Proceedings, State of Beef Conference
November 7 and 8, 2018, North Platte, Nebraska

EXTERNAL AND INTERNAL PARASITES

David J. Boxler
University of Nebraska West Central Research and Extension Center, North Platte

External Parasites

The Horn Fly

Horn flies are small, less than a quarter of an inch in size and are commonly found of the backs, sides, and poll area of cattle. During warm weather, especially by mid-afternoon they will often be found on the belly region of cattle were there is shade and cooler conditions. Male and female flies will acquire more than 30 blood meals per day (Figure1). Once the female has mated she will leave the animal to deposit eggs in fresh cattle manure. During warm weather, the entire life cycle can be completed in 10 to 20 days. Newly emerged horn flies can travel several miles searching for a host, fly immigration can result in an increase in fly population numbers even if good fly management practices are in place.

Horn fly feeding causes irritation, blood loss, decreased grazing efficacy, reduced weight gains and diminished milk production in mother cows. Additionally, horn flies can spread summer mastitis. Research conducted in the U.S. and Canada have shown horn flies can decrease weight gain in cattle, and negatively impact calf weaning weights from 4- 15 percent. Trials in Nebraska have established calf weaning weights were 10-20 pounds higher when horn flies were controlled on mother cows. Yearling cattle can also be impacted by the horn fly; decreasing yearling weights by as much as 18 percent. Economic losses associated with horn flies are estimated at more than $1 billion dollars annually in the United States. The economic injury level is the smallest number of flies that will cause losses equal to the cost of controlling the fly.

The economic injury level (EIL) for horn flies is 200 flies per animal, and fly control should be implemented if the EIL is exceeded.

Many insecticides and delivery methods are available for managing horn flies. Backrubbers/oilers and dust bags they should be used in a forced-use system to achieve maximum horn fly control. Animal sprays delivered by low pressure or mist blower sprayers and pour-on products will provide 7 – 21 days of control and will need to be re-applied during the fly season. Insecticide ear tags and strips are a convenient method of fly control and should be applied late May to receive season-long horn fly control. If insecticide ear tags and strips are applied earlier, re-tagging or adding an additional form of fly control mid-fly season might be necessary. Oral larvicides (IGR's) impact developing larvae in the manure pats and prevent fly larvae from developing into adults. One important factor when using an oral larvicide is assuring steady consumption. An additional issue when using an oral larvicide is horn fly migration from neighboring untreated herds, which can disguise the efficacy of the product. The Vet Gun™ applies an individual capsule of insecticide to an animal and can provide control between 21 and 35 days.

For more information about horn flies, NebGuide G1180, The Horn Fly, can be accessed at http://extensionpublications.unl.edu/assets/pdf/g1180.

The Face Fly

Face fly adults are slightly larger and darker than the house fly. The face fly has a sponging type mouth part like the house fly and feeds on animal secretions, nectar, and dung liquids. Only the female face fly will be found clustering around an animal's eyes, mouth, and muzzle causing extreme annoyance and irritation. Livestock will react to fly feeding by bunching, seeking shade of trees or in some cases, standing in water in an effort to avoid the flies. Face flies will also feed on blood and other secretions around wounds caused by injury. Face flies are present throughout the summer, but populations usually peak in late July, August, and early September. They are most numerous along waterways, areas with abundant rainfall, canyon floors with trees and vegetation, and on irrigated pastures.

Female face fly feeding damages eye tissues; increases susceptibility to eye pathogens; and can vector *Moraxella bovis*, and M. *bovoculi* the causative agents of pinkeye or infectious bovine keratoconjuctivitis. Pinkeye is a highly contagious inflammation of the cornea and conjunctiva of cattle. Controlling face flies is essential in reducing most pinkeye problems. It is estimated $150 million per year is lost to pinkeye treatments, reduced weight gains, and reduced milk production from face fly feeding and irritation.

Adequate face fly control can be difficult because of their habit of feeding around the face and the significant time they spend off the animal. Control is increased when cattle receive daily insecticide applications by either dust bags, oilers, sprays, or an insecticide impregnated ear tag/strip. Ear tags/strips should be applied at the label recommended rate. Both adult animals and calves must be treated if control is to be achieved. Pinkeye vaccines are available and should be considered if face flies and pinkeye have been a recurring problem. Currently, commercial and autogenous pinkeye vaccines are available; please check with your local veterinarian about the use of these products in your area.

For more information about the face flies, NebGuide 1204, The Face Fly, can be accessed at http://extensionpublications.unl.edu/assets/pdf/g1204.pdf.

