DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Agriculture and Natural Resources

FSA7072

Fly Control for Organic Dairies

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Horn flies, face flies, stable flies and house flies are significant fly pests of dairies, both on cattle and on the premises. Lower milk production, decreased feed conversion efficiency, community nuisance problems and public health concerns about unsanitary milk-handling conditions are among the problems caused by these pests. Stable, horn or face flies on dairy cattle during the warm months of the year can irritate cows and spread disease from one animal to another.

The animals affected by flies or disease may be less able to endure stressful situations. Additionally, the energy taken to resist or fight the flies takes away nutrients that could be used for milk production and can add to the heat stress of the summer. These pests can result in decreased milk production in annoyed cows because of decreased feed intake and loss of blood from the biting flies. Large numbers of flies are often associated with increased bacterial and somatic cell counts in milk, which reduce the quality of milk and are routinely monitored by milk inspectors. Estimates of loss of milk production and spread of disease vary, but research has shown that heavy infestations of stable flies can reduce milk production by 15 to 30 percent, and horn flies can reduce milk production by 10 to 20 percent.

Interest in organic agriculture is increasing throughout the nation as more producers make the transition to organic farming. There is a push for organically-produced food as concerns involving public perceptions of pesti - cides and commercial fertilizers increase. Consumer interest in products perceived as healthy and concern for animal welfare are also increasing. Due to these concerns, there is now a desire for organic milk, and many dairies are making the transition to organic production.

In dairy production, contamination of milk by insecticides is a major concern to dairy producers and milk marketing agencies. Aware of the increasing cost of insecticides, decreasing availability of new chemicals and the development of insecticide resistance in resident fly populations, farmers are beginning to recognize the cost effectiveness of holistic, integrated pest management strategies. As a result, interest in biological control agents for the suppression of flies on dairies is growing.

Sanitation

Sanitation is the primary control method for flies on any dairy. Moreover, there are limits to fly management for organic dairy producers. Because synthetic pesticides are not allowed for organic production, proper sanitation on dairies is even more important. Manure and decomposing feed create an ideal habitat for the production of house fly and stable fly larvae.

Proper handling and disposal of waste materials around dairy facilities are critical in fly management so that breeding sites are eliminated. Daily, or at least twice weekly, removal of manure from barns, calf pens, holding areas, feeding areas, loafing areas and milking areas is necessary. Manure should be moved to a covered dry

stacking area or a lagoon (liquid manure pit). Because wet (not liquid, as in lagoons) manure is essential for fly breeding, dried manure and liquid manure do not normally produce large numbers of flies. However, improperly managed lagoons can contribute to the fly numbers and may also produce rat-tailed maggots, which are the larval stages of the syrphid fly. Syrphid fly larvae and adults are harmless and very rarely considered pests. Occasionally, syrphid fly larvae become a nuisance when large numbers migrate to dry areas to pupate. Proper lagoon maintenance, which includes minimizing the amount of floating solids, ensuring manure is completely covered in water, maintaining steep banks and removing emergent vegetation, will minimize breeding habitat for fly pests as well as syrphid flies. Routine cleanout and/or agitation of manure pits will disrupt syrphid fly larval development.

Remove manure from the dry stack to the field at least twice weekly. Manure may be applied thinly on pasture or crop land using a flail-type spreader to aid in drying. Base manure applications on recommendations obtained from soil testing. Consult your county Extension agent for additional information on manure applications and soil testing.

In addition to manure management, other sanitation practices are critical. Leaky water troughs, wet hay or straw, spilled feed and overgrown vegetation can result in increased fly breeding. Repair of leaky plumbing and faucets and prompt removal of wet hay or straw will aid in preventing large buildups of fly populations. Tall weeds around pens and buildings often hide spilled feed and manure, as well as hamper the drying of wet areas.

These sanitation practices are the most effective method of reducing fly numbers and are cost effective compared with the use of insecticides.

