

# Crop Profile for Dairy Cattle Production in US (North Central Region)

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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.

## Production Statistics: Milk Cow Inventory

Source: National Agricultural Statistic Service (January, 1998)

Rank	State	(1,000 Head)	Production (mil#)	(with herd sizes of)					
				Total Operations	0-29	30-49	50-99	100-199	200+
1	Wisconsin	1,380	22,368	25,000	4,600	8,500	9,400	2,000	500
2	California	1,350	27,582	2,800	500	40	120	290	1,800
3	New York	700	11,530	9,000	1,700	1,900	3,600	1,300	500
4	Penn	638	10,662	11,300	2,400	3,800	3,800	1,100	200
5	Minnesota	570	9,210	10,500	1,900	3,800	3,700	850	250
6	Texas	380	5,768	3,500	1,600	200	400	600	700
7	Michigan	298	5,410	4,200	1,100	900	1,100	850	250
8	Idaho	280	5,193	1,400	400	160	270	250	320
9	Ohio	270	4,415	6,000	3,100	800	1,400	580	120

10	Washington	260	5,305	1,400	540	70	130	290	370
11	Iowa	240	3,693	4,500	1,300	1,200	1,500	420	80
13	Missouri	160	2,362	4,500	1,900	830	1,100	600	70
16	Illinois	145	2,203	2,400	530	500	1,000	320	50
18	Indiana	140	2,189	3,400	1,900	550	630	260	60
22	S. Dakota	101	1,384	2,000	NA	NA	NA	NA	NA
29	Kansas	79	1,285	1,500	NA	NA	NA	NA	NA
32	Nebraska	70	1,040	1,500	NA	NA	NA	NA	NA
34	N. Dakota	48	713	1,300	NA	NA	NA	NA	NA
United	States	9,191	156,091	123,700	39,070	27,285	35,850	14,040	7,455

## 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 herdsmen, 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.

### **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.

### Dairy Herd Pesticide Application Method Summary

	% of Animals
Sprays and Aerosols	12.8
Dusts and Dust bags	8.7
Pour-ons	37.1
Ear tags	1.3
Oilers/ Scratchers	3.8
Oral	0.4
Feed/Mineral Additive	7.2
Injection	2.9

### Top Ten Insecticide Active Ingredients Used for Dairy Animals in the North Central Region

Rank	Active Ingredient	% of Animals	Classification of Active Ingredient
1	permethrin	16.6 %	Pyrethroid
2	eprinomectin	10.2 %	Avermectin
3	pyrethrins	6.8 %	Pyrethroid
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

### Dairy Pesticide Use by Class

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 mange mites
Organophosphates	chlorpyrifos clorsulon coumaphos diazinon dichlorvos enthion famphur fenthion malathion pirimiphos-methyl stirophos trichlorfon	14.6	grubs mites all flies lice ticks mosquitoes mange mites
Chlorinated Hydrocarbons	methoxychlor	0.4	horn fly face flies lice mites mange mites
Other		4.7	
Multiple Products		0.2	
No Pesticide Applications		22.1	

## Insect Pests

Different kinds of invertebrate pests are associated with dairies in the North Central Region. These include parasitic insects, mites and worms, any of which can reduce the comfort of the animals, affect their appearance, or reduce their rates of growth, lactation and feed conversion efficiency.

Prominent wintertime pests on dairy cattle are lice and mites. **Lice** include three blood sucking species and one chewing species. 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. 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. Fortunately, the problematic species on dairy cattle (and beef cattle) do not occur on other domesticated animals, wildlife, or birds. Consequently, if a dairy 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. 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.

Summertime pests include different kinds of parasitic, gastrointestinal worms that can cause clinical and subclinical disease. These worms reduce digestion efficiency and growth. The worms are transmitted by the ingestion of infective larvae on herbage in fecally contaminated pasture. Cattle housed in dry-lots or indoors are much less exposed to infection. Abomasal worms are also transmitted by the ingestion of contaminated forage, but wintertime expression of disease in confined settings is greater than with the other gastrointestinal parasites, because of potential for carryover from the previous grazing season. Anthelmintics can reduce internal parasite burdens, and in turn reduce rate of pasture contamination. If coupled strategically with pasture rotation, it is possible to minimize disease caused by these pasture borne parasites.

