Dairy and Beef Cattle Fly IPM Training Videos
An Integrated Pest Management Program for New York State, 2017-2020 USDA-NIFA CPPM

Ken Wise
Jaime Cummings
Karen English
NYS IPM

Project Summary

Dairy production is an integral component of many rural communities in the northeastern US, helping to sustain the economic viability of our region. There are 4,640 dairy producers in New York milking 615,000 cows (NYS NASS, 2016). In 2017, NY dairy cattle milk sales totaled $2.4 billion and beef are valued at almost half a billion dollars (NYS NASS, 2017). Many of these dairy and beef producers use insecticides to control nuisance and biting flies in the barn and on pasture without regard to action thresholds, environmental concerns or human health issues. We propose to develop online integrated pest management training videos on flies affecting cattle in the barn and on pasture for agricultural professions including veterinaries, livestock/dairy consultants, extension educators; and dairy/beef producers in the Northeastern US.

Problem and Justification

Dairy production is an integral component of many rural communities in the northeastern US, helping to sustain the economic viability of our region. In 2010, 5,389 dairy farms were in production in New York (NY NYS Dairy Statistics 2017). In 2014, NY dairy cattle milk sales totaled $2.4 billion and beef were valued at almost half a billion dollars (NYS NASS, 2014). Currently, there are 615,000 dairy and 115,000 beef cattle in NY. These cattle are affected by biting and nuisance flies from spring to fall.

Biting and nuisance flies, and external parasites adversely affect animal health, productivity and reduce farm profitability. A complex of pests is usually involved, which can differ in the intensity of direct and indirect host effects. Damage from infestations of summer and winter active arthropod pests of dairy and beef cattle in the U.S. have been estimated to exceed $2.26 billion in losses annually (Byford et al. 1992).

In the most recent pest management survey of New York dairy farmers (1997), twenty-eight percent of respondents indicated flies in and around barn areas were most difficult to control and 43% indicated animal confinement area flies were the most likely to cause economic loss (Harrington et al. 1998). Flies in and around the barn were treated with an insecticide an average of once a week. Most respondents (80-90%) employed cultural practices such as manure removal, while less that 5% of respondents released beneficial insects to manage barn flies. In this same survey, 52% of respondents selected flies on pastured cattle as being the most difficult pest to control and 56% indicated pasture flies were the most likely to cause economic loss (Harrington et al. 1998). Additionally, dairy farmers reported using insecticides two to three times per month to manage flies on pastured cattle.

Several challenges currently face those seeking to effectively manage livestock pests today. Implementation of the 1996 federally mandated Food Quality Protection Act (FQPA) resulted in

the removal of a number of commonly used livestock insecticide materials, such as dimethoate, naled and chlorpyrifos. In the last decade, relatively few new insecticides have been registered for use on livestock. Efforts by the Cornell University Veterinary Entomology research group have documented widespread insecticide resistance in house flies, a primary pest on livestock operations (Kaufman, et al. 2001). In some cases, 100% of house flies treated with specific insecticides survived when treated with the legal application rate of insecticides. The combination of fewer insecticides available and an increased presence of insecticide resistance has heightened the need for more effective pest management options.

To complicate matters, as suburban areas encroach on rural agricultural landscapes, emigration of pest flies to off-site locations can act as a community lightning rod creating a new set of challenges for those involved in animal agriculture. This results from potential public health concerns and nuisance complaints from neighboring communities.

Individuals relying upon a largely insecticide-based pest management strategy will find this tactic an inadequate approach to controlling these pests. With fewer insecticides available, prospects for new materials limited, insecticide resistance more prevalent, and urbanization of once rural areas becoming more common place, livestock producers will continue to face increased challenges with fly management in the future.

These issues highlight the need for producers to have the best information available to manage dairy cattle pests and to utilize a broad integrated approach that includes a variety of cultural, biological, physical and chemical tactics.

