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HORN FLY MANAGEMENT FOR WYOMING BEEF CATTLE

Introduction

Horn flies (*Haematobia irritans*) are an external parasite of cattle causing more than $2.19 billion in annual losses to the U.S. beef cattle industry. These flies are not native to the United States and were first recognized in the country in 1887; they are now found nationwide. Due to their preference for laying eggs in the dung piles of cattle, they are considered a filth fly. In Wyoming, horn fly infestations can reach levels that cause reductions in animal production, justifying efforts to reduce their negative impacts.

Life Cycle

Horn flies produce new generations of flies every 10 to 20 days in warm, humid weather conditions (Figure 1, page 2). Adults only live for about 2 to 4 weeks. Adult flies suck blood from cattle during both the day and the night. Female flies leave only to lay eggs in fresh manure, returning to the cattle after laying eggs. The manure is a rich resource environment for the eggs and subsequent life stages.

The eggs hatch into larvae within 1 to 2 days. The larvae grow in the manure for 3 to 5 days, then change into pupae in the manure and soil beneath and continue to develop for another 6 to 8 days. Upon emerging from the pupae in the manure, new adult horn flies begin to seek out the nearest cattle and the life cycle repeats itself. The last generation of horn flies of the warm season overwinter in the pupal form.

Production Losses

In cattle, the irritation and biting of horn flies can cause production losses in several ways. The physical irritation

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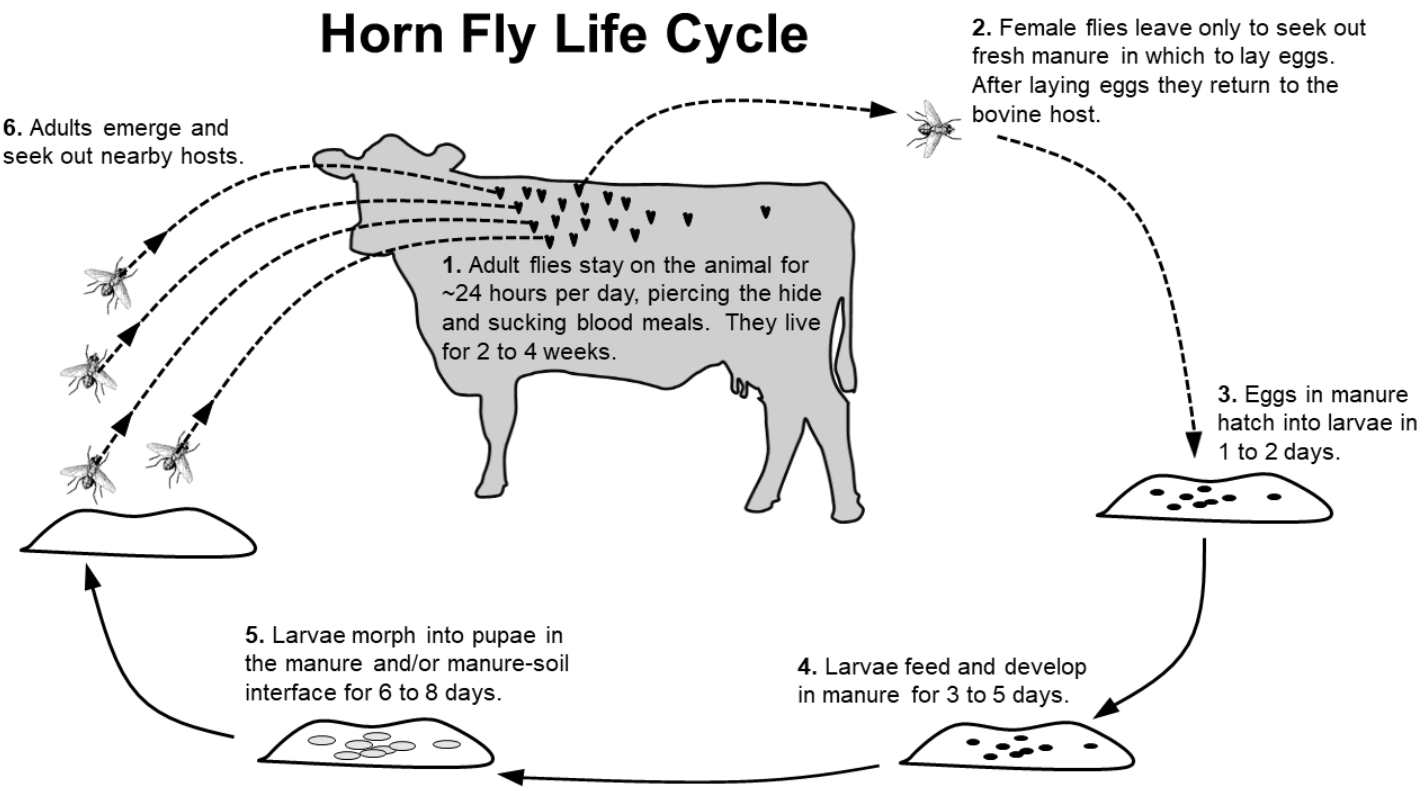