House Fly

The house fly, *Musca domestica*, is a premise fly that is not parasitic on animals. They are the ¼-inch-long, nonbiting flies often seen around the premises. They are dull gray, with four black stripes on the thorax. House flies breed in manure, decaying feed and organic matter and garbage. Their life cycle (Figure 1) consists of egg, larval (maggot), pupal and adult stages and is normally completed in 10 to 21 days, although flies can develop in as little as a week. Females usually lay up to 600 eggs during their lifetime, and 1 pound of manure is sufficient for more than 1,500 maggots. Flies have multiple generations per year and overwinter in all life stages.

Large numbers of house flies can become a serious nuisance around the dairy and to nearby neighbors and potentially pose public health threats

Figure 1. The life cycle of the house fly. *(Clemson University, USDA Cooperative Extension Slide Series, Bugwood.org)*

Figure 2. Black garbage fly. *(J.A. Hogsette, USDA)*

Figure 3. Blow fly. *(Leon Higley, UNL Entomology)*

through the transmission of pathogens. Severe house fly infestations can also cause increases in bacterial counts of milk.

Black garbage flies (Figure 2) and blow flies (Figure 3) are premise flies similar to house flies. They can also become an annoyance to animals and people. Black garbage flies are shiny and black, with a similar life cycle to that of the house fly. Blow flies are larger than house flies and have a metallic look with varying colors. They also have a similar life cycle to the house fly but require such matter as animal carcasses, afterbirth or spilled milk to develop.

Control

House flies are monitored by placing sticky fly ribbons in each location that is being monitored. Suitable sites to monitor house fly abundance include animal housing areas, manure storage areas, calf barns, milking parlors and milk rooms.

Sticky ribbons are left up for seven days and then replaced. The number of flies for each sticky ribbon is recorded. An average of 300 flies per week on a ribbon indicates that insecticide control is necessary for that specific site.

Take into consideration the location of the site being monitored. For example, 300 flies per ribbon in some areas is not as critical as 300 flies inside

the milk room or milking parlor, which could not be tolerated due to potential contamination of the milk.

Sticky ribbons can also provide some control when dealing with small fly numbers by collecting flies on the ribbon. However, when dealing with larger numbers, a fly-trapping tape system can also be used. This system is not suitable for monitoring but can provide some control.

Fly-trapping tapes can be unrolled to extend the entire length of the parlor, holding area or barn. The system uses a reel mechanism, and when the tape that is extended across the ceiling is full of flies, the reel can be turned to expose a new section of sticky tape for fly collection. Remember, good sanitation is the most important component in a house fly management program.

In organic dairy production, parasitoid (referred to by some as fly parasite) releases are designed to augment the existing natural enemies already present. Natural parasitoid populations usually lag a few weeks behind fly populations. Augmenting with commercial parasitoids can keep house fly populations at a level where little or no chemical control is needed.

Figure 4. A parasitic wasp emerging from a house fly pupa. *(Beneficial Insectary)*

Parasitoids prevent emergence of adult flies from parasitized pupae. The life cycle of a parasitoid consists of the tiny wasp stinging the fly pupa in order to lay eggs inside. The eggs hatch into larvae which feed on the developing fly pupa within the pupal case, and then the adult wasp emerges from the fly pupa (Figure 4), leaving no adult fly to emerge. Successful fly management with parasitoids must include an effective manure management program so the wasps do not become overwhelmed with a large number of house flies.

When buying commercial parasitoids, it is important to ensure that wasps survive shipping and are from a reputable source. The parasitoids are sent as killed fly pupae containing immature parasitoids. The best way to confirm viability is to put 30 to 50 pupae at room temperature inside a small glass jar, such as a baby food jar. After three days, make a note of how many adults have emerged. The emergence rate should be 70 to 100 percent. This will verify that wasps are viable and can attack the fly pupae on the premises.

Research has shown effective parasitoid release rates of 200 to 250 per cow, and species to release include *Muscidifurax zaraptor*, *M. raptorellus* and *Trichomalopsis sarcophagae*. Avoid other parasitoid species, such as *Nasonia vitripennis*, because research has shown poor dispersal and parasitism rates. Parasitoid releases should begin in April. Pupae should be placed in covered areas, corners or, if released in sunny places outside, covered with dry manure. Recent research with the fungal pathogen *Beauveria bassiana* has demonstrated significant reduction of house fly adults and larvae in poultry houses.

