DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Agriculture and Natural Resources

FSA3045R

Managing Internal Parasites in Beef and Dairy Cattle

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Introduction

Parasite control programs (PCP) in cattle are essential to maximize animal health and production, and the need to control internal parasites will exist for as long as cattle graze pastures. However, there is a great deal of variation from one operation to the next regarding parasite levels both on pastures and in individual animals. Heavily stocked pastures tend to have higher concentrations of parasites when compared to those that are lightly stocked. Cattle kept in a drylot are less likely to carry heavy worm burdens when compared to those allowed to graze pastures. Cattle under 2 years of age will typically have more internal parasites than older cattle. Therefore, the methods of controlling internal parasites should be tailored to individual production situations.

Strategic and targeted deworming, an important part of any PCP, starts with understanding the life cycles of problem parasites, identifying key parasitic behaviors (such as seasonal life cycle adaptations) and implementing targeted controls that are both effective and economical. A successful PCP, along with good herd management, can lead to increased production and overall profits.

Effects of Internal Parasites

The effects of parasitism can be separated into two types – subclinical and clinical. Losses in animal productivity (milk production, weight gain, altered carcass composition, conception rate, etc.) are all subclinical effects, whereas the visible symptoms (roughness of coat, anemia, diarrhea, lethargy, etc.) are clinical effects. The subclinical effects make up most losses and are of major economic importance to the producer as these effects tend to go unnoticed. Surveillance of parasitic burdens in cattle is a vital part of a successful PCP and can be achieved by the implementation of periodic fecal egg counts (FEC).

The severity of infection varies in individual animals, dependent on age, stress levels, secondary illnesses, production status and sex of the animal. Weaned calves are extremely vulnerable to parasitisms, as this is a very stressful period and have a lesser immune system regarding internal parasites acquired by grazing pastures. Healthy, mature cows acquire a degree of immunity to internal parasites, although there are some worms, such as the brown stomach worm (*Ostertagia ostertagi*), that evade animals' immune systems and will continue to infect the animals throughout their lives. Parasite burdens are most detrimental in mature cows near parturition because of stress and the suppression of their immune system. Cows, especially dairy cattle, 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 being produced. Bulls tend to be more susceptible to internal parasites when compared to cows, due to a lower gastrointestinal immune response.

Parasites of Concern

The most important class of internal parasites that affect Arkansas cattle are the nematodes, or "parasitic roundworms,"

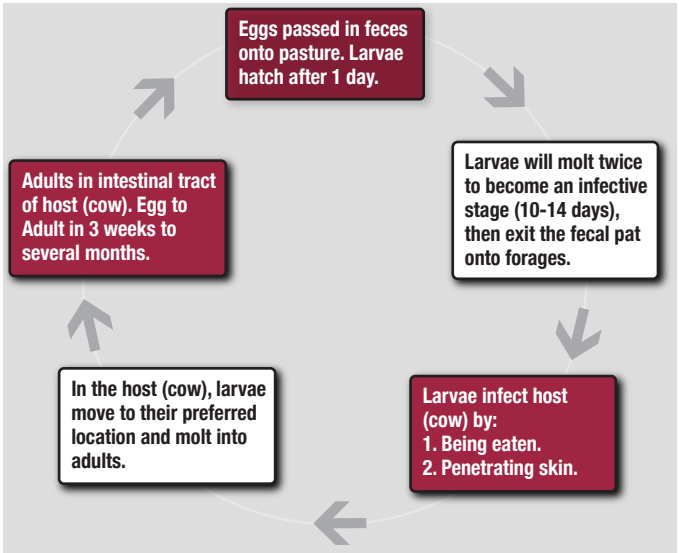
though cestodes ("tapeworms") and trematodes ("flukes" or "flatworms") can become a concern in certain situations. Protozoa, such as the species that causes coccidiosis, also affect the gastrointestinal tract of cattle but will not be included in this article.

