their veterinarian for insecticide recommendations and sometimes could not remember the exact product purchased.

Many producers rely on a contract application service such as Orkin for insecticide applications.

A common complaint among producers was that ear tags were very ineffective in controlling insect pests.

All producers generally agreed that **synthetic pyrethroids are critical** to effective control of insects on livestock. Some producers indicated that this was often as much for reducing fly movement to nearby residential areas as it was for reducing nuisance activity on the cattle.

## Lice and Mites

### Life cycle and biology

- Prominent wintertime pests.
- Lice include three blood sucking species and one chewing species.

### Distribution and Importance

- Considered the second most important livestock pest after face and horn flies.
- Moderate densities of lice cause their hosts to scratch and rub, which leads to dermatitis, hair loss, and decline in animal production efficiency. Dermatitis can also be caused by three species of skin inhabiting mites that stimulate dermal hypersensitivity.
- Weight loss may result from animal irritation due to high populations.
- Both lice and mites are permanent ectoparasites that spread solely through contact between infested and naive animals; lice and mites do not fly or jump, and off-host reservoirs such as bedding in vacant pens are of minor epidemiological consequence.
- The problematic species on dairy cattle do not occur on other domesticated animals, wildlife, or birds. Consequently, if a herd is closed to contact with other dairy or beef herds, it is feasible to eradicate lice and mites from the subject herd, and to maintain parasite-free status if bio-security

is adequate.

### **Chemical Control (General)**

- A variety of formulations of insecticides and acaricides are available to combat lice and mites, and pesticide resistance is not yet widespread.
- No vaccines or other biological methods are available to control lice and mites, and there are no cultural methods that are practical and effective on a commercial scale.

### **Sprays for Lice:**

#### **Triazapentadienes**

Amitraz (Taktic)

- Use rate: 1 qt 12.5% EC/100 gal water, use 2 gal/fully grown animal.
- No pre-slaughter waiting interval.

#### **Organophosphates**

-Some producers specifically avoid organophosphates due to toxicity

Coumaphos (Co-Ral)

- Use rate: 4 qt 5.8% Livestock Insecticide Spray ;
- 1 to 2 lb 25% WP, or
- 1 to 2 qt 11.6% EIL, or
- 1 pint 42% F/100 gal water.
- Co-Ral products are not used on animals under 3 months of age.
- No pre-slaughter waiting interval.

#### **Botanicals**

These products are specifically used for their low level of human toxicity.

Permethrin (Atroban; Ectiban; Expar; Insectaban; Insectrin; permectrinothers)

- Use rate: 1 qt Ectiban 5.7% EC, or
- 1 pint Permethrin II 10% E, or
- 2 lb Permethrin 25% WP/100 gal water;
- 1 pint Atroban 11% EC or
- 1 qt Insectaban 5.7% EC/25 gal water.
- No pre-slaughter waiting interval.
- Some producers obtain 2 weeks of good control vs one week with other compounds.

Permethrin Synergized (Atroban; Back Side Plus; Hard Hitter; Insectiban; Expar; Permethrin)

- Use rate: as per label, applied as low-pressure sprays.
- Not applied more often than once every 2 weeks.
- No pre-slaughter waiting interval.

#### **Organophosphates**

Tetrachlorvinphos/Dichlorvos (Ravap)

- Use rate: 1 gal 28.7% EC/75 gal water.
- No pre-slaughter waiting interval.
- Do not apply to calves less than 6 months old
- Do not apply to teats of lactating animals

### **Pour-on's for Lice:**

-Usually used once a year when cows are dry.

-Producers will select one of the following insecticides and tend not to rotate these from year to year.

-Are effective for internal parasites as well.

#### **Macrocyclic lactone**

Moxidectin (Cydectin Pour-On )

- Commonly used and considered effective, cheap, and broad spectrum.
- Use rate: RTU, apply 1 ml/22 lb body weight along backline from withers to tailhead.
- No pre-slaughter waiting period.
- Not used on calves to be processed for veal.
- Moxidectin is an endectocide.
- Is used by some producers because it has some effect on internal parasites.

#### **Avermectin**

Eprinomectin (Eprinex 0.5% Pour-On)

- More expensive than moxidectin but is still used commonly.
- Considered most long lasting (2 months)
- Commonly recommended by vets

- Pre-slaughter interval with no milk withdrawal is important to producers
- Use rate: RTU, apply 1 ml/22 lb body weight along backline from withers to tailhead.
- 0- day pre-slaughter waiting period.

