

Crop Profile: Dairy Livestock in New York

I. Profile Prepared by:

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II. Basic Commodity Information

State Rank: 3

% U.S. Production: 6.99% of milk cows; 7.69% of dairy products sales; 5% total calves and cattle sales

Number of Milk Cows: 701,000 head

Pounds Milk Produced: 11.7 billion

Cash Value: \$1.79 billion

Yearly Production Costs: \$14.52/cow tmilk

Production Regions: Statewide

Production Methods: The main housing options for dairy cows and their replacements are freestall barns, tie stall barns, loose housing or bedded-pack barns, outside corrals or feed lots, and pasture. Housing facilities for young stock should include a clean, dry maternity area for birth, a hutch or pen, and a weaning pen or super hutch which can hold 3-5 calves. A proper ventilation system is necessary in the barns to continuously exchange air. A proper manure handling and storage system must be coordinated with cow numbers, cropland acres, crop nutrient needs, and weather.

Cornell undertook a survey of the dairy industry in New York in 1997. New York state dairy producers, for the most part, managed their milking herds in stanchion barns with access to pastures. Scraping was the primary method of cleaning barns to remove manure. Manure removal was once or twice per day. Indoor pens with manure removal once per day were the primary method of housing and cleaning out calves. These practices were consistent with those reported in the 1991 survey (Partridge et al, 1992) of NYS dairy producers.

Flies on pastured cattle were indicated as the pests causing an economic loss to their operations in NYS. Flies in and around the barn were ranked second highest. These pests were also ranked as the most difficult to control with currently registered active ingredients. Presence of pest and animal discomfort were the main criteria for determining when to use pesticides on their dairy animals. The majority of survey respondents reported that past success, farm supply dealer, and veterinarian recommendations were their primary criteria for determining what pesticides to use against pests. Disappointingly, Cooperative Extension did not rank very highly as an information source that New York dairy producers were utilizing. This is a lower ranking than in the 1991 survey.

Fly baits were primarily used for fly control in and around the barn. Space sprays were the next most popular method of control. Products that contained permethrin or pyrethrins plus synergist were used against flies, lice and mites by a significant portion of respondents. Most producers did not use oral formulations or residual sprays for fly control in and around the barn. A number of survey respondents used pyrethrin plus synergist formulations in the milk room for fly control. Permethrin animal sprays were used the most for fly control on pastured cattle and for louse and mite control.

According to Geden and Rutz (1991), the house fly has developed very high levels of resistance to the insecticides available (registered) for its control. Therefore, dairy producers are in need of alternative methods for improved pest suppression. Fly control on farms using a combination of parasitoid releases, frequent bedding/manure removal and avoidance of insecticides that are harmful to the parasitoids has been shown to be twice as effective as on conventionally managed farms, while reducing insecticide usage by 80% (Geden and Rutz, 1991). In addition, cost to the dairy producer for increased frequency of removal of manure/bedding has been shown to be minimal while reducing or eliminating the cost of insecticides (Lazarus, et al., 1989).

New York dairy producers practiced some form of alternative, non-chemical pest control. Manure management was the most frequently indicated method used. A significant number of producers were also using fly ribbons and baited traps for control of flies. A comparison of data from the 1991 dairy survey to this survey indicated that producers still show an interest in the use of biocontrols such as predators and parasites, but use of these controls has remained the same. During 1997, most New York dairy producers spent between \$100.00 and \$299.00 annually for fly control and between \$50.00 and \$99.00 for other pests, such as lice, mange, cattle grubs, gnats and ticks. This cost is similar to the 1991 survey. Chemical fly control costs have remained the same, while cost for other pest control (i.e. lice, mange, cattle grubs, gnats and ticks) has increased.

Commodity Destination(s):

Fed to calves.....130 million pounds
 Consumed as milk, cream
 and butter.....17 million pounds
 Sold wholesale11.5 billion pounds
 Retailed by producers12 million pounds

III. Pest Information: Insects**1. House Flies**

Type of Pest: Insect

Frequency of Occurrence: Annual --- May through October

Damage Caused: Severe house fly infestations may increase bacterial counts in milk, and state inspectors routinely note fly abundance in milk rooms. Flies can also become a serious nuisance both around the production facility and in nearby communities. Demographic changes in the Northeast in recent years have placed many once isolated dairy producers in closer proximity to their neighbors. These new neighbors often are intolerant of flies, putting greater pressure on producers to keep house fly populations to a minimum.

% Animals Affected: 100% of confined animals

Pest Life Cycles: House flies, *Musca domestica*, are nonbiting insects that breed in animal droppings, manure piles, decaying silage, spilled feed, bedding, and other organic matter. They can complete their life cycle from egg to adult in 10 days under ideal conditions in summer months. Each female can produce 150 to 200 eggs, which she lays in batches at 3- to 4-day intervals. Although house flies may be of only minor direct annoyance to animals, their potential for transmitting diseases and parasites is considerable.

Timing of Control: When monitoring with spot cards and number of spots is >100/card/week

Yield Losses: None documented

Regional Differences: None

Cultural Control Practices: A variety of cultural control practices are used effectively to manage house flies and stable flies.

Sanitation -- The fly life cycle requires that immature flies (eggs, larvae, pupae) live in manure, moist hay, spilled silage, wet grain, etc, for 10 to 21 days. Removing and spreading fly breeding materials weekly helps to break the cycle. Waste management is therefore the first line of defense in developing an effective fly management program. It is much easier and less costly to prevent a heavy fly build up than to attempt to control large fly populations once they have become established.

