DAIRY PEST MANAGEMENT (ARTHROPODS)

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INTRODUCTION

There are 10 major arthropod pest species affecting dairy cattle including six fly and four louse species. Damage inflicted by arthropods falls into two categories: direct damage and indirect damage. Direct damage includes blood loss, introduction of salivary secretions, tissue damage, reduced value of saleable animal products, and annoyance. Indirect damage includes transferring pathogenic organisms and decreased vigor.

Pest management procedures follow integrated approaches discussed elsewhere in this publication. To be successful, the tactics utilized must disrupt the arthropod life cycle at several places.

At any given time, cattle can be infested with several species of arthropods and as parasite levels rise and fall with the seasons, animals often experience compensatory gains offsetting earlier damage. However, when considering losses in milk production, compensatory gains are not applicable. Determining which species is responsible for a given amount of damage is difficult. A consensus on the losses as well as the costs attributed to arthropod infestations on dairy cattle is not available. The monetary figures presented here have been estimated for all cattle (beef and dairy) in the United States (1). Most studies investigating the effects of individual parasite species have been limited to beefcattle.

FLIES AFFECTING CONFINED ANIMALS

The house fly, *Musca domestica* (L.), and stable fly, *Stomoxys calcitrans* (L.), are the primary pests of confined dairy cattle (2, 3). House flies are nonbiting insects that breed in animal droppings, manure piles, decaying silage, bedding, and other organic matter (3). Their reproductive potential and movement to off-farm locations makes fly management imperative. House flies have been documented to mechanically transmit more than 100 known disease organisms. Monetary damage estimates have not been calculated for the house fly, however, losses can be expected to increase as urban expansion continues to encroach on traditionally agricultural areas.

The stable fly is a blood-feeding insect that causes considerable distress to cattle (2). It is often observed feeding on the lower legs of cattle and its presence is indicated when animals stomp. Stable flies and house flies breed in similar material, however, stable flies also breed in grass clippings and other types of decaying vegetative matter (3). Reported losses (milk production, butterfat, etc.) attributed to stable fly infestation have varied from significant damage to no observed effect. Additionally, observed weight losses have been shown to be offset by supplementing animal diets with grain. It has been estimated that stable flies annually result in losses of more than $398 million.

House fly and stable fly populations can be monitored in the barn using spot cards (3). Stable flies can also be monitored by counting the number of flies on all four legs of at least 10 animals. Flies can be managed successfully by integrating intensive manure management with cultural, biological, and chemical controls (2, 3). Manure management is the primary method of confined fly control. Removing or drying breeding areas can considerably reduce fly abundance. In areas that cannot be cleaned regularly (such as calf pens and silage storage areas) or in outdoor hay storage areas, fly management can be aided with good water drainage. Utilizing augmentative biological control, including parasitoid releases, in areas traditionally difficult to clean can help to reduce fly populations further. The correct species of parasitoid to be used depends greatly on the region of the United States and facility type.

When needed, chemical control should be used with an overall IPM approach in mind. Fogs or space sprays containing pyrethrins should be the first choice (3). Py-

rethrin fogs and fly baits are compatible with biological control. Residual premise sprays should be reserved for emergency and late season uses only.

FLIES AFFECTING PASTURED ANIMALS

Two flies, the horn fly, *Haematobia irritans* (L.) and the face fly, *M. autumnalis* De Geer, are the primary pests of pastured cattle in most areas of the United States (2). Both flies breed only in freshly deposited cattle dung and neither are pests of confined cattle. Horn flies are blood-feeding insects that are found in constant association with cattle. The economic losses in the United States associated with horn flies have been estimated at more than $730 million annually (1, 4).

The nonbiting female face fly visits cattle for short periods of time where she consumes animal nasal and ocular secretions (2). Fly feeding habits, irritancy, and disease aspects result in economic loss. The face fly has been shown to alter the time of grazing (2), which in turn can alter feed efficiency. While feeding, the fly can mechanically transmit the causative agent of pink-eye and *Thelazia* eyeworms (3). Most research has demonstrated that face fly infestations do not affect milk secretion (5). Annual losses to cattle have been estimated to surpass $50 million, predominantly due to pink-eye transmission (1).