Figure 1. Life cycle of the horn fly.

of horn flies swarming and biting reduces animal productivity because cattle spend energy trying to relieve the irritation—by stomping their feet, swinging their heads, swishing their tails, and shaking their hides (i.e., the panniculus reflex). The time and energy spent trying to reduce the physical irritation leads to reduced cattle grazing time, which can then lead to reduced milk production and calf gains.

Reductions of calf weaning weights due to horn fly irritation range from 4 to 15%. For stocker cattle (i.e., yearlings), this can result in daily weight gain up to 18% lower for animals plagued by horn flies when compared to protected yearlings. In a New Mexico State University (NMSU) study published in 2019 (Smythe et al. 2019), calves weaned from cows treated for horn flies averaged 35.9 pounds heavier at weaning than the calves from unprotected cows.

Horn flies can also serve as a vector for disease pathogens, including bovine mastitis (*Staphlococcus aureus*) and a nematode causing granular dermatitis (*Stephanofilaria stilesi*). Finally, the consumption of blood meals by horn flies can cause substantial reductions in blood volume: each individual fly can consume 24 to 38 blood meals per day at about 1.5 mg of blood per meal.

Economic Threshold for Treatment

When deciding whether treatment is cost effective, it is important to consider the economic threshold. The economic threshold is the pest or injury level when the value of loss exceeds the cost of control. For horn flies on beef cattle, this threshold is estimated to be about 200 flies per cow—or, when looking at 1 side of a cow, 100 flies per cow side (Kunz et al. 1984, Schreiber et al. 1987, Oyarzun et al. 2008). The goal of management is to prevent a pest population from reaching or exceeding the economic threshold. The cost of horn fly treatment(s), the treatment's efficacy, and the current price of cattle influence the threshold.

The five-year average price of stocker steers in Wyoming is $1.74 per pound.[1] If a producer sees the additional gain of 35.9 pounds per calf by implementing effective horn fly integrated pest management (IPM) strategies, that would potentially yield $62.46 more per calf.

The treatment used in the four-year NMSU study (Smythe et al. 2019) was two insecticide ear tags per mother cow, supplemented with a pour-on treatment when horn fly populations spiked. The calves in the study were not treated directly but gained protection through their treated mothers. The approximate cost of treatment based on current prices of the products NMSU used was $5.40 for the two ear tags and $0.39 for each individual pour-on treatment per cow. This cost does not include labor to apply treatments or induced animal handling stress.

Trends in Wyoming (Elevation/Season)

It is important to note that in Wyoming, the cold environment and highly diverse topography can influence the infestation of horn flies on cattle. Cattle at higher elevations typically have lower infestations of horn flies and may not reach economic thresholds for treatment. For example, in 2019 and 2020, we assessed horn fly infestations at five locations ranging from 4,200′ up to 8,600′[2] and found that cattle at the lowest elevation always had the highest horn fly infestations and cattle at the highest elevation always had the lowest horn fly infestations. The latter never exceeded economic thresholds.

Similar results were found in a study published by the University of Wyoming in 1999,[3] which also showed that as the elevation increases, horn fly numbers may decrease on cattle. Moreover, the 2019 and 2020 studies suggested that in some years and in some locations, horn fly infestations may not reach economic thresholds. For example, in a 5-year (2016–2020) assessment of black cows in the Laramie Valley of Wyoming (approximately 7,200′), the herd average exceeded economic thresholds only 3 out of the 5 years.