The prime fly sources in confinement areas are animal pens, especially those housing calves. The pack of manure and bedding under livestock should be cleaned out at least once a week. In free-stall barns the next most important fly breeding area is the stalls, which should be properly drained and designed to encourage complete manure removal. In stanchion barns, drops should be cleaned out daily. Wet feed remaining in the ends of the mangers, as well as green chop and other forage and feed accumulations around silos, breed flies and should be cleaned out at least weekly.

Sticky tapes, paper, ribbons. Sticky ribbons, especially the giant ones, are very effective for managing small to moderate fly populations. Their only disadvantage is that they need to be changed every 1 to 2 weeks because they dry out, get coated with dust, or get "saturated" with flies.

Maintenance of a fly-free zone in the milk room. Sometimes fly location is more important than total fly numbers on the farm. Installing and maintaining tightly closed screen doors and windows to the milk room can greatly reduce fly numbers in this sensitive area. Keeping traffic in and out of the milk room to a minimum will help as well. The occasional flies that still get in can be controlled with sticky tapes, light traps, or careful use of insecticides (discussed below under Chemical Control).

Prevent flies from emigrating from the facility. Again, farm location can be important, especially if housing and commercial developments have been built near the farm. Certain management practices can reduce fly breeding outdoors.

Spreading manure and bedding as thinly as possible will help ensure that it dries out quickly. If practical, it should be disked under as well to help kill fly larvae and pupae that may be present, especially if cool or overcast weather will slow the drying process. Drainage problems that allow manure to mix with mud and accumulate along fence lines in exercise yards should be eliminated. Gaps under feed bunks where moist feed can accumulate should be sealed.

Biological Control Practices: Female flies lay their eggs on manure, calf bedding, wet feed, or silage. The larvae hatch, and the maggots develop for about a week before they reach the pupal stage. Inside the pupa, which is protected by a hard reddish-brown shell, the developing fly goes through the metamorphosis from maggot to fly.

Flies have "natural enemies" that are commonly present in livestock barns. Beetles and mites devour fly eggs and larvae, adult flies are prone to diseases, and fly pupae are attacked by small parasitic wasps (parasitoids). Unnoticed and unaided by us, these natural biocontrol agents can take a heavy toll on the fly population.

Parasitoids are among the most important of these natural biocontrol agents. About a dozen species occur throughout the United States. Some species perform better in different climates, and some prefer different kinds of manure and other fly breeding materials. The species best adapted to dairy farms in the Northeast is *Muscidifurax raptor*. This versatile species attacks fly pupae inside barns as well as outside, and accounts for most of the naturally occurring parasitoids on our dairy farms.

Parasitoids are like "smart bombs" that live only to find and to kill fly pupae. Although the female parasitoid has a stinger, she cannot use it for anything except killing flies. When she finds a fly pupa, she first stings and feeds on it. This kills the fly. She then uses her stinger to lay an egg inside the pupa. The egg hatches and the parasitoid larva feeds on the dead fly. The young adult parasitoid then chews its way out of the fly's pupal case and resumes the search for new pupae to kill. Development from egg to adult parasitoid is completed in about 3 weeks.

Evolution has led to a natural balance that allows both the parasitoid and the fly to coexist. If we think of the fly and the parasitoid as competitors in a race each summer, the fly has certain advantages that help it to "win" unless we intercede to level the playing field. For example, the fly develops twice as fast from egg to adult, lives longer, and lays more eggs than *Muscidifurax raptor* parasitoids. As fly populations begin to grow in late May and early June, the parasitoid populations lag behind. The result is that the parasitoid population is usually behind that of the fly by several weeks.

The parasitoid also lags behind the fly in developing resistance to insecticides. Many insecticide treatments for the fly therefore have the undesirable side effect of killing large numbers of parasitoids. If you use insecticides highly toxic to natural enemies in the early summer, you can get stuck on a "pesticide treadmill." Each subsequent insecticide treatment kills more beneficial insects and creates conditions that require repetitive treatments to keep flies in check. This also aggravates the problem of insecticide resistance in the flies.

Parasitoid populations can be conserved by using insecticides that are compatible with these important biocontrol agents. Methomyl scatter baits and pyrethrin space sprays are good examples of compatible insecticides. Residual premise sprays such as permethrin, dimethoate, and rabon are highly toxic to parasitoids and should be used only as a last resort for dealing with occasional fly outbreaks.

Other Issues: Litigation, high levels of insecticide resistance, potential contamination of milk.

Chemical Controls: Insecticides can play an important role in integrated fly management programs. Chemical control options include space sprays, baits, larvicides, residual premise sprays, and whole-animal sprays.

Space sprays with synergized pyrethrins or a combination of dichlorvos and synergized pyrethrins provide a quick knockdown of adult flies in an enclosed air space. Because space sprays have very little residual activity, resistance to these insecticides is still relatively low in fly populations in the Northeast. Scatter baits containing the insecticide methomyl are also very useful for managing moderate fly populations. As indicated previously, space sprays and baits are compatible with fly parasitoids.

A number of insecticides are labeled for use as larvicides, either for direct treatment of manure or in controlled-release formulations. Direct application of insecticides to manure and bedding should be avoided in general, because of harmful effects on beneficial insects. The only exception is occasional spot treatment of breeding sites that are heavily infested with fly larvae but that cannot be cleaned out. Controlled-release larviciding options include boluses and feed additives that result in the insecticide's being excreted with animal feces.