#### **Botanicals**

Permethrin Pour-On (Back Side; DeLice; Durasect; Expar; Ectiban; Hard-Hitter; Permethrin all in 1%; Boss 5%; Permethrin CDS 7.4% and Permethrin CD 10%; Brute 10%)

- Considered effective and longer lasting than many other products
- Often used 3 to 4 times a year
- Use rate: for 1% formulation, apply ½ ml/100 lb animal weight and not more than 5 fl.oz./animal along back and down face, except for Durasect, apply in two strips along each side of midline from shoulders to tailhead. Boss 5%, 3 ml/100 lb body weight;
- Permethrin CDS 7.4% , 2 ml/100 lb body weight;
- Brute 10 % or Permethrin CD 10%, 1.5 ml/100 lb body weight.
- Not more often than once every 2 weeks.
- No pre-slaughter waiting interval.

#### **Premise and Feedlot (Stable and House flies)**

##### **Life cycle and biology**

- Many kinds of free living flies attack dairy cattle in the North Central region. The most common ones are the stable fly and the house fly, both of which develop as larvae in decomposing organic debris such as rotting feed, soiled bedding and accumulated animal manure. Accordingly, stable flies and house flies are most abundant around confined cattle.
- Stable flies will disperse readily from confinement breeding sites to surrounding areas, so they occur on pastured stock, too.
- Stable flies visit their hosts just long enough to obtain a blood meal; nonfeeding and fed ones are on adjacent "resting" sites.

##### **Distribution and Importance**

- Stable fly attacks cause noticeable irritation (leg stamping, tail switching and bunching) and measurable reductions in growth rate and feed conversion.
- Financial loss due to flies is not easily measured, but a rough estimate can be determined by counting the number of stable flies, for instance, on the front legs of five cows. If there are five per front leg, every year the operation may be losing about \$9.80 per animal. In other words, just 10 flies per animal can reduce feed efficiency, yet populations of 200 to 250 flies are often common. Persistent flies cause cows to resort to "shaking off" motions, which reduces time spent feeding.
- House flies, in contrast, are known to annoy workers and nearby residents, but they have not been shown to affect animal performance.

##### **Non Chemical controls**

- Sanitation practices such as manure removal are effective for stable and house flies.

##### **Chemical Control (General)**

- **Residual premise** sprays and space fogs can be useful, but are a supplement to, and not a substitute for, breeding site (debris) management.
- Resistance to pesticides in stable flies has yet to be detected, but resistance in house flies to some organophosphate and pyrethroid insecticides is common.

#### **Pasture (horn and face flies)**

##### **Life cycle and biology**

- Two kinds of flies that occur mainly on pastured cattle are the horn fly and the face fly. Both of these flies develop in isolated dung pats on pastures, and not in accumulated debris. Horn flies reside continuously on their host animals and feed on blood.

##### **Distribution and Importance**

- Considered the most important insect pest of dairy cattle.
- Their frequent biting reduces comfort and growth rate of growing stock.
- Horn flies numbers of 50 or more per animal is consider an economic threshold.
- Face flies are physically on their hosts just long enough to feed on facial secretions.
- They do cause irritation, but effects of moderate numbers of flies on growth and production have been too weak to measure.
- Face flies are, however, important as vectors of bacteria and worms that cause eye diseases.

##### **Non-Chemical controls:**

- "Walk through" fly traps using the "inverted cone principle" for trapping flies are effective for horn

flies in pastures when properly placed. Some training of animals to walk through the trap may be necessary.

### **Chemical Control (General)**

- **Topical** insecticides are generally effective against horn flies, although resistance to pyrethroids (delivered widely with ear tags) is widespread in the North Central region.
- None of the available control methods are very effective against face flies, however some pour-ons used for other insects have enough effect to help justify expense of treatment
- Feed-through insecticides (aimed at the dung feeding larvae) are partially effective at controlling both of the pasture flies, as are non-chemical walk-through traps that trap flies that are physically on animals as they walk through such traps.

### **Back/Face rubber or Dust bag for horn and face flies and stable and house flies.**

#### **Organophosphates**

##### Coumaphos (Co-Ral)

- Use rate: 4 qt 5.8% Livestock Insecticide Spray ;
- 1 to 2 lb 25% WP, or
- 1 to 2 qt 11.6% EIL, or
- 1 pint 42% F/100 gal water.
- Co-Ral products are not used on animals under 3 months of age.
- No pre-slaughter waiting interval.

##### Tetrachlorvinphos/Dichlorvos (Ravap)

- Use rate: 1 gal (23% + 5.7%) EC/25 gal water, one gallon mixture covers 500 to 1,000 sq.ft. of surface.
- Applications repeated as needed.

##### Stirofos (Rabon 3%D) 4 to 8 bl /dust bag

- No preslaughter waiting period.