The Stable Fly

Stable flies are another serious pests of pastured cattle. Stable flies are blood-feeding flies, mainly feeding on the front legs of cattle, but can also be found on the belly area. It normally takes a stable fly about 2 to 5 minutes to complete a blood meal (Figure 3). Their bites are very painful and cattle react by stomping their legs, bunching in pasture corners, or standing in water to avoid being bitten. Stable flies cause similar weight grain losses to pasture and confinement cattle. University of Nebraska research recorded a reduction in average daily gain of 0.44 lbs. per head with animals that received no insecticide treatment compared with animals which received a treatment. The economic threshold of 5 flies per leg is often exceeded in mid-western pastures.

The female stable fly deposits eggs in spoiled or fermenting organic matter mixed with animal manure, soil, and moisture. Grass clippings and poorly managed compost piles may also be stable fly developing sites. Winter hay feeding sites where hay rings are used can be a source for larval development through the summer if proper moisture is present. The life cycle of the stable fly can take 14 to 24 days, depending upon weather conditions. The source of early season stable fly numbers on pastured cattle is not completely understood, but some probably develop locally. The presence of early season stable flies might be migrants from southern locations. However, it is well documented that stable flies can fly more than 10 miles or more.

Managing pasture stable flies is difficult, currently, the only adult control option is on-animal sprays, delivered by low pressure or by mist blower sprayers. Weekly applications are required to reduce fly numbers. Sanitation or clean-up of wasted feed a winter feeding sites may reduce localized larval development. If sanitation is not an option, these sites may be treated with a larvicide (Neporex®). Implementing either procedure may not totally reduce the economic impact of the stable fly.

Note of Caution about Fly Insecticide Resistance

Insecticides are categorized by Insecticide Mode of Action (MoA) groups based on how they work against insects.

Continual use of products from a single group against a pest species can lead to reduced control (resistance to all products in the group). To lessen control failures due to insecticide resistance, do not apply insecticides within the same MoA group number repeatedly, even when using different application methods (residual sprays, knockdown sprays, insecticide ear tags and feed-throughs (IGR's). Rotate between MoA groups during the fly season.

Cattle Lice

As the above average fall temperatures give way to winter conditions cattle lice numbers will increase. Cattle lice are a cold season insect that thrives in very cold conditions. Populations are most noticeable during December, January, February, and decline during March when temperatures warm. Lice are transmitted by contact from one animal to another. Cattle with hair loss, an unthrifty appearance, and leaving hair on fences and other objects from rubbing may be a sign of lice infestation. However other factors can mimic lice infestations such as natural shedding, poor nutrition, mite infestations, mineral deficiency, photosensitivity, and other diseases. To determine if lice is the problem, secure the suspect animal(s) in a chute and perform a two-handed hair parting on the top line, withers, and face. Lice numbers between 1-5 per square inch represent a low population, 6-10 per square inch represent a moderate population, and more than 10 lice per square inch is considered a heavy population.

In Nebraska we can encounter four different cattle lice species. The biting or chewing louse (little red) *Bovicola (Damalinia) bovis*, reddish brown in color with dark bands running transversally across the body. Typically the chewing louse feeds on hair, skin, skin exudates and debris near the skin surface. This species is initially found on shoulder and top line, and back, but as populations increase, can be found on the sides and sometimes over the whole animal.

The other three species are sucking lice, which feed on blood, and can cause irritation, anemia, impact weight gain, and even death in extreme cases.

The short-nose cattle louse, *Haematopinus eurysternus* is the largest louse at 3-5 mm in length and is typically found on older animals, but can be found on any age or breed of cattle. This species can usually be found in the neck region, dewlap, back, and base of tail.

The long-nose cattle louse, *Linognathus vituli* is about 2.5 mm in length, bluish in color and differs from other louse species by its long slender head. This louse can be found on the dewlap, shoulders, sides of neck and rump, but when numbers are high, they can be found over the entire body.

The little blue cattle louse, *Solenopotes capillatus* is about 1-2 mm in length, bluish in color, and smallest of the sucking lice species. It often can be found in dense patches on the dewlap, muzzle, around eyes, and neck. Heavy populations can greatly impact cattle weight gains.

University of Nebraska and other studies indicate heavy lice populations may reduce weight gains by as much as 0.21 lb/day. These studies also indicate calves fed at a higher nutrition level had lower lice populations and were affected less severely by lice than calves fed a maintenance ration.

Insecticide formulations fall into three categories: non-systemic pour-on, systemic pour-on, and systemic injectable. Some non-systemic pour-ons require just one application and some require two applications spaced 14 days apart. Systemic injectables work better on the three species of sucking lice than on the little red chewing louse. A systemic pour-on effectively kills both chewing and sucking lice.

Use of systemic control products between Nov. 1 and Feb. 1 is not advised as they may cause a host-parasite reaction from killing developing cattle grubs while they are in the esophagus or spinal canal of the animal. A systemic product used during fall weaning will not be a problem. Producers who did not use a systemic during fall weaning, should consider using only **non-systemic control products** during this November to February time frame.