Treatment of building surfaces with residual sprays such as permethrin, dimethoate, naled, and rabon has been one of the most popular fly control strategies over the years. High levels of resistance to these insecticides are now very common. These materials should be used sparingly and only as a last resort to control fly outbreaks that cannot be managed with other techniques.

Milk rooms represent a special case. Because sanitary codes restrict insecticide use in milk rooms, the only chemical treatments recommended are space sprays with synergized pyrethrins (read label carefully regarding protection of milk and milk handling equipment) and placement of Vapona strips. *Use of sticky ribbons and cultural practices that restrict fly entry into the milk room can greatly reduce the need for insecticidal treatment in the milk room.*

2. Stable Flies

Type of Pest: Insect

Frequency of Occurrence: Annual -- May through October

Damage Caused: Cattle are most irritated by these pests during the warm summer months. Both male and female stable flies feed on blood several times each day, taking one or two drops at each meal. Stomping of feet is a good indication that stable flies are present, since they normally attack legs and bellies. Production performance declines in infested herds because of the flies' painful biting activity and animal fatigue from trying to dislodge flies.

% Animals Affected: 100%

Pest Life Cycles: The stable fly, *Stomoxys calcitrans*, is about the size of a house fly but is dark gray. Its abdomen has seven rounded dark spots on the upper surface. The adult's piercing mouthparts protrude spearlike from under the head. Stable flies breed in wet straw and manure, spilled feeds, silage, grass clippings, and in various other types of decaying vegetation. Each female fly lives about 20 to 30 days and lays 200 to 400 eggs during her lifetime. Under optimum conditions, an egg develops to an adult in about 3 weeks.

Timing of Control: Counts of flies on lower legs >10 indicates need for control measures.

Yield Losses: loss in milk production and weight gain

Regional Differences: None

Cultural Control Practices: A variety of cultural control practices are used effectively to manage house flies and stable flies.

Sanitation -- The fly life cycle requires that immature flies (eggs, larvae, pupae) live in manure, moist hay, spilled silage, wet grain, etc., for 10 to 21 days. Removing and spreading fly breeding materials weekly helps to break the cycle. Waste management is therefore the first line of defense in developing an effective fly management program. It is much easier and less costly to prevent a heavy fly build up than to attempt to control large fly populations once they have become established.

The prime fly sources in confinement areas are animal pens, especially those housing calves. The pack of manure and bedding under livestock should be cleaned out at least once a week. In free-stall barns the next most important fly breeding area is the stalls, which should be properly drained and designed to encourage complete manure removal. In stanchion barns, drops should be cleaned out daily. Wet feed remaining in the ends of the mangers, as well as green chop and other forage and feed accumulations around silos, breed flies and should be cleaned out at least weekly.

Sticky tapes, paper, ribbons. Sticky ribbons, especially the giant ones, are very effective for managing small to moderate fly populations. Their only disadvantage is that they need to be changed every 1 to 2 weeks because they dry out, get coated with dust, or get "saturated" with flies.

Maintenance of a fly-free zone in the milkroom. Sometimes fly location is more important than total fly numbers on the farm. Installing and maintaining tightly closed screen doors and windows to the milk room can greatly reduce fly numbers in this sensitive area. Keeping traffic in and out of the milk room to a minimum will help as well. The occasional flies that still get in can be controlled with sticky tapes, light traps, or careful use of insecticides (discussed below under Chemical Control).

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Biological Control Practices: Female flies lay their eggs on manure, calf bedding, wet feed, or silage. The larvae hatch, and the maggots develop for about a week before they reach the pupal stage. Inside the pupa, which is protected by a hard reddish-brown shell, the developing fly goes through the metamorphosis from maggot to fly. Flies have "natural enemies" that are commonly present in livestock barns. Beetles and mites devour fly eggs and larvae, adult flies are prone to diseases, and fly pupae are attacked by small parasitic wasps (parasitoids). Unnoticed and unaided by us, these natural biocontrol agents can take a heavy toll on the fly population.

Parasitoid wasps are among the most important of these natural biocontrol agents. About a dozen species occur throughout the United States. Some species perform better in different climates, and some prefer different kinds of manure and other fly breeding materials. The species best adapted to dairy farms in the Northeast is *Muscidifurax raptor*. This versatile species attacks fly pupae inside barns as well as outside, and it accounts for most of the naturally occurring wasps on our dairy farms.

Parasitoid wasps are like "smart bombs" that live only to find and to kill fly pupae. Although the female parasitoid has a stinger, she cannot use it for anything except killing flies. When she finds a fly pupa, she first stings and feeds on it. This kills the fly. She then uses her stinger to lay an egg inside the pupa. The egg hatches and the

parasitoid larva feeds on the dead fly. The young adult parasitoid then chews its way out of the fly's pupal case and resumes the search for new pupae to kill. Development from egg to adult parasitoid is completed in about 3 weeks.

Evolution has led to a natural balance that allows both the parasitoid and the fly to coexist. If we think of the fly and the parasitoid as competitors in a race each summer, the fly has certain advantages that help it to "win" unless we intercede to level the playing field. For example, the fly develops twice as fast from egg to adult, lives longer, and lays more eggs than *Muscidifurax raptor* parasitoids. As fly populations begin to grow in late May and early June, the parasitoid populations lag behind. The result is that the parasitoid population is usually behind that of the fly by several weeks.