#### **Botanicals**

##### Permethrin (Atroban; Ectiban; Expar; Gardstar; Hard Hitter; Permethrin; Pounce)

- 0 days preslaughter
- 1 t/20 gal fuel or mineral oil

### **Topical “Knockdown” Insecticide Sprays for horn and face flies and stable and house flies:**

#### **Organophosphates**

##### Dichlorvos (Vapona)

- Use rate: 1 gal 43.2%/100 gal water.
- No pre-slaughter waiting period.
- Some use by producers

### **Topical “Residual” Insecticide Sprays (Pour-ons) for horn and face flies and stable and house flies: Producers are looking for long lasting products.**

#### **Pyrethroids**

##### Cyfluthrin (Countdown, Cylence) (POUR-ON)

- Used as a pour-on because of convenience (cattle are inside twice a day)
- When used as spray is used about once a month
- Use rate: 1.5 ml/100 lb body weight
- 0 days preslaughter
- Use in rotation with other insecticides specifically to retard resistance development

##### Permethrin (Atroban; Ectiban; Expar; Gardstar; Hard Hitter; Permethrin; Pounce)

- Use rate: for 0.1% residual spray,
- Apply no more often than once every two weeks.

##### Permethrin Synergized (Ready to Use)

- Use rate: undiluted
- 0 days preslaughter

### **Feed additive for horn and face flies and stable and house flies**

-Some producers avoid the use of feed additives because they fear it inhibits manure breakdown by beneficial insects

-Other producers question its efficacy because they don't see the dead flies

##### Methoprene (Altosid / Moormans IGR)

- 0 days pre slaughter
- Use from May through August
- 0.25 to .5 lb/100 lb body wt

Rabon (stirofos)

- 0 days preslaughter
- 70mg a.i./100 lb body wt

### **Bolus for horn and face flies and stable and house flies**

Diflubenzuron (Vigilante)

- 0 days preslaughter
- 1 bolus/550 to 1100 lb body wt
- Controls horn flies and face flies, but not stable flies.
- Only one producer had experience with this method and it didn't work well

### **Manure Sprays for horn and face flies and stable and house flies:**

Dichlorvos (DDVP; Vapona)

- Use rate: 1 gal 43.2%/50 gal water, 1 or 2 qt mixture covers 100 sq. ft. of surface.

Tetrachlorvinphos (Rabon.)

- Use rate: 4 lb 50% WP/25 gal water, one gallon mixture/100 sq. ft. of manure pile surface.

Tetrachlorvinphos/(1) Dichlorvos (Ravap)

- Use rate: 1 gal (23% + 5.7%) EC/25 gal water, one gallon mixture/100 sq.ft. of manure pile surface.

### **Fly Baits for horn and face flies and stable and house flies**

#### **Other MOA**

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

- All but Fly Patrol, contain non-food house fly aggregation attractants called (z)-9-tricosene, Muscamone, or Tricolure.

### **Ear tags and tape for horn and face flies and stable and house flies:**

- All ear tags have a 0 days pre-slaughter interval. Pyrethroid ear tags are discouraged due to high levels of resistance in horn flies; may be used once every third or fourth season if necessary.
- Producers indicated that they work for a very short period of time.
- Ear tags with pyrethroids include Cutter Gold, Max-Con, Ear Tag Plus, Ectrin, Starbar, Vet Shack, Guardian, Apollo, Atroban, Ear Force, Ear Force Ranger, Expar Extra, Fearing Duflex, GardStar, InsectaGard, Python, and ZetaGard.

Cyfluthrin (Cylence1%)

Permethrin (Permethrin 10%CD)

Moxidectin (Cydectin) and eprinomectin (Eprinex) are used for internal parasites but may also effectively control horn flies for 2 to 4 weeks.

Ethion (Commando) and Fenthion (Cutter Blue) may control horn flies for 6 to 8 weeks.

### **Pasture (Biting flies: horse, deer, black, also midges and mosquitoes)**

#### **Life cycle and biology**

- Dairy cattle are also exposed to attack by a wide variety of blood feeding, aquatic biting flies. These biting flies include many species of horse flies and deer flies (Tabanidae), biting midges (Ceratopogonidae), mosquitoes (Culicidae), and blackflies (Simuliidae).

#### **Non Chemical Controls:**

- An Epps trap is useful for reducing the number of biting flies in pastures. Most recommendations call for one trap for every 40 acres of pasture.
- Flies in the first three families develop as larvae in mud or shallow, still water, whereas the blackflies develop in flowing water (creeks, streams and rivers). Source reduction is generally impractical.
- The tabanids and blackflies are reluctant to enter buildings, so cattle can be protected if given access to shelter.