Management of these two pests has relied heavily on insecticide applications (2). Currently, few successful, nonchemical options are available (3). The use of sticky fly traps, walk-through traps, and introduction of natural enemies has met with mixed success. Cattle dung supports a large number of arthropod species that either prey on, compete with, or alter the dung environment (3). These arthropods can affect pest fly populations, and current recommendations, designed to conserve natural enemies, are to avoid systemic and feed-through insecticide applications during the spring and summer seasons.

CATTLE GRUBS

Two species of cattle grubs occur in the United States: the northern cattle grub, *Hypoderma bovis* (L.), and the common cattle grub, *H. lineatum* (Villers) (2, 3, 6). Cattle grubs are usually observed during their larval stage in warbles on the backs of animals. These flies are most often pests of young stock, as older animals develop a degree of immunity. Economic losses to cattle grubs result from several forms of attack. First, gadding behavior in response to adult *H. bovis* oviposition activity alters grazing efficiency and increases the risk of self-inflicted injuries. The migration of the larvae through animal tissues results in losses in weight gain, delayed time to first lactation and long-term production losses. Finally, breathing holes cut by larvae into the animal's hide severely reduce the value of the leather. Meat surrounding the warbles is discolored and often must be trimmed further reducing the carcass value. Unlike damage inflicted by other cattle pests, a portion of the economic damage inflicted by grubs (hide damage and systemic insecticide-related paralysis and death) to dairy cattle can be directly compared with that observed in beef cattle. Annual losses to the cattle industry are estimated to surpass $66 million (excluding control costs), however, because many dairy cattle are no longer pastured and thus not infested with grubs, this figure is predominantly associated with beef cattle (7).

Very few natural enemies of cattle grubs have been reported (6). Management of cattle grubs is difficult without chemical control; however, flies will not enter darkened buildings (3). Therefore, animals confined in barns will not have cattle grubs. Systemic insecticides should not be used for control of cattle grubs on lactating animals. Because of larval migration through sensitive areas (esophagus or spinal column), systemic insecticide applications should not be made if larvae have entered these areas (date is dependent on latitude and elevation). Treatments made following the suggested treatment period may result in paralysis, bloat, and death.

CATTLE LICE

Lice are the primary, permanent ectoparasites of dairy cattle. These include three sucking lice species (*Haematopinus eurysternus* (Nitzsch); *Linognathus vituli* (L.); *Solenopotes capillatus* (Enderlein) and the cattle chewing louse, *Bovicola bovis* (L.) (2, 3). All four species cause extreme annoyance to cattle. Milk production declines in heavily infested cattle (3). Hair loss, reduced feed conversion, and general unthriftiness also result from louse infestations. Populations of lice on adult animals are generally highest in the winter months while young stock housed in barns show high levels of infestation throughout the year (3). Cows in stanchion barns and calves housed communal pens are much more likely to be infested than cows in free stalls and calves in hutches, respectively. Initial infestations of lice primarily occur from direct animal to animal contact. Because of the environmental conditions produced in a barn, dairy cattle often carry heavy louse populations longer than beef cattle. Losses associated with cattle lice have been estimated to surpass $125 million annually (1).

No louse predators or parasitoids have been reported and pathogens have not been shown effective (2). Infestations of cattle lice must be controlled with insecticide applications; however, good management practices using cultural control can reduce the chance of reinfestation and thus make subsequent insecticide applications unnecessary (3). Following treatment of a herd, all new animals should be treated and quarantined prior to introduction into the general population. Careful and regular monitoring will allow producers to detect louse infestations and take action before populations get out of control. Calves can be housed outdoors in hutches to reduce chance of infestation by 90%.

COMBINED INFESTATIONS

Because dairy cattle are seldom affected by a single pest, studies documenting production losses due to multiple species attack are valuable. However, mixed results have also been obtained with these studies (8). Protection from horn fly and stable fly infestations have shown either milk production losses attributed to fly attack or no benefit to pest control. Obtaining loss data from dairy cattle is difficult due to the fact that milk production can significantly be affected by such variables as pest infestation level, climate, breed and age of host, and animal husbandry practices.

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