The parasitoid also lags behind the fly in developing resistance to insecticides. Many insecticide treatments for the fly therefore have the undesirable side effect of killing large numbers of parasitoids. If you use insecticides highly toxic to natural enemies in the early summer, you can get stuck on a "pesticide treadmill." Each subsequent insecticide treatment kills more beneficial insects and creates conditions that require repetitive treatments to keep flies in check. This also aggravates the problem of insecticide resistance in the flies.

Parasitoid populations can be conserved by using insecticides that are compatible with these important biocontrol agents. Methomyl scatter baits and pyrethrin space sprays are good examples of compatible insecticides. Residual premise sprays such as permethrin, dimethoate, and rabon are highly toxic to parasitoids and should be used only as a last resort for dealing with occasional fly outbreaks.

Other Issues: Annoyance to humans and animals, disease transmission, milk contamination

Chemical Controls: Insecticides can play an important role in integrated fly management programs. Chemical control options include space sprays, baits, larvicides, residual premise sprays, and whole-animal sprays.

Space sprays with synergized pyrethrins or a combination of dichlorvos and synergized pyrethrins provide a quick knockdown of adult flies in an enclosed air space. Because space sprays have very little residual activity, resistance to these insecticides is still relatively low in fly populations in the Northeast. Scatter baits containing the insecticide methomyl are also very useful for managing moderate fly populations. As indicated previously, space sprays and baits are compatible with fly parasitoids.

A number of insecticides are labeled for use as larvicides, either for direct treatment of manure or in controlled-release formulations. Direct application of insecticides to manure and bedding should be avoided in general, because of harmful effects on beneficial insects. The only exception is occasional spot treatment of breeding sites that are heavily infested with fly larvae but that cannot be cleaned out. Controlled-release larviciding options include boluses and feed additives that result in the insecticide's being excreted with animal feces.

Treatment of building surfaces with residual sprays such as permethrin, dimethoate, naled, and rabon has been one of the most popular fly control strategies over the years. High levels of resistance to these insecticides are now very common. These materials should be used sparingly and only as a last resort to control fly outbreaks that cannot be managed with other techniques.

Whole-animal sprays can be made directly on the animals to manage stable fly problems. Although this approach can provide needed relief from biting fly pressure, the control is rather short-lived.

3. Horn Flies

Type of Pest: Insect

Frequency of Occurrence: June through September

Damage Caused: Unlike most other flies, horn flies remain on the animals almost constantly, leaving only for very brief periods to lay eggs on very fresh (less than 10-minute-old) droppings. Development from egg to adult is completed in 10 to 20 days. The flies overwinter as pupae in or under dung pats. Horn flies can be a serious pest of pastured cattle by causing reduced milk production, poor weight gain, blood loss, and animal annoyance and fatigue.

% Animals Affected: >75% on pastured animals

Pest Life Cycles: The adult horn fly, *Haematobia irritans*, is about half the size of a house fly or stable fly. Both sexes have piercing mouthparts which they use to penetrate animal skin to obtain blood meals. Horn flies are intermittent feeders that take 20 or more small blood meals each day. The flies normally congregate on the shoulders, backs, and sides of the animals. During very hot or rainy weather the flies move to the underside of the belly.

Timing of Control: Counts on lactating animals >50/animal; non-lactating >200/animal constitutes need for control

Yield Losses: loss in milk production and weight gain

Regional Differences: None

Cultural Control Practices: See cultural control under face flies.

Biological Control Practices: Biological control against these pests at present is limited to beneficial organisms that occur naturally in the field. Face flies are attacked by parasitic nematodes, and immature stages of both horn flies

and face flies are attacked by predaceous mites, predaceous beetles, and parasitic wasps (parasitoids). Manure competitors such as dung beetles also limit fly populations by removing and burying cattle dung before immature flies can complete their development. Adult flies are attacked by predaceous yellow dung flies.

In spite of the diversity and importance of natural enemies of face flies and horn flies, methods are not known for exploiting these biological control agents in pest management programs. Parasitoid releases for house fly and stable fly control are not effective against these pasture pests.

Other Issues: high levels of insecticide resistance

Chemical Controls: Insecticidal control options for horn flies and face flies include whole-animal sprays, self-applicating devices, feed-through insecticides and growth regulators, and controlled-release devices, such as ear tags and tapes.

Whole-animal sprays provide rapid relief from fly pressure. Animal sprays are applied either as a dilute coarse spray, often applied under high pressure to soak the skin, or as a fine low-volume, more concentrated mist.

Self-applicating devices include back rubbers covered with an absorbent material treated with an insecticide-oil solution, or dustbags filled with an insecticidal dust. Back rubbers and dustbags should be placed in gateways, near water and feed sources, and in other areas where animals will make frequent contact with them.

Feed-throughs include insecticidal feed additives, treated mineral blocks, and bolus formulations. These treatments are generally less effective for face flies than for horn flies. In either case, feed additives have no effect on adult flies that are already present or that may immigrate from neighboring farms. Unless a farm is very isolated or participating in an area-wide management program, feed-throughs may not provide satisfactory fly suppression.

Controlled-release ear tags and tapes are generally very effective for horn fly control in the Northeast, and they often reduce face fly pressure as well. Because these products have not been used extensively in the Northeast, insecticide resistance is not a major concern at present. But in other parts of the country, high levels of resistance have developed in horn flies to pyrethroids such as permethrin, fenvalerate, resmethrin, and flucythrinate. You can prevent horn fly resistance from becoming a serious problem by following guidelines developed by a panel of experts in the field. These guidelines include the following:

- Do not treat unless flies exceed threshold levels.
- Use organophosphate insecticides, such as racion or coumaphos, for early-season horn fly control, and reserve ear tags for late summer use.
- Remove ear tags in the fall to reduce development of resistance to low levels of pyrethroids.