Common cattle nematodes found in Arkansas and important attributes can be found in Table 2; the cooperiads and *Ostertagia* are the most prevalent as well as the most important. Tapeworm infections in cattle tend to be of minimal concern. In Arkansas, flukes only occur in areas where pastures are partially or fully submerged in water during the grazing season and where mud snail populations (a life cycle requirement) exist. These areas include poorly drained pastures, river bottom pastures and pastures that contain pools of water (ponds, ditches, etc.) from which cattle graze. Fluke infections can cause great economic losses due to chronic wasting of the animal. Learning which parasites are on an operation is important for targeted deworming treatments.

Nematode Life Cycle

Figure 1 shows the generalized life cycle of cattle nematodes. In the host animal, adult male and female nematodes copulate, and the female produce eggs that are expelled with the feces onto pastures. After about one day, a first stage larva hatches from the egg. It will molt twice more to become an infective, third stage larva, all within the fecal pat. The infective larva leaves the fecal pat and infects the cow by being eaten with the grass or by penetrating the skin, depending on the nematode species. Once inside the host, it molts to a final larval stage, then to a mature adult. This life cycle will vary depending on the species of worm and environmental conditions. Nematodes, such as *Ostertagia* and *Haemonchus*, undergo a seasonal arrestment and embed in the lining of the abomasum until favorable environmental conditions occur. Understanding the life cycles of important parasites will help tailor deworming treatments and management practices that will be most effective for a livestock operation.

Figure 1. Typical Trichostrongyle Life Cycle.



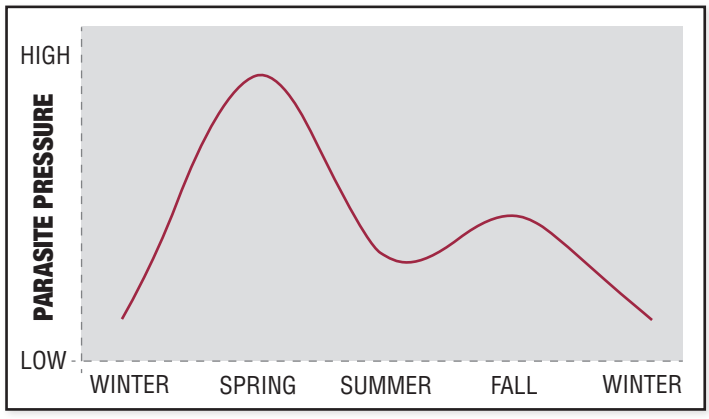
Life Cycle of the Liver Fluke

The liver fluke's life cycle requires two hosts for completion: snails are the intermediate host and ungulates (cattle, sheep, horses, pigs, deer, etc.) are the definitive host. Adult liver flukes are found wedged in the bile ducts of the liver. The eggs are laid in the ducts and expelled with the feces into standing water. After 10-12 days, a larva hatches from the egg in water, infects the snail and multiplies asexually. The second larval stages exit the snail in 5-7 weeks and encyst on aquatic vegetation, where it will persist until consumed by the definitive host. Inside the host, the fluke migrates to the liver, wedges itself into a bile duct and matures into an adult that feeds on liver tissue.

Seasonal Parasite Pressure

The intensity of parasite pressure from pasture varies with season and management practices. Parasite pressure from pastures follows the forage growth during the grazing season (Figure 2). Typical cattle parasite pressure increases in Arkansas during the spring and tapers off during the hot, dry summer months when forage isn't growing as fast and dew content is low; it has a slight bump during fall forage growth, then falls off to lower levels during the winter months. However, *Ostertagia* is opposite, completing its life cycle during the winter and arresting during the warm, hot season (in Arkansas). Cattle in drylot systems typically have fewer worms and less seasonal variation when compared to cattle that are allowed to graze. Understanding the seasonal changes in parasite pressure is an important part of targeted treatments.

Figure 2. Seasonal parasite pressure on Arkansas pastures.



Parasite Surveillance and Diagnosis

Gastrointestinal parasitisms are diagnosed by either a FEC or postmortem assessment. The postmortem examination is the most accurate method of determining intestinal parasitisms, as it can be concluded definitively how many of each species are in the intestinal tract. This diagnosis is typically done only when an animal dies naturally.