Successful louse control depends on application timing. Many livestock producers will administer an endectocide treatment at weaning time, usually late September or October with intentions of controlling internal parasites, cattle grubs and cattle lice. These fall applications may help reduce lice populations, but may not remove the infestation. A warm extended fall, may slow down developing lice numbers. Livestock producers who use this management strategy should monitor their cattle for signs of lice especially during the months of December, January, and February. If replacement animals are brought into a herd during the winter months they should be examined for lice. If present, the animals should be isolated and treated before introduction into the existing herd.

Internal Parasites

Helminths, or parasitic worms hinder the performance of cattle, especially those raised on pasture. The term helminth describes several parasitic worms in cattle, including the gastronintestinal *nematodes Ostergia, Cooperia, Haemonchus, Trichonstrongylus, Oesophagostomom, Bunsostomum, and Nematrodirus*. The life cycle of these worms occurs within cattle and on grass. Sexual reproduction occurs within cattle intestines, while egg hatching and larval development occur on grass. One female worm may produce tens of thousands of eggs.

Helminths derive nourishment and protection from cattle, living in association with and at their expense. The primary host's expense is providing blood to the parasite. Worms cause problems ranging from mild gastrointestinal inflammation to clinical disease. The effects of internal parasites on cattle will vary with the severity of infection as well as age and stress level of the animal.

Calves and young cattle are most sensitive to helminths due to their underdeveloped immune systems. Cattle develop tolerance to worms as they age, and must be exposed to parasites in a managed fashion. There is significant economic evidence to support deworming young animals. Higher economic returns are observed because deworming allows an animal's body to use feed for normal metabolism and weight gain rather than diverting nutrients to support worms. Mature cows acquire a degree of immunity to parasites that reside in the lower gastrointestinal tract. Parasite loads are most damaging in mature cows near calving because immunity is suppressed. Cows, especially dairy, in early lactation are often in a negative energy balance due to the stress of lactation. These cattle are affected more than cows in later lactation, when smaller levels of milk are produced. Bulls are typically susceptible to internal parasites than cows.

The major effects of parasitism can be separated into two types, subclinical and clinical. Losses in animal productivity (milk production, weight gain, lower conception rates, and elevated rate of other diseases) are all subclinical effects; while visible disease-like symptoms (diarrhea, rough hair coat, lower weight gains, anemia, and edema) are clinical effects.

Understanding the life cycle of a helminth can help the livestock producer manage this pest. In a host animal, adult nematodes produce eggs. The eggs are expelled from the host with feces which then contaminate the pasture. A first-stage larva hatches from the egg and will molt two times before it becomes a third-stage larva. Once the larva is in the third-stage, it is capable of migrating from dung pats and soil onto moist grass. Infection occurs when the third-stage larva is consumed with the grass. The larva completes its life cycle in the gastrointestinal tract of its host. Once the adult stage is reached, mating occurs and the life cycle starts over. Most eggs do not survive, mortality is the greatest between egg and stage L2. Fungi and insects often help reduce eggs and larvae with in manure pats.

Unlike other nematodes, the medium stomach or brown stomach worm (*Ostertagia*) can spend part of its life cycle in hypobiosis, a condition similar to hibernation. This condition usually begins in spring with the hibernating larvae emerging in the summer.

Parasite pressure in a pasture varies with season and management. Parasite burden peaks during the spring and is lowest during the hot, dry summer months. Parasite pressure will be less under good management conditions which includes a good nutrition and health program.

There are several key pasture management practices which producers can use to reduce parasite contamination and load in their pastures. 1. Establish optimum stocking rates to prevent overgrazing. 2. Maintain pasture grass residual height of 4 inches or taller. 3. Limit rotational grazing events to less than 4 days. 4. Move more susceptible younger cattle to a safe pasture. Safe pastures include pastures that were not grazed during the last 12 months. 5. Older animals with tolerance to helminths should graze following younger animals. Pasture management practices may reduce the parasite burden in cattle, but, this method alone will not guarantee complete parasite eradication.

There are four broad classes of anthelminitcs: benzimidazoles, imidazothiazoles, macrocyclic lactones (ML), and tetrahydropyrimidines.

Benzimidoazoles (Albendazole, Fenbendazole, Oxfendazole) are often referred to as "white dewormers". These compounds are given orally, have little residual activity and are quickly broken down in the gastrointestinal tract.

Imidazothiazole (Levamisole) can kill adult stages of worms: however these compounds have a short period of activity. These compounds are administered orally, and as an injection.