#### **Chemical Control (General)**

- Treatments for other insects are partially effective for biting flies. Because these insects are secondary in importance this associated treatment is usually sufficient for adequate control.
- Topical insecticides and repellents can provide temporary relief, but are impractical on a commercial scale.

### **Spray treatments**

**Pyrethroids** for all biting flies.

Permethrin (Ectiban 5.7% 1qt/100gal water)

- 0 days preslaughter interval

- Do not apply more than every 14 days.

## **Grubs (heel flies)**

### **Life cycle and biology**

- Cattle grubs were once common in growing stock housed outdoors during summer.
- Adult grubs lay eggs on outdoor cattle during the heel fly season (early summer), and then the larvae burrow sub-dermally for the next 9-10 months, eventually erupting from the animals' backlines the next spring.

### **Distribution and Importance**

- Cattle grubs once caused substantial losses due to slaughter condemnation and hide injury. However, their prevalence has been greatly reduced through use of systemic insecticides administered in the fall.
- Not considered a problem for dairy cattle.
- Without insecticides damage and economic loss can be considerable, as animals are severely irritated by the flies and burrowing larvae.

### **Insecticides:**

## **Pour-on's and Spot-on's for grubs.**

### **Macrocyclic lactone**

#### Moxidectin (Cydectin Pour-On )

- Use rate: RTU, apply 1 ml/22 lb body weight along backline from withers to tailhead.
- No pre-slaughter waiting period.
- Not used on calves to be processed for veal.
- Moxidectin is an endectocide.

### **Avermectins**

#### Eprinomectin (Eprinex Pour-On)

- Use rate: RTU, apply 1 ml/22 lb body weight along backline from withers to tailhead.
- No pre-slaughter waiting period.
- Not used on calves under 8 weeks of age.
- Eprinomectin is an endectocide.

## **Ticks**

### **Life cycle and Biology**

- Dairy cattle in the southern tier of the North Central region and cattle pastured near woods can be attacked by ticks. Important species are the lone star tick, the American dog tick, and the black legged tick.

### **Distribution and Importance**

- Lone star ticks can reduce rate of gain in growing stock, and all are potential vectors of blood-borne pathogens. These three species are 3-host ticks that first feed on rodents. Consequently, exposure to ticks can be minimized by restricting grazing to cleared, brush free pastures, which are less suitable as habitat for the ticks' rodent hosts.

### **Chemical Control (General)**

- Area-wide or topical applications of acaricides can provide temporary reductions in tick infested habitats, but it is unclear if these practices would be economical for dairy producers

### **Triazapentadienes**

#### Amitraz (Tactic)

- Use rate: 1 qt 12.5% EC/100 gal water, use 2 gal/fully grown animal.
- No pre-slaughter waiting interval.

### **Pyrethroids**

#### Permethrin (Atroban; Ectiban; Expar; Gardstar; Hard Hitter; Permectrin; Permethrin; Pounce)

- Use rate:
- 

#### Permethrin Synergized Pour-On (Atroban; Back Side Plus; Expar; Permethrin)

- Use rate: undiluted of 1% permethrin plus Permectrin CDS Pour-On may be used in a mist spray applied to structural surfaces.

## **“TO DO” list**

List here the important research, education, or regulatory needs for the above insects and/or pesticide

controls.

### **RESEARCH**

Please list items of information you would like to know about any livestock insect or insect control that you don't know and that could be addressed through research programs.

- Is resistance caused by reducing insecticide rates?
- Does a heavy dew affect the effectiveness of an insecticide like Tempo?
- If a producer has resistant insects, will the level of resistance in a population drop the next season if the insecticide is discontinued?

### **REGULATORY**

List here any pipeline pesticides you would like to see registered or any current products you would like to see have their label expanded. Also list any other actions you would like to see the EPA take with regards to product registration or use.

- 

### **Education**

Please list items of information you would like to know about any livestock insect or insect control that you don't know and that could be addressed through education or extension programs. (I.e. the information probably already exists, you just don't have ready access to it.)

- We need a comprehensive, up-to-date, searchable web site database of currently registered products for use on lactating and non-lactating cattle. (Search by insect or product)
- Could use a dairy day (in MN) that helped producers identify insects early.
- Need an educational program to explain cost effectiveness of treating mites/lice.
- Do insects cause sores on animals or reduce healing of existing sores?