IPM Management Strategies

When managing any pest it is important to consider Integrated Pest Management (IPM) strategies. In the case of horn flies, we suggest keeping the following six IPM strategies in mind.

1. Identifying pest correctly
2. Monitoring pest populations
3. Management based on economic thresholds
4. Preventing pest problems (short-term and long-term)
5. Combining or integrating tools
6. Monitoring for efficacy of treatments

Estimating infestation levels

Ranchers can rapidly estimate the numbers of horn flies in real-time (Figure 2). While counting flies might seem impossible, it is within reason to estimate the number on a handful of cattle to determine if the infestation level is becoming concerning. However, it is important to note that not all cattle breeds will have uniform horn fly populations between individual animals (Lysyk et al. 2004). Black-hided animals tend to have more uniform populations, meaning that if you count 10 animals out of a herd of 50, you will have an accurate estimate. However, if you have light-colored animals, the distribution of horn flies will be clumped, meaning that more animals will need to be checked in order to get an accurate representation of the overall population.

For example, in a herd of light-colored animals you will have to check at least 30 animals out of a herd of 50 to get an accurate assessment of the horn fly population. It does not take many visually apparent flies to exceed the threshold—typically if we think a cow has a high number of flies that are physically irritating, then it is likely she has exceeded the threshold. For more detailed estimates, taking photos to count flies later is recommended.

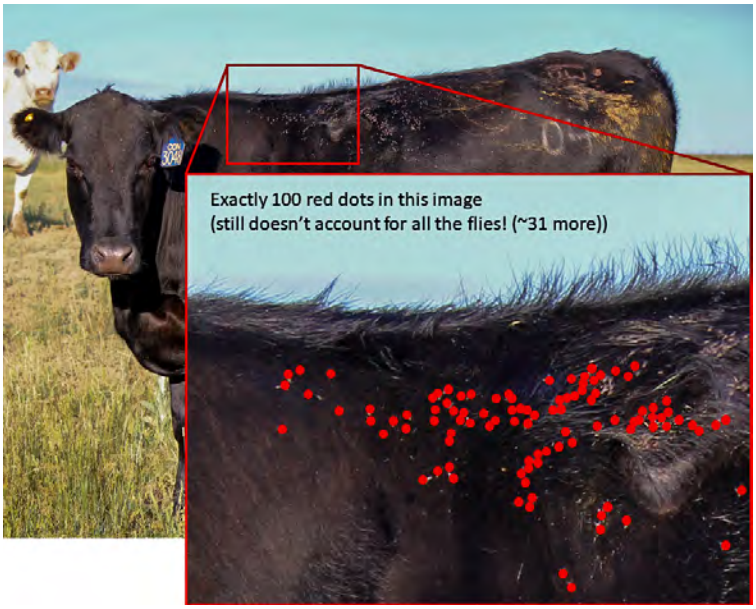
1 https://www.cattlerange.com/pages/market-reports/weekly-stocker-calves-prices-by-state/

2 4,281'—Lingle, WY; 5,046'—Cody, WY; 6,630'—Cheyenne, WY; 7,160'—Laramie, WY; 8,606'—the Bighorn Mountains

3 Kaufman, P. E., Lloyd, J. E., Kumar, R., Campbell, J. B., & Boxler, D. J. (1999). Differences between horn fly densities on cattle pastured in Wyoming and Nebraska as possibly influenced by elevation. Southwestern Entomologist 24(2): 115-121.

First, assess the side profile of cattle; note the majority of flies congregated along the back and sides. Visual sampling during the heat of the day can lead to undercounts as horn flies move to the shade of the sternum and belly.

Second, estimate a smaller area and do a rapid count.



Third, estimate the number of similar areas of size and density. For example, this cow has >500 horn flies on one side.