Macrocyclic lactones (ML) (Eprinomectin, Doramectin, Ivermectin, Moxidectin) are generally regarded as the most effective and least toxic dewormer currently in use. They offer longer residual activity. Long-acting formulations are popular because therapeutic levels of the compound are available to kill multiple –generations of susceptible larvae and adults without the need to re-administer the product. Administered as an injection or as a pour-on. Shortly after pour-on formations were made available, research found the absorption of pour-on products to be erratic and unpredictable.

Tetrahydropyrimidine (Morante) are short residual products that work on adult worms by interfering with their neuromuscular system. Administered as an injection.

Since bulls, cows and young animals are affected differently by internal parasites, treatment programs will differ. Mature cows should be treated at least one time per year. The best time to treat a mature cow is near calving. A mature cow's vulnerability to parasite harm increases during this time due to stress of production and suppressed immune system. In situations where parasite load is high, such as overstock pastures, treating twice a year may be necessary. Bulls should be treated twice a year, spring and fall. Treatment of calves should begin when they reach three to four months of age and again at weaning if they are kept as replacements or stockers.

Yearlings can be treated on a seasonal basis, spring and fall, until they are mature cows. If calves are backgrounded in a dry lot, one initial treatment should be adequate.

Establishing a cost-effective internal parasite control program begins with your veterinarian. They will collect fecal samples and conduct a fecal egg count (FEG) which can be either qualitative (positive or negative for eggs) or quantitative (number of eggs per gram of manure). To gauge the overall herd infestation, 20% of the herd or 20 animals, whichever is greater should be sampled. If a dewormer is used, a fecal egg count reduction test (FECRT) should be used to determine the efficacy of treatment. Typically, the FECRT compares the FEC to a 14-day post-treatment FEC. Treatment is considered to be effective with a FECRT of 90%-95%. A FECRT of less than 90% indicates a less than desirable treatment, and may indicate resistance. Identification of the surviving parasites is important for managing the development of anthelmintic resistance. A specialized test called a polymerase chain reaction (PCR) is used to identify specific parasite species.

Resistance to anthelmintic compounds by internal parasites have been demonstrated throughout the world. The first documented case of anthelmintic resistance to endectocide compounds in the U. S. occurred in 2003. Currently, it appears that in the U.S. the following is the state of resistance in cattle nematodes: (A) widespread resistance to *Cooperia* spp. to the macrocyclic lactones, (B) resistance to *Haemonchus* sp. to macrocyclic lactone use is becoming more common, (3) there has only been one documented instance of resistance against the macrocyclic lactones by *O. ostertagi*, (4) resistance against drugs in the benzimidazole class of drugs has only been confirmed for *H. contortus*, and (5) the macrocyclic lactone resistant parasites have the potential to significantly impair cattle health and productivity. Resistance to a specific active ingredient class does not mean the worm is also resistant to other drug classes. Resistance to various drug classes is developing faster than new classes of dewormers are being developed. The development of resistance can be slowed by avoiding misuse of dewormers, particularly through sub-therapeutic use.

While not labeled for combination use, many veterinary parasitologists agree deworming concurrently with different classes of products will increase their efficacy without contributing to resistance. Fortunately, multiple-resistant worms have not yet been reported in cattle, regardless of the use of single or multiple ingredient classes. In combination, these dewormers kill resistant worms that would have otherwise survived. Studies have shown that administration of benzimidazoles enhanced the efficacy of injectable and pour-on MLs. Resistance to all MLs is delayed when used in combination with benzimidaloes or imidazothiazoles, Combination therapy is only appropriate when the active ingredients do not share the same mode of action.

An important factor in the development of heliminth resistance is the level of selective pressure applied against the parasite genome. One method of reducing that pressure is by a management tool of known as “refugia”. Refugia refers to the portion of the total nematode population at a given time of anthelmenitic treatment that do not develop to the infective stage and are not digested prior to the clearance of the antihelmintic from the treated host.

Refugia include larvae residing on pasture or within the intestine at the time of deworming. Intestinal larvae may not be exposed to the treatment due to various chemical or biological factors. Untreated herd mates also contribute to refugia. Stage L3 larvae on pasture at the time of treatment contribute to refugia when they are not ingested prior to clearance of the dewormer from the treated animal. Current management procedures rely upon leaving untreated animals in the herd.

Understanding the systems of internal parasites, their relationship with their host, and environment coupled with appropriate diagnostic testing allows producers to make informed decisions related to grazing and deworming. Overseeing this relationship effectively will result in improved animal health and producer productivity.

Dave Boxler is a Focused Extension Educator in livestock entomology, located at the West Central Research and Extension Center, North Platte. Boxler provides extension programming on livestock insects to local, state, regional, and international clientele. His research studies are currently focused on three pasture fly species: horn fly, face fly and stable fly. These studies involve assessing and evaluating current fly control methodologies, developing and evaluating biopesticides, designing and evaluating stable fly traps, and conducting insecticide resistance bioassays for horn flies and stable flies.

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