Although ear tags and boluses are controlled-release application methods, the amount of active ingredient they release decreases over time. Because of this, timing of ear tag and bolus placement is important. If at all possible, delay using these application methods until July so there will still be enough active ingredient left in mid-August, when horn fly populations reach their peak. Early tagging or bolusing of heifers at the time they are placed on spring pasture in April or May will greatly reduce the effectiveness of these treatments later in the summer when it is needed the most.

4. Face Flies

Type of Pest: Insect

Frequency of Occurrence: June through September

Damage Caused: annoyance, transmission of pink-eye, moraxella bovis, Thelazia eye worms

% Animals Affected: 100% of all pastured cattle

Pest Life Cycles: The face fly, *Musca autumnalis*, is a robust fly that superficially resembles the house fly. It is a nonbiting fly that feeds on animal secretions, nectar, and dung liquids. Adult female face flies typically cluster around the animals' eyes, mouth, and muzzle, causing extreme annoyance. Their activity around the animals'

eyes allows face flies to serve as vectors of eye diseases and parasites such as pinkeye and *Thelazia* eye worms. They are also facultative blood feeders, meaning that they gather around wounds caused by mechanical damage or biting fly activity to feed on blood and other exudates.

By contrast, male face flies feed only on nectar and dung. They spend much of their time resting on branches and fences and attempting to catch and copulate with female flies as they move about. Females lay their eggs on very fresh droppings on pasture, and development from egg to adult is completed in about 2 to 3 weeks, depending on temperature.

Face flies are strong fliers that can travel several miles. Unlike house flies, face flies do not enter darkened barns or stables during the summer months. In the fall, however, they enter buildings and overwinter indoors in a state of diapause, or hibernation.

Timing of Control: treat after population exceeds 10/animal or pink-eye appears

Yield Losses: potential milk loss, but doesn't occur each summer

Regional Differences: None

Cultural Control Practices: Dragging pastures to destroy breeding sites results in pasture fouling. Flies do not enter buildings.

Biological Control Practices: Biological control against these pests at present is limited to beneficial organisms that occur naturally in the field. Face flies are attacked by parasitic nematodes, and immature stages of both horn flies and face flies are attacked by predaceous mites, predaceous beetles, and parasitic wasps (parasitoids). Manure competitors such as dung beetles also limit fly populations by removing and burying cattle dung before immature flies can complete their development. Adult flies are attacked by predaceous yellow dung flies, and face flies are occasionally attacked by pathogenic fungi.

In spite of the diversity and importance of natural enemies of face flies and horn flies, methods are not known for exploiting these biological control agents in pest management programs. Parasitoid releases for house fly and stable fly control are not effective against these pasture pests.

Other Issues: Flies move into homes to hibernate

Chemical Controls: Insecticidal control options for horn flies and face flies include whole-animal sprays, self-applicating devices, feed-through insecticides and growth regulators, and controlled-release devices, such as ear tags and tapes.

Whole-animal sprays provide rapid relief from fly pressure. Animal sprays are applied either as a dilute coarse spray, often applied under high pressure to soak the skin, or as a fine low-volume, more concentrated mist.

Self-applicating devices include back rubbers covered with an absorbent material treated with an insecticide-oil solution, or dustbags filled with an insecticidal dust. Back rubbers and dustbags should be placed in gateways, near water and feed sources, and in other areas where animals will make frequent contact with them.

Feed-throughs include insecticidal feed additives, treated mineral blocks, and bolus formulations. These treatments are generally less effective for face flies than for horn flies. In either case, feed additives have no effect on adult flies that are already present or that may immigrate from neighboring farms. Unless your farm is very isolated or you are participating in an area-wide management program, feed-throughs may not provide satisfactory fly suppression.

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- Remove ear tags in the fall to reduce development of resistance to low levels of pyrethroids.

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5. Horse Flies and Deer Flies

Type of Pest: Insect

Frequency of Occurrence: May through September

Damage Caused: Large numbers of these flies can cause extreme annoyance and fatigue, blood loss, reduced milk production, and reduced weight gain. Some species have also been implicated in the transmission of tularemia, anthrax, anaplasmosis, and leukosis. Female flies typically lay their eggs in distinctively shaped egg masses on vegetation near marshes, ponds, or streams. Development from egg to adult requires 70 days to 2 years, depending on the species.

% Animals Affected: Pastured animals (approx. 10%)

Pest Life Cycles: Horse flies and deer flies belong to the fly family Tabanidae. They represent a complex of at least 300 species, some of which are very pain-inflicting and annoying pests. Dairy cattle on pasture occasionally are severely attacked by these flies, particularly on pastures that border woodlands or wet, marshy areas. Female horse

flies and deer flies cut through the skin of the animal with knife-like mouthparts. They then feed on the blood that pools around the wound. The wound continues to bleed after the fly leaves and often attracts face flies.

Timing of Control: when flies occur

Yield Losses: minimal

Regional Differences: Predominant near wet/marshy areas

Cultural Control Practices: Trapping has minimal effect on population, but may provide some relief

Biological Control Practices: None

Other Issues: May transmit Anaplasmosis

Chemical Controls: Horse flies and deer flies are notoriously difficult to control. They are strong fliers that move large distances between breeding areas and hosts. Because they land on host animals to feed for only a very short time, it is difficult to deliver a lethal dose of insecticide to them during their episodic host attacks.