FECs give a standardized estimation of intestinal parasite burden intensity relative to egg output and are conducted routinely in a successful PCP. In short, parasite eggs are identified using a microscope and the results are expressed as "number of parasite eggs per one gram of feces" (epg). Though an estimation, this process remains one of the most efficient and affordable methods to diagnose intestinal parasite levels in cattle. On a typical cattle operation, 20 percent of a herd will harbor 80 percent of the total parasite population, and FEC can help producers identify that 20 percent for treatment or culling. FEC are a valuable tool to help producers save money on dewormers that are no longer effective in their operations. A successful PCP includes parasite and dewormer surveillance by conducting FEC frequently and consistently.

Pasture Management Practices that Reduce Parasitisms

Intensive pasture management can go a long way to helping control parasitisms in an operation. These practices (a few are listed below) will not solely guarantee parasite-free cattle but are very useful tools in helping to maintain manageable parasite levels.

- Do not overgraze pastures. Infective nematode larvae can migrate up to 6 inches on forages with the dew, with the bottom 3 inches containing the highest concentrations. Keeping grazing at heights above 4 inches will help to reduce reinfections from pastures. This can be achieved by implementing rotational grazing. Rotational grazing allows producers to control grazing height and consistency by blocking off smaller sections of a large pasture, then rotating grazing animals on a "schedule."

- Remove standing water from grazing pastures (adding drainage, fencing, etc.). Mud snails are required for a large portion of the liver fluke life cycle, and these snails require water to live. Preventing access to pasture in water prevents access to these snails.

- During the dry months with little grass growth, producers can drag pastures to expose the infective larvae to the dry environment. Infective nematode larvae require moisture to persist on pastures and are very susceptible to dehydration. It should be noted, however, that dragging pastures when there is adequate moisture for parasite survival can contaminate the entire dragged pasture.

Chemical Control of Parasites

Until relatively recently, anthelmintics (dewormers) provided an excellent tool for controlling parasites.

Table 1. Common nematode parasites of Arkansas cattle.

Cattle Worms	Organ Affected	Worm-Specific Attributes
Ostertagia ostertagi **(brown stomach worm)**	Abomasum	• Seasonal and intraburden arrestment • Benzimidazole tolerance • Macrocyclic lactone resistance • Overcomes effective immune response
Haemonchus placei **(barber pole worm)**	Abomasum	• Seasonal and intraburden arrestment • Most prevalent in the south • Highly reproductive • Drug tolerance and resistance
Trichostrongylus axei **(small stomach worm)**	Abomasum	• High incidence, but generally small population size • Usually not of concern
Cooperia punctata *Cooperia oncophora* **(the "cooperiads")**	Small Intestines	• Macrocyclic lactone resistance • Not necessarily "mild" pathogens • Extremely high (~100%) incidence • Stimulates a good immune response
Nematodirus helventianus **(thread-necked worm)**	Small Intestines	• Macrocyclic lactone resistance • Low, but increasing incidence • Stimulates a good immune response • Environmentally persistent
Strongyloides papillosus **(intestinal thread worm)**	Small Intestines	• Relatively high incidence • Only mildly pathogenic • Usually not of concern
Oesophagostomum radiatum **(nodular worm)**	Large Intestine	• Displays both oral and skin penetration infection routes • Relatively low incidence • Usually not of concern
Fasciola hepatica *Fascioloides manga* **(liver flukes)**	Liver	• Geographically and topographically restricted • Drug tolerance and resistance

However, the emergence of drug-resistant cattle worms should give producers pause when considering using a dewormer. Deworming as a means of parasite control in the absence of FEC and other parasite control methods should not be solely relied upon to be effective nor sustainable. The need for a dewormer application should always be confirmed with a FEC to try to delay the occurrence of anthelmintic resistance in an operation. Strategic, targeted deworming can be achieved by conducting routine FEC, followed by the deworming of individual animals that warrant treatment. Reducing 'blanket treatments' (treating the whole herd/group due to convenience rather than diagnosis) will reduce the amount of drug exposure (re: resistance) as well as save the producer money by reducing unnecessary drug use. Targeted treatments should be specific and knowing both the target parasite and its life cycle becomes crucial for an effective treatment.