**Table 5. Pests Reported as Problems on Dairy Animals (1998 data for NC Region)**

<b>Pest</b>	<b>% of farms reporting</b>
Lice	47.8
Flies (Unspecified)	36.5
House fly	28.2
Horn fly	24.9
Stable fly	24.2
Horse fly	17.8
Blowflies	14.8
Mites	14.1
Ticks	13.5
Deer fly	7.6
Worms (Internal parasites)	6.7
Grubs	3.6
Other	7.4

## Weeds

There are a number of weeds which can cause problems for cattle. Their affects on cattle fall into three general categories; those which are poisonous or cause photosensitization, those which reduce feed consumption and forage quality, and those which impart an off-flavor to milk and meat. Included among plants which are poisonous or result in photosensitization of livestock are; **corn cockle** (*Agrostemma githago*), **pigweeds** (*Amaranthus* spp), **hemp dogbane** (*Apocynum cannabinum*), **marijuana** (*Cannabis sativa*), **water hemlock** (*Cicuta maculata*), **jimsonweed** (*Datura stramonium*), **horsetail** (*Equisetum arvense*), **white snakeroot** (*Eupatorium rugosum*), **white sweet clover** (*Melilotus alba*), **yellow sweet clover** (*Melilotus officinalis*), **pokeweed** (*Phytolacca americana*), **buttercups** (*Ranunculus* spp), **nightshades** and **bull nettles** (*Solanum* spp), **Johnsongrass** and **sorghums** (*Sorghum* spp), **cocklebur** (*Xanthium* spp), and **red, white and alsike clovers** (*Trifolium* spp). The toxic principals of these weeds includes production of hydroquinones, alkaloids, thiaminase, and glucosides. For some weeds the toxic principal is accumulation of nitrates (**pigweeds**) or the formation of prussic acid (**sorghum** spp). Depending on the amount consumed and other stress factors the livestock may experience the effects may range from minor to fatal.

All weeds reduce forage quality to some extent. By their very nature most weeds grow faster than the grass, legume, or grain crop in which they are found and will mature before the crop, resulting in coarse and less palatable forage at the time of harvest. Although some weeds, such as **pigweeds** and **dandelions** (*Taraxacum* spp), are touted as very palatable forage, their protein content is considerably less than that of a clover or alfalfa stand. One weed that is particularly onerous is **leafy spurge** (*Euphorbia esula*). This weed is very aggressive in taking over pasture and rangeland and is unpalatable to cattle. Such weeds, when found in great numbers, will reduce the production efficiency of livestock fed such forage. Weeds can also reduce feed consumption through other means. Thistles, such as **bull thistle** (*Cirsium vulgare*), **musk thistle** (*Carduus nutans*) and **Canada thistle** (*Cirsium arvense*) and other weeds which produce sharp spines or burs significantly reduce the palatability of hay and fodder fed to the animals and may reduce uptake of forage by injuring their tongue and mouth.

A number of weeds, when eaten by livestock, can cause off-flavors to be imparted to milk or meat. Most notable among such plants are **wild garlic**, (*Allium vineale*), **wormwood** (*Artemisia* spp), and

**yarrow** (*Achillea millefolium*). Although cattle will typically avoid such plants when grazing adequate pasture, they may very well consume these plants when other forage species are limited. This is also true of contaminated ensiled or baled forage when fed to cattle without alternatives. When milk is contaminated by off-flavor components it may be rejected by processors, resulting in significant losses to the dairy producer. Although the source of meat which has an off-flavor may be difficult to trace, once identified it may tarnish the reputation of the producer for some time and greatly restrict his ability to market animals.

Although a discussion of weed control will be left to the reports on alfalfa, wheat, pasture or whatever crop contains the weed, it is worth noting that the presence of weeds is so pervasive that it is nearly impossible to prevent some incidental consumption. Producers must therefore pay close attention to the quality of pastures and harvested forages, and strive to reduce the likelihood of animals receiving toxic doses. Prudent approaches will often necessitate the use of cultural, mechanical, and chemical means of control to effect minimal exposure.

## Cattle Buildings and Feedlots

### **Background:**

Buildings and feedlots can be an important part of livestock management in the North Central Region. Toward the southern portion of the region beef cattle are seldom housed inside. However, in the northern portion of the region beef cattle, because of the cold winter weather and brisk prairie winds, are housed more often. In addition, in cold weather cattle need large amounts of feed to stay warm, and dairy animals burn carbohydrates to maintain body heat, carbohydrates that otherwise would be used for milk production.

Feedlots play an essential role too. There are inefficiencies that attend cattle grazing range and pasture grasses that may be buried under snow or have been trampled or diminished greatly by overgrazing. Concentration of cattle near grain and feed storage permits cattle to receive a balanced ration of high quality feed. It also permits monitoring of herd health and enhances the ease with which breeding and gestation is monitored.