Moreover, because livestock represent only one of many host animals these pests feed on, treating the cattle will have a negligible impact on total fly populations. Severe horse fly and deer fly pressure is generally temporary because of the seasonality of fly activity. In some cases, cattle can be moved from low-lying pastures near marshy areas to other pastures where fly pressure is less during these periods of peak activity.

6. Black Flies

Type of Pest: Insect

Frequency of Occurrence: Sporadic and very seasonal (May through October)

Damage Caused: Blood loss, annoyance

% Animals Affected: Probably <5% overall

Pest Life Cycles: Black flies belong to the family Simuliidae, which includes at least 700 different species. Most are generalist feeders that attack cattle as well as humans, deer, and other animals. Black fly larvae live in clean, fast-moving water such as streams and dam outfalls.

Timing of Control: Fly occurrence

Yield Losses: Milk and weight loss. Milk loss of 20-40% possible

Regional Differences: Definite species differences from region to region. Mostly problem in areas with fast-moving streams (Catskill and Adirondack regions).

Cultural Control Practices: Provide shelter

Biological Control Practices: None

Other Issues: Effective management usually requires an effort by state government entities.

Chemical Controls: Mosquitoes, black flies, and biting midges are also difficult to control. Strategies such as boluses and feed additives that are aimed at fly larvae have no effect on any of these pests because the immature stages do not occur in animal droppings. Whole-animal sprays and pour-ons can provide temporary relief in some cases from horse flies, deer flies, mosquitoes, etc.; read product labels carefully to see which ones claim to control or "aid in the control of" these pests. Widespread treatment of streams where larvae develop can aid in control. Can be very costly.

7. Mosquitoes

Type of Pest: Insect

Frequency of Occurrence: usually May through October

Damage Caused: blood loss, annoyance

% Animals Affected: 20%

Pest Life Cycles: Mosquitoes also belong to a large family, the Culicidae, which includes numerous species that attack cattle and other animals. Mosquito larvae live in permanent and transitory standing water, including ponds, tree holes, drainage ditches, and stockpiled tires. Although dairy cattle are sometimes attacked by large numbers of these pests, such problems tend to be very local and short-lived.

Timing of Control: Pest occurrence

Yield Losses: No data available

Regional Differences: species differences and abundance varies on geography

Cultural Control Practices: reduce breeding areas around farm

Biological Control Practices: None

Other Issues: Control generally requires a mosquito abatement district

Chemical Controls: Mosquitoes, black flies, and biting midges are also difficult to control. Strategies such as boluses and feed additives that are aimed at fly larvae have no effect on any of these pests because the immature stages do not occur in animal droppings. Whole-animal sprays and pour-ons can provide temporary relief in some cases from horse flies, deer flies, mosquitoes, etc.; read product labels carefully to see which ones claim to control or "aid in the

control of' these pests. Larviciding works but is often not practical. Spraying for adults can lower numbers temporarily.

8. Midges (Culicoides)

Type of Pest: Insect

Frequency of Occurrence:

Damage Caused: blood loss, annoyance, disease transmission (Blue tongue, EHD)

% Animals Affected: ~20%

Pest Life Cycles: Biting midges, also called "no-see-ums" or punkies, are tiny biting flies in the family Ceratopogonidae. Adult flies feed on blood, and larvae feed on decaying organic matter in moist soil habitats. Ideal breeding grounds are sometimes created where manure mixes with mud around cattle watering areas and manure lagoons. In some regions of the country, biting midges also transmit the virus that causes blue tongue disease.

Timing of Control: Pest presence, disease occurrence/detection

Yield Losses: export restrictions (semen) and possible drop in milk production

Regional Differences: abundance related to breeding area availability

Cultural Control Practices: Prevent larval development. Drain standing water, adjust shore line, prevent cattle from using ponds.

Biological Control Practices: None

Other Issues: Transmission of Blue tongue can alter ability to export

Chemical Controls: Mosquitoes, black flies, and biting midges are also difficult to control. Strategies such as boluses and feed additives that are aimed at fly larvae have no effect on any of these pests because the immature stages do not occur in animal droppings. Whole-animal sprays and pour-ons can provide temporary relief in some cases from horse flies, deer flies, mosquitoes, etc.; read product labels carefully to see which ones claim to control or "aid in the control of" these pests.

9. Cattle Grubs

Type of Pest: Insect

Frequency of Occurrence: Adult present May through killing frost; larvae present in cattle until May.

Damage Caused: Economic losses to cattle grubs take several forms. First, gadding behavior in response to adult fly activity decreases the animal's ability to graze efficiently. Gadding also makes cattle difficult to handle and increases the risk of self-inflicted injuries. Second, tunneling cattle grub larvae through the animal's tissues causes great damage. Heavy infestations in replacement animals can result in poor weight gain, delayed time to first lactation, and long-term production losses.

Third, the breathing holes cut by the grubs damage the most valuable portion of the hide, substantially decreasing its value at slaughter. Moreover, the meat surrounding the warbles is discolored and must be trimmed at the slaughterhouse, further reducing the carcass's value.