If insecticides are needed to control house flies, pyrethrins can be used. Synergists, such as piperonyl butoxide, are not listed for organic production, so use "pyrethrin only" labeled insecticides approved for organic production. Make sure to follow instructions on the label. Avoid using direct pesticide treatments in fly breeding areas where parasitoids have been released to ensure that the beneficial insects survive.

Horn Fly

The horn fly (Figure 5), *Haematobia irritans*, is the most economically important ectoparasite of cattle. Horn flies are small blood-feeding flies (half the size of house flies) found primarily on the shoulders, back and sides of cattle. However, they may move to the belly of cattle during very hot or rainy weather.

They are similar in color to a stable fly but half the size. Horn flies have spearlike piercing mouthparts protruding from under their heads which allow them to feed on blood. Horn flies spend all their time on the animal except when a female leaves to deposit eggs in fresh cattle feces less than 10 minutes old. Females usually lay no more than 20 eggs per batch, which are deposited in groups of three to seven. During her lifetime, a female can lay 200 to 500 eggs.

Figure 5. A horn fly feeding on a cow. *(Craig Sheppard, University of Georgia, Bugwood.org)*

Figure 6. A walk-through (Bruce) horn fly trap. *(Kelly Loftin, Arkansas Cooperative Extension Service)*

The life cycle of the horn fly consists of the same life stages as the house fly. It takes horn flies 9 to 12 days to complete the cycle from egg to adult. The adults live from 6 to 8 weeks, and mating occurs on the host about 3 days after emergence. There are two seasonal horn fly peaks during spring and fall, and they overwinter in the soil as pupae. Large populations can result in a decrease in body weight and feed efficiency related to blood loss and annoyance to the animal. Large horn fly numbers can also cause a 10 to 20 percent decrease in milk production.

Control

Horn fly populations are monitored by counting the number of horn flies on the heads, shoulders and backs of at least 10 animals (10 to 15). Average counts approaching 35 to 50 horn flies per side per animal (75 to 100 total) indicate that additional control measures may be necessary.

The walk-through (Bruce) trap (Figure 6) will help control horn flies by dislodging the horn flies as the animal passes through the trap. Dislodged flies are trapped in elements located on the sides of the trap. Trapped flies cannot escape and die from starvation or dehydration. The animals must pass through the trap to provide control; therefore, the traps are usually located in a place where animals must pass to gain access to water or to travel to the milking parlor.

In one Arkansas trial, an overall reduction of 57 percent of horn flies was noted when compared to an untreated herd. In another trial, it was found that traps helped reduce the frequency of insecticide applications by 50 to 75 percent. During wet years, watch cattle to confirm use of the trap, as alternative sources of water may be available for the animals to drink; decreased use of traps will reduce their effectiveness for horn fly control. Consult your county Extension agent for plans on building these traps.

If insecticides are needed, pyrethrins can be used, but do not use synergists, such as piperonyl butoxide, that are not listed for organic production. Use insecticides labeled "pyrethrin only," and be sure to follow label instructions. With organic production in the South, alternative control methods involving repellents and a combination of control measures are being evaluated.

Face Fly

The face fly (Figure 7), *Musca autumnalis*, is a nonbiting fly that resembles a house fly. Unlike horn flies and stable flies, they do not bite but are still parasitic on the animals because they feed on animal secretions (such as secretions found around the eyes and nose). Activity around the cows' eyes (Figure 8) allows face flies to be potential vectors of eye diseases, such as pinkeye. The flies also result in economic losses from decreased weight gain and milk production.

Figure 7. The face fly. *(Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org)*

Figure 8. Face flies feeding on cattle. *(Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org)*

Female face flies are primarily found clustering around the eyes and nose of cattle, whereas the males feed only on nectar and dung. They breed in fresh cattle feces with a life cycle similar to horn flies. The cycle from egg to adult is completed within 11 to 17 days, and they overwinter as adults in protected areas, such as farmhouses, barns, church steeples, etc.

Control

This pest is not easy to control because the face is a difficult area to treat and the fly's feeding activity is intermittent. They are equally attracted to adult cattle and calves. Only a small number of face flies will be found on an animal during any

given time, because most of the time the fly is resting on plants, fence posts and other objects. Face flies are monitored by counting the number of flies on the faces of at least 10 (10 to 15) cattle. Average counts of 10 face flies per animal warrant insecticide treatment.