On January 1, 2014 the Northeastern IPM Center for Livestock Commodity Working Group set priorities for livestock IPM research and extension. The working group's highest priorities were:

- IPM Educational Outreach to enhance knowledge, use and adoption of IPM approaches to better managing pests of livestock in New York.
- Development of an Online IPM educational programs to better meet the needs of NY producers

In March 2009 the North Central IPM Center identified IPM research and education needs (NCERA 201). The center set high priorities in Livestock IPM. These are as follows:

1. Educational resources on topics where regional expertise is limited, e.g. mycotoxins in animal feed, livestock IPM, stored grain IPM

On April 25, 2006 the NY Organic Dairy Task Force identified barriers to organic dairy production

1. Dairy fly management was one of their main priorities.

These goals are compatible and provide rationale to address livestock pest management issues. It is the responsibility of the NYS IPM Livestock and Field Crops Team to train and teach dairy and livestock extension educators and livestock producers how to implement IPM for dairy and beef cattle relative to flies. While one on one consultation is a very effective method of transfer of technology, it often may not be possible due to time or resource constraints. We are developing short (2 to 4 minutes) on-line training video's for the IPM approach to dairy and beef cattle fly pest management. These videos provide producers and other professionals with skills and knowledge of proven, effective, integrated pest management techniques to minimize, avoid and mitigate common cattle arthropod pest problems. The brief fly IPM videos will capture key

elements of fly management online exposing stakeholders to IPM concepts and enhancing IPM use and implementation by extension educators, agricultural professionals and producers. Having the videos available and marketed to extension educators and agricultural professionals will increase opportunities for the dissemination cattle IPM technology. These videos include IPM approaches to management of face flies, horn flies, stable flies, and house flies our most common fly pest species. The videos are designed to be appropriate for both conventional and organic dairy and beef production.

Review of Literature

Integrated pest management plays a key and vital role in helping to solve livestock fly pests problems. These insect pests include house fly, stable fly, horn fly, and face fly on cattle. There is a significant body of literature on the biology and economic impact of these pests. Biting and nuisance flies are among the most important pests in dairy and beef production systems responsible for damage and control costs in excess of a billion dollars per year across all livestock systems in the United States (e.g., see Taylor et al. 2012).

House flies are considered to be the #1 nuisance pest associated with dairy and other confined animal operations (Geden and Hogsette 1994, Hinkle and Hickle 1999). House flies are capable of carrying more than 65 disease organisms that affect humans and animals (Greenberg 1971), such as the virulent *Escherichia coli* strain O157:H7 (Sasaki et al. 2000). Stable flies are among the most serious pests of cattle worldwide. With their painful bites, they can reduce weight gains of cattle on finishing rations up to 20% (Campbell et al. 1977). The total impact to U.S. cattle industries is estimated to exceed $2 billion dollars annually (Taylor et al. 2012). Given the economic importance of nuisance and biting flies, control of their populations is critically important. For decades, insecticides have provided economical control of these pests. However, the evolution of insecticide resistance compromises the control achieved in many locations around the USA.

Stable flies develop as maggots in a wide array of decomposing organic matter, including soiled animal bedding and soiled feed debris that accumulates wherever cattle are confined (Moon, 2002). Populations grow exponentially through continuous reproduction from spring to fall in northern temperate localities (Beresford and Sutcliffe, 2010; Taylor et al., 2012). Dairy farm surveys indicate calf hutch bedding is a prominent source of stable flies around dairies (Schmidtmann, 1988), and choice of bedding material can minimize stable fly production (Schmidtmann, 1991). More recently, it has also become apparent that feed debris and manure that accumulate during winter are important sources of stable flies, especially where overwintered debris piles remain intact into the following summer (Talley et al., 2009).

The face fly is the primary pest of pastured cattle in most states north of the 35th parallel. Adult face flies overwinter in attics and out-buildings and colonize cattle in the spring (Karfsur and Moon 1997). The face fly feeds on lachrymal and mucosal secretions of the eyes and nose of cattle. Gravid flies lay eggs exclusively in fresh cattle dung pats, and the life cycle can be completed in as little as 14 days. When face flies are abundant, cattle change grazing habits, which often results in poor utilization of pasture. In addition to the annoyance and irritation associated with its feeding habits, the face fly is the primary means of transmission of *Moraxella bovis*, the causative agent of infectious bovine keratoconjunctivitis (IBK), also known as pinkeye (Glass et al. 1982, Glass and Gerhardt 1983, Krasfur and Moon 1997). Face fly infestations were estimated to cause annual losses of more than $53 million (Drummond et al. 1981). Action

threshold levels of 10-15 flies per face were established to reduce the spread of pinkeye and maximize animal comfort (Krafsur & Moon 1997). In the northeast face fly numbers often exceed 100 flies per face.