However, both buildings and feedlots result in concentration of insect pests of cattle as well. Not only do large numbers of animals attract these pests but unsanitary conditions in and around structures and pens often produce excellent breeding and reproduction conditions. Spilled feed, garbage, manure, standing water, and rotted hay or bedding are ideal sites for rearing several species of fly larvae and mosquitoes. In particular, stable flies, house flies, horn flies and face flies find these conditions optimal for rearing and reproduction. Although these flies are a considerable nuisance to cattle, they do not spend much actual time on the animal. Therefore, to effectively reduce the nuisance factor efforts should be focused more on elimination of breeding and rearing sites and less on controlling or avoiding the pest by treating the animal.

Effective sanitation is the key to insect pest reduction. Regular removal of manure and spilled feed is central to an effective pest reduction plan. Repairing feed bunks and upgrading flooring to concrete can make cleaning easier and more efficient. Channeling runoff and eliminating pools of standing water also reduces insect pest habitats. These factors, along with the use of insecticides where appropriate, can dramatically reduce pest numbers.

### **Control Methods of Building and Feedlot Insects.**

**Space sprays:** Space sprays are insecticides sprayed inside buildings used to house livestock. Typical applications require that doors and windows are closed when spraying occurs. Animals may or may not be removed from the enclosed building (see labels) during application but sprays should not be applied directly to cattle. Most of these sprays are "knockdown" sprays and their effectiveness is limited to a few hours or days.

### **Chemical control:**

A high percentage of producers contract with Orkin, or similar licensed applicators to apply insecticides to buildings and facilities. Producers may not know exactly what product is being applied but have greater confidence in the job being done in an effective and timely manner.

### **Organophosphates**

Dichlorvos (Vapona 40 2%EC )

- 2 qt to 1 gal/50gal water. Use 1pt to 1 qt /8000 cu ft. or 1000 sq ft.

Dichlorvos (Vapona Feedlot 43.2%EC)

- 1 gal/100 gal water. Use 5 gal/acre.

Naled (Dibrom 8E 58%EC)

- 1 pt 8E/20gal water. Use 5 gal/acre.

#### **Pyrethroids**

Permethrin (Ectiban, Hard Hitter, Insectiban 5.7%EC)

- 4 fl oz/1,000 cu ft.

Permethrin (Permethrin II 10% or Atroban 11%EC)

- 4 fl oz/1,000 cu ft.

#### **Botanicals**

Pyrethrin plus synergist

**Surface Residual Sprays:** Residual sprays are used on the interior of buildings to provide extended control of insect pests inside barns and cattle shelters. Insects are killed when they come in contact with coated surfaces. The insecticides used are intended to thoroughly cover walls, ceilings, and partitions. Residual insecticides are not to be applied to animals nor should animals be present in the building when sprays are applied. Milking rooms should not be treated with residual insecticide sprays.

#### **Pyrethroids**

Lambda-cyhalothrin (Grenade 10%WP or 9.7%ER)

Permethrin(Ectiban 25%WP or 5.7%EC, Atroban, Expar, Hard Hitter, Insectaban, Insectrin, Overtime, Permaban, PermethrinII)

- 6 oz 25%WP/11 gal water or 1qt 5.7%EC/12.5 gal water.
- Use 1 gal/750 sq ft.

Permethrin (GardStar 40%EC)

- 4 fl oz/10gal water

Cyfluthrin (Countdown 20WP, 2EC, or Tempo 20WP or 2SC)

#### **Organophosphates**

Diazinon (Dryzon 50%WP, other)

- 2 lb/25 gal water. Use 1 gal/350 to 750 sq ft.
- Do not use on dairy buildings.
- Keep animals out of building for 4 hours after spray.

Stirofos plus dichlorvos (Ravap 28.7%EC)

- 1 qt/6gal water. Use 1 gal/500 to 1,000 sq ft.

**Baits:** Baits are useful for house fly control. Surface residual sprays may be 'bait enhanced' through the addition of sugar or syrup to the spray mixture. Labels provide specific instructions for preparing bait mixtures. Baited sprays or granular baits should not be used in areas frequented by birds or domesticated animals.

#### **Other MOA**

Methomyl (Apache, Fly Bait Plus, Golden Malrin, Musca-cide, Tailspin 1% Dry Bait)

- 4 oz/1000 sq ft

#### **Organophosphates**

Trichlorfon (Dipterix 1% Dry Bait)

- 4 oz/1000 sq ft.

#### **Nicotinoids**

Imidacloprid (QuickBait 0.5% Dry Bait)

**Manure Spray:** Manure sprays are applied over the top of the manure droppings or concentrations. Insecticides used for manure sprays will control horn and face flies and stable and house flies that develop in manure, manure pits, lagoons, and stored bedding waste. Manure sprays should not be used where livestock may come in contact with the residual insecticides.