The face fly is a difficult pest to control with traditional methods. In the northeastern areas of the United States, auto face sprayers and pyrethrins are used to control these flies. Self-treating devices, such as back rubbers equipped with face flaps, are often effective. In organic production, insecticide uses are primarily limited to pyrethrin. When using pyrethrin, remember to avoid synergists, such as piperonyl butoxide, which are not listed for organic production. Use "pyrethrin only" labeled insecticides and follow label instructions. Diesel, fuel oil and mineral oil, which are often used with back rubbers, cannot be used in organic production. Instead, vegetable oil and soybean oil would be options.

Stable Fly

The stable fly (Figure 9), *Stomoxys calcitrans*, is also a parasite found primarily on cattle rather than the premises. They are blood-feeding flies that are about the same size as the house fly but darker gray in color. Unlike the house fly, stable flies have mouthparts similar to horn flies; their piercing mouthparts protrude from under their heads and allow them to take blood meals. Both male and female stable flies feed on blood.

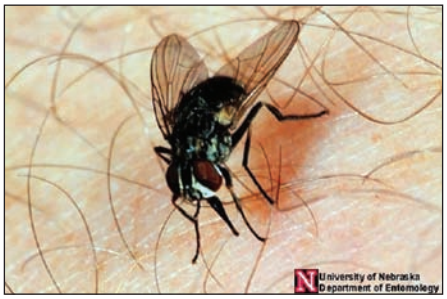

Figure 9. The stable fly. *(Leon Higley, UNL Entomology)*

Figure 10. Potential stable fly breeding site. *(University of Missouri Extension Service)*

The life cycle consists of the same stages as a house fly, but stable flies breed in decaying organic material, such as hay mixed with manure and urine (Figure 10). Adults can live 20 to 30 days, and a female can lay 200 to 400 eggs in her lifetime. The entire life cycle of a stable fly can be completed in about three weeks, and the flies probably overwinter as adults and immatures (larval stage). The overwintering of stable flies is not completely known, but they develop slowly during winter months under the frost line and move toward the soil surface to pupate as temperatures rise. These flies are important to control because they can cause a 15- to 30-percent decrease in milk production. They are bothersome to animals and humans and can also spread several diseases of animals.

Control

Stomping of the feet is an indication that stable flies are present, because they feed primarily on the legs and, to a lesser extent, the bellies of cattle. Stable fly populations are monitored by counting the number of stable flies on the legs (Figure 11) of at least 10 animals (10 to 15). Average counts approaching 10 stable flies per animal indicate that insecticide treatment is necessary.

Figure 11. Stable flies feeding on the legs of cattle. *(Jack Campbell, UNL Entomology)*

Augmenting with commercial parasitoids in organic dairy production can keep stable fly populations at a level where little or no chemical control is needed, just as with house flies. The same procedures listed for parasitoid use in house fly control should be applied for stable flies. Successful fly management with parasitoids must also include an effective manure management program. If insecticides are needed to control stable flies, pyrethrins can be used. Synergists, such as piperonyl butoxide, are not listed for organic production, so use insecticides labeled "pyrethrin only." Make sure to follow label instructions. Avoid using direct treatments of pesticides in fly-breeding areas where wasps have been released to ensure the beneficial insects survive.

Conclusion

Organic milk production is a new venture for southern milk producers. Increasing demands from consumers for organic products and alternative production methods have driven the dairy industry to explore new techniques of fly control. However,

current research using organic methods is limited. Many of the methods mentioned would be compatible in some conventional dairy fly/IPM programs, with the most important being to practice proper sanitation regularly. Less reliance on a limited number of conventional insecticides can also aid in preventing insecticide-resistant flies. Both public and producer interest in organic pest management methods is expanding, and research will need to continue to develop new strategies for producing organic products.

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Acknowledgments: Dr. Jodie A. Pennington, former professor and Extension dairy and goat specialist, and Sheri M. Brazil, former program associate - entomology, were co-authors of the original fact sheet.

Printed by University of Arkansas Cooperative Extension Service Printing Services.

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FSA7072-PD-3-2014RV