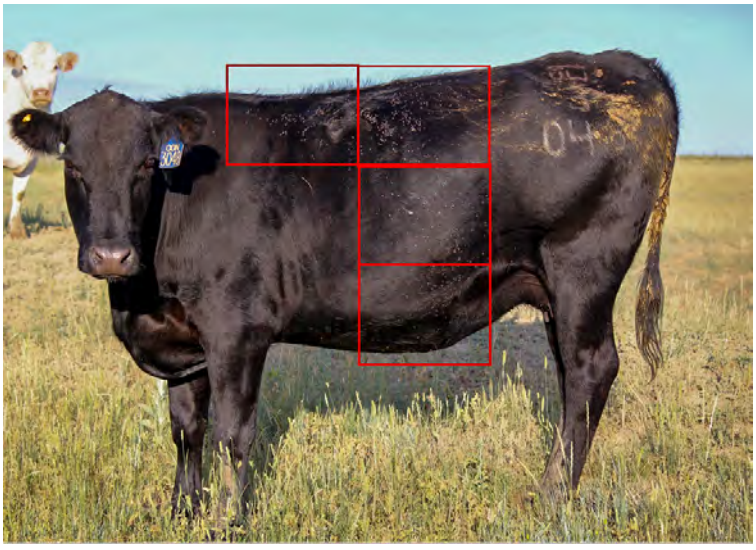


Figure 2. Estimating horn fly infestations. Images were captured in the morning on the side of the animal facing the sun to provide the best visual detection of flies.

Control Strategies

Animal Rotation and Habitat Disruption

This strategy attempts to get ahead of the horn fly's life cycle and/or disrupt fly habitat. There is some anecdotal evidence that rotation can move cattle away from new emerging horn fly generations but such rotations would likely need to be extensive. Research has found that moving between 3- to 8-acre paddocks was not of sufficient scale because flies can migrate longer distances.

It is common practice to break up the manure breeding material required by horn flies by dragging pastures and meadows. The physical disruption may open up the manure and dry out eggs/larvae and also expose the eggs/larvae to predators such as birds. There is some evidence that grazing in recently burned areas can reduce pest flies and ticks as well.

Breed Selection

Parasites are known to discriminate when selecting a cattle host based on a variety of factors, including breed, sex, age, hair color, and hide thickness. Strategically this can be used to a rancher's advantage. For example, research in Laramie showed that white Charolais cattle were less susceptible to high populations of horn flies than black Angus cattle. It has also been observed that bulls typically have much higher infestations than cows due to pheromones and respiration rates. Using this information, you might choose to treat only the most susceptible animals, such as bulls or black cattle.

Select for Cattle Heritability of Resistance

It has also been documented that some animals are simply more resistant to parasites, such as lice and horn flies, than others. Animal traits shown to be a potential mechanism for such resistance are hide thickness and density of hair follicles. Therefore, keeping or culling animals based on parasite infestation could be a means of optimizing heritability of resistance. A rancher in eastern Colorado has adopted this approach, scoring and selecting bulls based on horn fly resistance.[4]

4 https://www.americancattlemen.com/articles/dreaded-horn-fly

Chemical Control

There are many tools and options for chemical management of horn flies on cattle. An important consideration when selecting any of these tools, or combinations of tools, is the horn fly's ability to develop resistance to chemicals relatively quickly.

Backrubbers/Dust Bags/Oilers. This method has been around for many decades, with research dating back to the 1960s. It requires a physical device, is typically dosed with an insecticidal dust or insecticide-infused oil, for cattle to rub on. Such devices can be placed at congregation points where cattle go through a gate (i.e., forced) or freely provided for free-choice use by animals (i.e., voluntary). They can be effective, but in voluntary situations, they may not provide equal protection to the entire herd due to variation in individual animal use. Products available for backrubbers and oilers include pyrethroids with oxidase inhibitor synergists such as piperonyl butoxide (PBO) that help overcome insecticide resistance in pest populations.

Ear Tags. Ear tags impregnated with insecticides first became available in the late 1970s. Early use was very effective and relied on organophosphate and pyrethroid class insecticides, but the development of widespread insecticide resistant pest populations has led to a decline in usage. To avoid the development of insecticide resistance, it is important to rotate insecticide class usage. Resistance to pyrethroids in horn fly populations has been documented to occur in as little as 3 years, going from 20 weeks of efficacy in the first year to 1 week of efficacy in the third year. To follow ear tag best use practices, visit bit.ly/osu-hornfly-insecticide-ear-tags.

Ear tag products are available with three insecticide classes that have different modes of action.[5] They include those using the *organophosphate* class active ingredients such as Diazinon and Coumaphos, and *Pirimiphos-methyl* and *pyrethroid* class active ingredients such as Zeta-cypemethrin, Permethrin, and Lambda-cyhalothrin (preferably formulated with a

5 A mode of action refers to specifically how an insecticide affects an organism.

Figure 3. It is ideal to put two tags in cattle, one in each ear.

synergist such as PBO). A third class is the *macrocyclic lactones*, specifically those with the active ingredient abamectin.