**Tapeworms** are transmitted when cattle ingest feed that is contaminated with an oribatid mite that is the intermediate host for the immature tapeworms. The oribatid mite occurs in all styles of housing. Cattle are also intermediate hosts for other tapeworms that occur in muscle, and can lead to condemnation at slaughter. Prevalence of tapeworms and effects on cattle health in the North Central region are not well documented. Cattle flukes can occur in animals that graze in marshy areas. Fluke eggs are shed in feces, larvae infect and develop in snails, and then exit to grass where they encyst before being ingested by grazing cattle. Flukes have a significant impact on cattle growth and productivity. Transmission is prevented if cattle are prevented from grazing on marsh grass.

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. Nonetheless, 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. Stable fly attacks cause noticeable irritation (leg stamping, tail switching and bunching) and measurable reductions in growth rate, feed conversion and lactation. House flies, in contrast, are known to annoy workers and nearby residents, but they have not been shown to affect animal performance. Residual premise sprays and space fogs can be useful, but are a supplement to, and not a substitute for, breeding site (debris) management. Resistance in stable flies has yet to be detected, but levels of resistance in house flies to some organophosphate and pyrethroid insecticides is common.

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. Their frequent biting reduces comfort and growth rate of growing stock. 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 lactation have been too weak to measure. Face flies are, however, important as vectors of bacteria and worms that cause eye diseases. Topical insecticides are generally effective against horn flies, although resistance to pyrethroids (delivered with ear tags) is widespread in the North Central region. However, this primarily affects beef cattle as

dairy producers are reluctant to tag dairy cattle. In contrast, none of the available control methods are very effective against face flies. 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.

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)**. 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.

Topical insecticides and repellents can provide temporary relief, but are impractical on a commercial scale. The tabanids and blackflies are reluctant to enter buildings, so cattle can be protected if given access to shelter. Window and door screens will exclude mosquitoes and biting midges, which will enter buildings during darkness.

**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. 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 fall. Grubs were never abundant among dairy cattle housed indoors, because egg laying adults are reluctant to enter buildings.

Dairy cattle in the southern states of the North Central region can be attacked by **ticks**. Important species are the lone star tick, the American dog tick, and the black legged tick. 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. 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.

**Table C. 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
Mange 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*), marihuana (*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*), poke (*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 at very palatable forage, their protein content is considerably less than that of a clover or alfalfa stand. 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 (*Cirsium* spp) 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.

### Dairy Pesticide Use by Class

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 mange
Organophosphates	chlorpyrifos clorsulon coumaphos diazinon dichlorvos enthion famphur fenthion malathion pirimiphos-methyl stirophos trichlorfon	14.6	grubs mites all flies lice ticks mosquitoes mange
Chlorinated Hydrocarbons	methoxychlor	0.4	horn fly face flies lice mites mange
Other		4.7	
Multiple Products		0.2	
No Pesticide Applications		22.1	

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.

## Contacts

Purdue University

[Fred Whitford](#) , PIAP state liaison for Indiana, ph. # (765/494-1284)

University of Illinois

[David R. Pike](#) , PIAP state liaison for Illinois, ph. # (217/333-9648)

University of Minnesota

[Roger Moon](#) , Livestock entomologist for Minnesota, ph. # (612/624/2209)

University of Nebraska-Lincoln

Steven R. Skoda, ph. # (402/437/5267)

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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 Permectrin Permectrin II Synergized Delice	Body Spray	3.56	6.6	1.4
		Ectiban Insectrin Permectrin 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
		Permectrin	Pour-on	5.07	3.2	1.0



<b>growth regulators</b>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
methoprene												100		
diflubenzuron												*	100	
<b>avermectins</b>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
doramectin				83										17
eprinomectin				100										
ivermectin				64									*	36
moxidectin				100										
<b>benzimidazoles</b>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
albendazole									100					
fenbendazole								19		5		75		
<b>acetylcholine mimics</b>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
levamisole				70									30	
morantel tartrate													100	
<b>pyrethroids</b>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cyfluthrin				99									1	
fenvalerate	63								37					
flucythrinate									100					
lambda cyhalothrin									100					
permethrin	14	1	1	71	1			2	10					
pyrethrins	46			51	1				2					
zeta-cypermethrin								100						
<b>organophosphates</b>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
chlorpyrifos				100										
clorsulon														100
coumaphos	16	42		2	33				7					
diazinon									100					
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	