#### **Growth Regulators**

Cyromazine (Larvadex 5%SC)

- 1 qt/25gal water

- Use 1 gal/100 sq ft manure.

**Organophosphates**

Dichlorvos (Vapona 40.2%EC)

- 1 gal/100 gal water.
- Use 1 to 2 qt/100 sq ft manure.

Stirofos plus dichlorvos (Ravap 28.7%EC)

- 1 gal/25 gal water.
- Use 1 gal/100 sq ft manure.

**Feed Additives:** Feed additives are meant to inhibit the development of insect pests that develop in fresh manure, primarily face and horn flies. The insecticide passes through the animal and prevents the hatching and development of fly eggs laid in the manure. House and stable flies, which do not lay eggs in fresh manure, are not affected by feed additives.

**Growth Regulators**

Methoprene (Moorman's 0.02% IGR)

- 0.25 to 0.5 lb/100 lb body wt/animal/month
- 0 days preslaughter
- Use May through September

**Organophosphates**

Stirofos (Rabon 7.76% or 97.3% Oral Larvacide)

- 70mg ai./100 lb body wt/animal/day
- 0 days preslaughter
- Use May through September

**Biological Control Agents:** Biological control agents, specifically parasitic wasps (*Spalangia* spp) have shown some promise for control of house and stable flies. However, current research indicates that insufficient control is achieved with these parasitic wasps unless used in conjunction with sanitation and prudent insecticide use. There are no other biological controls that are sufficiently efficacious to mention.

-Biological control agents are not much used by producers.

**Traps:** There are numerous traps that may be used to reduce insect pest numbers. Traps tend not provide sufficient control of insects and are often species specific, requiring multiple methods of control for adequate management of insects on cattle. Because most traps work by attracting insects they work best in enclosed spaces where insect populations are finite. Improper placement of traps may draw more insects into cattle confinement areas, resulting in a worsening of the pest problem.

Traps attract insects through the use of scent or visual cues such as form or bright light. Once attracted to the trap insects may be held in the trap via sticky substances or by their failure to find their way back through a constricted entrance. A number of traps kill insects via an electrocuting grid.

-Traps are not much used by producers.

**Diatomaceous earth:** Diatomaceous earth and abrasive dusts, such as silicates, are also used for insect control. They work by scaring the insect exoskeleton, the cuticle, resulting in body fluid leakage and dehydration. Abrasive dusts work best where insects can come into repeated contact with the material. Dusts can be used directly on most animals and on buildings and pens, as there is a high degree of safety with these products. Generally, abrasive dusts are less effective than synthetic pesticides and are therefore used to augment other practices.

-Diatomaceous earth is not much used by producers.

Table 6. Dairy Pesticide Use by Class(1998 Survey of the NC Region)

Pesticide Class	Active Ingredients	% of Animals Treated	Target Pests
Growth Regulators	methoprene diflubenzuon	0.9	all flies

Avermectins	doramectin eprinomectin ivermectin moxidectin	18.7	grubs scabies lice internal worms lungworms mites lice horn fly
Benzimidazoles	albendazole fenbendazole thiabendazole oxyfendazole	1.2	tapeworms lungworms liver flukes roundworms
Acetylcholine mimics (Imidothiazoles, Pyrimidines)	morantel tartrate levamisole	3.1	roundworms lungworms
Pyrethroids	cyfluthrin fenvalerate flucythrinate lambda-cyhalothrin permethrin pyrethrin zeta-cypermethrin	31.1	all flies lice ticks mosquitoes
Organophosphates	chlorpyrifos clorsulon coumaphos diazinon dichlorvos enthion famphur fenthion malathion pirimiphos-methyl stirophos trichlorfon	14.6	grubs mites all flies lice ticks mosquitoes
Chlorinated Hydrocarbons	methoxychlor	0.4	horn fly face flies lice mites
Other		4.7	
Multiple Products		0.2	

Please read [text](#) for a description of insecticide methods of application.

Please read [text](#) for a description of insecticide active ingredients, product names, target pests, and restrictions.

Please view [table](#) for information on insecticide use rates based upon North Central Region dairy averages.

Please view [table](#) for comparing active ingredient methods of application based upon North Central Region dairy averages.

Please view [table](#) for comparing popularity of different methods based upon North Central Region dairy averages.

Please view [table](#) for state comparisons of active ingredient use.

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## Appendix

The appendix contains...

Table A. Specific products applied to dairy herd animals.

Table B. Application Methods for Pesticides Applied to Dairy Animals

Table C. Pests Reported as Problems on Dairy Animals

A description of insect pests and their impact on dairy animals.

A description of weed pests and their impact on dairy animals.