% Animals Affected: Only pastured cattle (~40%)

Pest Life Cycles: Cattle grubs are the larval stage of heel flies. Two species of these flies occur in the Northeast: the common cattle grub (*Hypoderma lineatum*) and the northern cattle grub (*Hypoderma bovis*). Both have similar life cycles. Adult flies emerge during the spring and summer. They are large, hairy flies that resemble bees. After mating, the females locate cattle on which to lay their eggs. Egg laying occurs between late May and August. Cattle often panic in the presence of the fast-moving flies and may run wildly with their tails high in the air in an effort to escape. In spite of this gadding response by cattle, the flies neither bite nor sting the animals. In fact, the adults do not feed at all and survive only 3 to 8 days.

Female flies attach their eggs to the hairs of the cow's legs and lower body regions (hence the term "heel fly"). Each can lay up to 600 eggs, which hatch in 4 to 7 days. Newly hatched larvae burrow into the skin, causing the animal considerable irritation. The young larvae then migrate through the animal's connective tissue. By November 1 most larvae of the common cattle grub have migrated to the submucosa of the esophagus, whereas those of the northern cattle grub migrate to the epidural tissues of the spinal canal.

During the winter months, the larvae of both species migrate again, this time into the animal's back. By February most larvae have reached the back and have cut a breathing hole through the hide. There the larva forms a warble (swelling) between the layers of the hide. Within the warbles, the grubs grow rapidly for about two months, reaching a final size of about an inch in length.

Young animals are more heavily infested with grubs than mature milking cows are, because older animals develop a degree of immunity to the grub larvae. When mature the grubs emerge through the breathing holes, drop to the ground, and pupate in pasture litter and soil. During this stage the grub's skin hardens and turns black. The

metamorphosis from grub to adult fly takes from 2 to 8 weeks. Adult heel flies emerge from the pupae and are active from late May through August. Most activity occurs during June and July.

Timing of Control: Treat all animals with systemic insecticide after killing frost, but before November 1.

Yield Losses: Drop in weight gain, hide damage, meat damage, may cause drop in milk production.

Regional Differences: Varied due to use of systemic insecticides

Cultural Control Practices: Cattle confined in barns from May to August are protected from cattle grubs, because heel flies do not enter barns to lay their eggs. But individual production and management practices often rule out this method of cultural control.

Biological Control Practices: None

Other Issues:

Chemical Controls: The most effective method of actually reducing fly populations is to organize a community-based, area-wide program for treating all nonlactating cattle with systemically active insecticides. Such an area-wide treatment can substantially reduce heel fly activity the following year.

In the absence of regional control programs, individual producers may minimize damage to their own animals by using systemically active insecticides on their young, nonlactating heifers. Several systemic insecticides are available as pour-ons, spot-ons, and injectables.

10. Cattle Lice

Type of Pest: Insect

Frequency of Occurrence: Present year around, populations highest in winter months.

Damage Caused: All four types of lice cause extreme annoyance to the host animals. Milk production declines in heavily infested cattle, and the animals' preoccupation with rubbing leads to hair loss, reduced feed conversion efficiency, and general unthriftiness. Infested animals become irritable and difficult to work with, especially during milking. People working around lousy animals are exposed to greater risk of injury and are also annoyed by stray lice they pick up from infested animals during handling.

% Animals Affected: >90% infested with at least one species

Pest Life Cycles: In contrast to the fly pests, lice are relatively small and inconspicuous. Four species of lice attack dairy cattle in the Northeast. By far the most common is the cattle chewing louse, *Bovicola bovis*. This species is about 1/8 inch long when fully grown, has a yellow-brown appearance, and is most common only found on the animal's neck, back, hips, and tailhead. *B. bovis* are not blood feeders, but they use their mouthparts to rasp away at animal skin and hair.

In addition to chewing lice, three species of sucking lice feed on the blood of dairy cattle: the long-nosed cattle louse (*Linognathus vituli*), the short-nosed cattle louse (*H aernatopinus eurysternus*), and the little blue louse (*Solenopotes capillatus*). Sucking lice have mouthparts specialized for penetrating animal skin. They spend most of their time with their heads firmly attached to the skin. Sucking lice often take on a darker appearance than chewing lice as they become engorged with blood.

Female lice lay their eggs by attaching them to hairs with a strong glue to prevent them from falling off. The eggs, known as nits, hatch in 10 to 14 days, and the young lice (nymphs) complete their development within several weeks. Lice, in contrast to some other livestock pests, are permanent parasites that spend their entire lives on the host animal.

Timing of Control: Treat when >10 lice/inch². Treat all animals.

Yield Losses: No data available

Regional Differences: None

Cultural Control Practices: Producers can save on the cost of insecticide treatments for lice by adopting cultural control practices. First, replacement animals brought into the herd should be isolated and carefully inspected for lice before they are allowed to mingle with the rest of the herd. Second, careful and regular monitoring for lice can detect problems before an infestation gets out of control. Third, housing calves in hutches will reduce infestations on these valuable replacement animals by 90 percent without any insecticide applications.

Biological Control Practices: None

Other Issues: Although louse problems are generally perceived as being most severe during the fall and winter months, animals of different age groups show distinct differences in the seasonality of infestation. Lice are most common on mature cows in December through March, with peak populations found in March. In contrast, calves housed inside barns show high levels of infestation throughout the year, with peak populations in June. This difference may be due to the fact that cows are placed on pastures in the spring, where exposure to direct sunlight heats the skin to levels lethal for most lice. Calves kept in the cool environment of the barn are not able to take advantage of sunlight's natural curative properties.