It is important to avoid using the same class of insecticide every year in order to avoid the development of insecticide resistance. Rotations could include using a macrocyclic lactone in Year 1, an organophosphate in Year 2, and a pyrethroid in Year 3. It is ideal to put two tags in cattle, one in each ear (Figure 3). Be sure to read the product label and tag the recommended classes of cattle to get the best possible results.

Sprays/Pour-Ons. The use of chemicals that are sprayed or poured onto cattle is effective, but these applications often only provide 1 to 3 weeks of control. Therefore, reapplication is likely to be needed. These chemicals can be mixed into sprayers to apply to cattle in a pasture; applied through a drench gun down the topline of cattle in the alley or chute; or applied through innovative paintball-style guns. While the cost per treatment may be low, the necessary reapplication can increase the total cost per head over the fly season. A number of synthetic chemical options and organic options are available.

Oral Fed-through. Also called oral larvicides and insect growth regulators (IGRs), these products are fed to cattle and kill the horn fly larvae in the manure. To be effective, it is necessary to have steady consumption leading up to the fly season, so it is important to begin application earlier rather than later. Some products that use the active ingredient methoprene recommend feeding from 30 days before the first spring frost to 30 days after the last fall frost.

Emerging Alternatives

Producers may be interested in some emerging alternatives to complement their horn fly management program. There are a number of *organic sprays/pour-ons*, some of which are made from naturally occurring substances like citrus extracts. It is important to note that some of these may be generally labeled for animals

Table 1. Hypothetical economic comparison of treatment options based on per head cost, duration of treatment effect, and total cost per head for 18 weeks.

Treatment option	Per head cost	Duration of treatment effect	Number of treatments for the season	Total cost per head
Ear tags	$ 5.00	18 weeks	1	$ 5.00
Pour-on	$ 2.00	3 weeks	6	$12.00

(horses and dogs) but may not include cattle. Like many synthetic chemical sprays/pour-ons, these products require reapplication.

There has also been interest in ***feeding garlic*** to reduce horn flies with research coming out of northwestern Saskatchewan, Canada[6] suggesting there may be some control due to the odor. This initial work used a salt-based supplement infused with garlic. There are more questions about this potential alternative and research results have been mixed.

There is also interest in using ***other insects***, such as dung beetles and parasitic wasps, to reduce horn flies. Dung beetles also use manure resources and can reduce or break up manure resources on the landscape. In Wyoming, the majority of dung beetles are the endocoprid type, which means they feed and lay eggs within the dung pat; they do not break up the exterior and move dung away from the pat location.

Regarding parasitic wasps that attack filth fly species, the idea is that these very small non-stinging insects seek out fly pupae in manure to insert their eggs into them. These beneficial insects may reduce filth flies particularly well in barn or pen settings. The research on these wasps in pasture situations has not shown efficacy at this time, mainly due to how far the manure pats are spread out within a pasture.

Economic Considerations

When selecting treatment options, it is important to consider the per head cost, the duration of the treatment effect, and the total cost per head (see Table 1 for a hypothetical comparison described here). For example, if one ear tag costs $2.50, then treating one animal would cost $5 (if using two tags per animal, placing one in each ear). If those ear tags are effective for 18 weeks and re-treatment is not necessary, then the total cost per head is $5. In contrast, if the cost for a pour-on is $2 per head but only lasts for 3 weeks, requiring 6 treatments over the same 18-week period, then the total cost per head would be $12.

Summary

Horn flies are a widespread pest affecting cattle in Wyoming. Some elevations and animals may be more susceptible to high infestation levels than others. Consider that certain types of cattle (and then individuals within those types) may have higher or lower levels of resistance and your selection decisions may be considered part of your management program.

Regular monitoring to estimate infestation relative to the economic threshold for horn flies on cattle (100 per cow side) will help you determine if treatment is warranted. If treatment is warranted, integrating multiple strategies, with the specific timing and application that each requires, will result in economical control.

6 https://www.canadiancattlemen.ca/features/garlic-is-worth-its-salt-for-fly-control/

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