Table A. **Specific Products Applied to Dairy Herd Animals** (1998 data for NC Region)

Class	Active Ingredient	Products	Method	A.I. Rate (Total g / head)	# Uses per Season	% Animals Treated
<b>Growth Regulators</b>		<b>ALL</b>				<b>0.9</b>
	methoprene	IGR Cattle Mix	Feed additive	0.76	4.4 mo	0.8
<b>Avermectins</b>		<b>ALL</b>				<b>18.7</b>
	doramectin	Dectomax	Pour-on	0.32	1.0	1.2
	eprinomectin	Eprinex	Pour-on	0.73	1.2	10.2
	ivermectin	Ivomec	Pour-on	0.28	1.4	4.2
		Ivomec	Injection	0.12	1.0	2.4
<b>Benzimidazoles</b>		<b>ALL</b>				<b>1.2</b>
	albendazole	Valbazen	Oral			
	fenbendazole	Panacur Safeguard	Crumbles (feed additive)	13.86	1.4	0.9
<b>Acetylcholine mimics</b>		<b>ALL</b>				<b>3.1</b>
	morantel tartrate	Rumatel	Feed additive	5.22	1.4	2.4
<b>Pyrethroids</b>		<b>ALL</b>				<b>31.1</b>
	cyfluthrin	Cylence	Pour-on	0.41	2.9	6.7
	permethrin	Total				16.6
		Atroban DeLice Durasect Expar Insectaban Insectrin Permethrin Permethrin II Synergized Delice	Body Spray	3.56	6.6	1.4
		Ectiban Insectrin Permethrin II Synergized Delice	Aerosol Coat Spray	9.36	67.8	1.0
		Ectiban Insectrin	Dust	44.76	4.0	0.3
		ALL Pour-ons		3.48	2.8	11.3
		Boss	Pour-on	4.84	2.5	1.2
		DeLice	Pour-on	3.05	2.6	3.4
		Durasect	Pour-on	3.30	2.6	1.8

		Expar	Pour-on	3.52	2.8	0.6
		Permethrin	Pour-on	5.07	3.2	1.0
		Synergized Delice	Pour-on	2.53	3.0	2.1
		Backside Brute Ectiban Hard Hitter Permethrin CD	Pour-on	3.79	3.8	1.2
		Ectiban Expar Insectaban Insectrin Permethrin CD Permethrin II Synergized Delice	Oiler/scratcher	2.76	3.9 mo	2.1
<b>Botanicals</b>						
	pyrethrins (synergized)	Total	Aqueous Coat Sprays and Aerosols	2.19	45.6	6.8
		LD-44z	Aerosol Coat Spray		54.9	0.4
		Various	Aqueous Coat Sprays and Aerosols	2.06	45.1	6.4
<b>Organophosphates</b>		<b>ALL</b>				<b>14.6</b>
	coumaphos	Co-Ral	Body spray	5.21	13.8??	0.6
		Co-Ral Zipcide	Dust	1.20	3.4	3.5
		Co-Ral Zipcide	Dust bag	1.61	3.9 mo	2.6
	dichlorvos	Vapona Vapona Plus PyVap	Coat Sprays and Aerosols	76.0	37.4	1.4
	famphur	Warbex	Pour-on	12.91	1.3	0.7
	stirophos (tetrachlorvinphos)	Rabon Oral Larvicide	Feed additive	106.2	4.2 mo	2.2

\* Month indicates the length of time the cattle were exposed to self applicator.

Table B shows the relative frequency of various application methods for each active ingredient. (To reduce the bias associated with small sample sizes, only active ingredients that were reported by at least 9 producers are shown.) The patterns shown here are not unexpected, given the modes of action and the target pests, but they deserve some comment by way of explanation. The growth regulators are administered continuously in feed rations, or sometimes as a bolus. The avermectins are mostly applied as pour-ons, with a smaller percentage applied as injections. The applied amount necessary to get a therapeutic dose into the animal is, of course, less with an injectable than with a pour-on. Almost all of the wormers are administered orally in one form or another; levamisole being the only exception. On the other hand, almost all of the pyrethroids and organophosphates are externally applied. The most notable exception to this is the use of stirophos as a feed or mineral additive. In this case, it is used as a manure larvicide rather than as a direct fly treatment.



	dichlorvos	87		13											
	ethion						100								
	famphur				100										
	fenthion				76		24								
	malathion	71	19			10									
	pirimiphos-methyl						100								
	stirophos		3			7	1						89		
	trichlorfon				100										
	<b>other</b>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	amitraz	100													
	methoxychlor		82			18									
	rotenone		100												
	Unknown	23	14	10	17	14	5	16		1					