Other animal housing conditions also affect louse populations. Cows in stanchion barns are twice as likely to be infested as cows in free stalls, owing to the greater opportunities of unrestrained animals to groom themselves. Calves housed in communal pens inside barns are 10 times as likely to be infested as calves in individual hutches. The effectiveness of hutches results from a combination of the animals' isolation from one another and the opportunity for calves in hutches to spend time in direct sunshine.

Chemical Controls: Many insecticides and application procedures are effective for managing lice. As with any insecticide application, it is essential to consult the label to ensure the insecticide is registered for use on dairy cattle, and if so, whether it may be used on lactating animals. Before selecting an insecticide, consider how it can be applied to meet individual needs and production practices. There are several categories of application methods: self-application devices, whole-animal sprays, pour-ons, and dusts.

Self-application devices such as dustbags must be placed in areas where animals will contact them frequently and treat themselves with repeated, small doses. Whole-animal sprays have the advantage of ensuring good coverage over the entire animal's body. But severe louse problems on mature animals are most common in winter, and it generally is wise to avoid soaking animals in periods of cold weather. Applications with foggers and mist blowers can overcome these problems. With these types of applications, a small quantity of concentrated pesticide is propelled as an aerosol made up of very small spray particles. The concentrated aerosol can then be applied evenly over the animal's body, greatly reducing the amount of liquid used.

Another method of application is the use of pour-on insecticides, in which a small quantity of pesticide is poured down the backline of the animal. The most popular application method for lice is dusting by hand. Dusts are easy to apply, require no mixing, and can be used year-round.

Insecticides must be used properly to achieve satisfactory control of lice. Many louse-control products require two treatments, 10 to 14 days apart. **The second treatment is essential to kill newly hatched lice that were present as eggs at the time of the first treatment and were therefore not killed.** Failure to make the second treatment in a timely manner will create problems requiring many more subsequent treatments.

11. Mange Mites

Type of Pest: Arthropod

Frequency of Occurrence: Primarily in winter months

Damage Caused: hair loss, possible reduction in milk production

% Animals Affected: <10%

Pest Life Cycles: CHORIOPTIC MANGE: Two economically important species of mites infest dairy cattle in the Northeast. One species, *Chorioptes bovis*, lives on the animals' skin and hair. Infestation by these mites results in a condition known as chorioptic mange, or barn itch. Chorioptic mange is generally characterized by dermatitis, hair loss, and scabbiness in small areas around the feet, legs, and tailhead. The skin underneath the affected areas becomes swollen and inflamed. Infestations by this mite are usually localized, although in some cases the lesions can spread to cause a more generalized dermatitis resembling sarcoptic mange.

Chorioptic mange mites live on the surface of the host animal's skin and feed on lymph as well as dead cells and other debris. Development from egg to adult mite is completed in about 2 weeks. Mite populations usually are very low in the summer months, and symptoms of infestation typically disappear during this time. Populations increase again in the fall, with the most severe problems occurring in winter. High levels of chorioptic mange in dairy herds can reduce milk production.

SARCOPTIC MANGE: Sarcoptic mange is a condition caused by another, smaller species of mite, *Sarcoptes scabiei*. The skin lesions arising from infestation by these mites are so severe that sarcoptic mange is handled as a quarantinable disease.

Unlike lice and *Chorioptes* mites, the microscopic sarcoptic mange mites burrow deeply into the skin, laying eggs inside the burrows. The eggs hatch into the larval stage. The larval mites then leave the burrows, move up to the skin surface, and begin forming new burrows in healthy skin tissue. Development from egg to adult is completed in about 2 weeks. The lesions resulting from infestations by these mites are a consequence of the reaction of the animals' immune system to the mites' presence. Because of the intensity of the animals' immunological response, it takes only a small number of mites to produce widespread lesions and generalized dermatitis. Animals show remarkable variation in the extent to which they react to the infestation, however. It is not uncommon to have healthy-looking animals in stanchions next to animals with lesions over much of their bodies.

Timing of Control: Treat after mites are detected

Yield Losses: 10-15% reduction in milk production

Regional Differences: None

Cultural Control Practices: Mange mites, like lice, are permanent external parasites that do not survive away from the host for very long. The best way to minimize the risk of introducing the mites into a herd is to be cautious when buying or boarding new animals. Avoid any animals that show visible skin lesions or that appear to be abnormally itchy or agitated. As an extra precaution, it is wise to segregate all newly purchased animals from the rest of the herd for several weeks and keep them under observation. A veterinarian should be called in if any of the animals show signs of unusual itchiness.

Biological Control Practices: None

Other Issues: Movement of mites onto humans ("milker's itch").

Chemical Controls: Several pesticides used for controlling cattle lice also are effective against chorioptic mange mites. Because of the severity of sarcoptic mange, it is regarded from a regulatory standpoint as a reportable disease. Therefore, the threshold for placing a herd under quarantine is the discovery of a single mite on one animal.

Once a herd has been placed under quarantine, animals may not be moved off the farm except for slaughter. Every animal in the herd must then be treated with high-pressure hydraulic spray equipment by certified pesticide applicators under the supervision of a state veterinarian. Either two or three treatments must be made, depending on the choice of insecticide used, with treatments spaced 7 to 10 days apart. Quarantine is lifted when post-treatment skin scrapings demonstrate the infestation has been eradicated. Because high-pressure spray equipment is necessary to ensure penetration by the spray into the skin, "home remedies" applied with low to moderate pressure gear of the type owned by many dairy producers are never successful.

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