The horn fly is an obligate blood-sucking parasite of cattle and is considered a serious pest of pastured cattle in US (Drummond 1988). Horn fly feeding annoys cattle, alters their grazing habits, and decreases both milk production and weight gains. Horn fly numbers as high as 10,000 per animal have been reported, and each fly feeds 10 to 12 times per day. Horn flies oviposit exclusively in fresh dung, and they do so immediately after it has been deposited (Bruce 1964). The fly can complete development in 9-12 days, with 50% adult survival at 5 weeks. Horn flies diapause beneath dung pats during the winter months. Horn fly control leads to increased milk production and calf growth (Johnsson and Mayer, 1999). Unlike other kinds of flies that just visit cattle for brief moments, adult horn flies reside on their host animals, which makes them especially vulnerable to control. Organic dairy farmers rely on essential oil repellents to alleviate horn fly problems, but success of these products is limited. Horn flies have been incriminated in the transmission of bovine mastitis, also known as summer mastitis (Gillespie et al. 1999, Edwards et al. 2000). In NC, 53% of horn flies collected from cattle were positive for *S. aureus,* and 39% of the cows were positive for the same genotype found in the flies (Anderson et al. 2012).

Objectives and Anticipated Impacts:

1. Develop a series of online training videos on IPM for flies on dairy and beef cattle for the producers and agricultural professionals in NY and the Northeast.
2. Measure adoption of IPM practices by users of the training videos.

Impacts will be measured through a post video survey to determine what was learned and the intention to-adopt IPM practices by each participant.

Approach and Procedures

Objective 1: Develop a series of online training videos on IPM for flies on dairy and beef cattle for the producers and agricultural professionals in NY and the Northeast.

We are developing a series online IPM videos for specific fly pests of dairy and beef cattle to train the producer and agricultural professional in the Northeast US. We plan to develop several videos of 2 to 4 minutes per video. Each video focuses on correct identification, monitoring, assessment and guidelines for management. We used photos and video footage taken over the course of the summer. The topics include: house flies, stable flies, horn flies, and face flies. The videos titles are as listed:

- Biology of House flies in the barn
- Biology and Thresholds of Stable flies in the Barn and Pasture
- Horn Flies Biology and Thresholds on Pasture
- Face Fly Biology and Thresholds on Pasture
- Thresholds of House Flies in the Barn
- Use of Biological Control of House and Stable Flies in the Barn

- Biology of horn and face flies around pastured cattle
- The Importance of Dung Beetles in the Pasture
- Use of Non-Toxic Pasture Fly Trapping Technology
- Non-toxic barn fly management,
- Proper use of insecticides in barns,
- Proper use 0f insecticides on pastured cattle

Each of these training videos are available to clientele on the NYS IPM Field Crops You-Tube web channel. http://www.youtube.com/user/NYSIPM. We will work in cooperation with several Cornell Cooperative Extension educators in developing these training videos.

Objective 2: Measure adoption of IPM practices by users of the training videos

Measuring behavioral change by participants is a vital component in any educational model. Program impacts will be measured through post-testing participants to to determine changes in participant's use of IPM practices. On-line learning has the potential to dramatically increase knowledge and the rate of adoption of IPM practices. Secondly, it can reach a wider range of users than providing in person courses. After completing an online video or field meeting, participants will complete a short survey to measure changes in the level of intent to adopt specific IPM practices. To evaluate this project, we will utilize online post-testing of individuals after the completion of each video to measure adoption of practices and how the information will be use in the future.

Current Progress

We decided to develop short videos created through a program Adobe Spark. We used photos and images taken by the NYS IPM Livestock and Field Crops Program from on-farm visits throughout NY state. In a few cases, when we did not have a good image for a specific issues, we used photos with permission from Bugwood.com. We decided to use short text to describe the fly information present in the video instead of narration. The videos are 2 - 4 minutes each with the intent of keeping the attention of the viewer until the end of the video. Currently, we have developed 4 videos that are available on the NYS IPM YouTube Channel.

- ✓ Biology and Thresholds for Face Flies: https://www.youtube.com/watch?v=d0Zu_nUNBOs&t=3s
- ✓ Biology and Thresholds for Stable flies: https://www.youtube.com/watch?v=Xo8w5Cawx1w
- ✓ Biology and Thresholds for Horn flies: https://www.youtube.com/watch?v=T1fmtzY7Wjw
- ✓ Non-Toxic Pasture Fly Traps for Cattle: https://www.youtube.com/watch?v=YLew_MfOoko

We are currently working on: Biology of House Flies in the Barn, Non-toxic barn fly management, proper use of insecticides in barns, and proper use of insecticides on pastured cattle, biological control of barn flies, and the Importance of dung beetles on pasture.

We are currently developing a short survey for online learners to take on the impacts of the videos on the farms or businesses.