It is also vital for producers to test the effectiveness of the dewormers being used. This can be achieved by conducting a Fecal Egg Count Reduction Test (FECRT). Testing dewormer effectiveness will save producers money and reduce the incidence of anthelmintic resistance, as

well as promote a successful PCP. The basic guidelines for a FECRT are below:

1. Collect fecal sample just before dewormer is administered. Conduct FEC on fecal sample (day 0).

2. 14 days after treatment, collect another fecal sample from the animal(s) that were dewormed on day 0. Conduct FEC on fecal sample (day 14).

3. Calculate the %FECR: $\frac{\text{(Day 0 FEC)-(Day 14 FEC)}}{\text{(Day 0 FEC)}} \times 100\%$

There are many different dewormers available to producers, along with many different application methods, so making an informed decision about which product to use is essential. The largest class of dewormers available to Arkansas cattlemen are the macrocyclic lactones, which is divided into 2 subclasses of drugs that have a similar mode of action: avermectins and milbemycins. Avermectins include the drugs ivermectin, doramectin, abamectin and eprinomectin, while milbemycins include the drug moxidectin. The abundance and availability of generic avermectin products have likely played a role in the occurrence of anthelmintic resistance, as they are not as effective as their pioneer avermectin products. Macrocyclic lactones are effective against arrested nematode larvae, however, avermectins have a relatively high incidence of resistance displayed against them. Benzimidazoles are another broad-spectrum dewormer class that is widely available and are dubbed the "white wormers." This drug class includes fenbendazole, oxfendazole and albendazole. Levamisole is a dewormer that is available as a drench and is an effective dewormer against some nematodes. However, levamisole should be used with caution as toxicity can occur if an animal is given an incorrect dosage. Clorsulon is an effective liver fluke adulticide and comes in a dual formulation with avermectins; there is no drug that is known to be effective against liver fluke larval stages.

When selecting a dewormer, the following should be considered:

- Diagnosis of Parasitism by FEC
- Age and Production Status of Animal Being Treated (calf vs. cow vs. bull, beef vs. dairy)
- Product Effectiveness
- Appropriate Application Method
- Species and Stage of Target Parasite (larval, adult, arrested)
- Cost Effectiveness of Treatment
- Slaughter/Milk Withdrawal Time

Table 2 displays the commonly used dewormers (pioneer products) and their trade names that are currently available to Arkansas producers. Each operation is unique in the level of both parasitisms, and drug resistance displayed, so an educated, informed decision when choosing the dewormer class and formulation for a particular operation is fundamental to a successful, sustainable PCP.

Ideally, each animal would be weighed before being given a dewormer to ensure an accurate dosage is administered. Accurate dosing will reduce the incidence of anthelmintic resistance and save producers money in the form of product that is not given out needlessly, as well as help avoid toxicity situations in the animals. Avoiding the underdosing of animals, however, is just as important in reducing the incidence of anthelmintic resistance.

Dewormer administration methods are also an important consideration when choosing a product.

Table 2. Deworming Products Available to Arkansas Cattle Producers.

Dewormers			Withdrawal Periods:	
Formulation	**Trade Name**	**Active Ingredient**	**Milk**	**Meat**
Injectable	Ivomec	Ivermectin	*	35 days
	Ivomec Plus	Ivermectin/Clorsulon	*	49 days
	Long Range	Eprinomectin	*	48 days
	Dectomax	Doramectin	+	35 days
	Cydectin	Moxidectin	*	21 days
Drench	Prohibit	Levamisole	*	48 hours
	Safe-Guard	Fenbendazole	None	8 days
	Synanthic	Oxfendazole	None	7 days
	Valbazen	Albendazole	*, ^	27 days, ^
Paste	Safe-Guard	Fenbendazole	None	8 days
Pour-on	Ivomec	Ivermectin	*	48 days
	Dectomax	Doramectin	+	45 days
	Cydectin	Moxidectin	None	None
	Eprinex	Eprinomectin	None	None
Feed Block	Safe-Guard	Fenbendazole	*	11 days
Feed Additives	Safe-Guard	Fenbendazole	None	13 days
Mineral	Safe-Guard	Fenbendazole	None	13 days

Note: All products listed at pioneer products. Generic products not listed.
* Not labeled for dairy cattle.
^ Do not administer in the first 45 days of pregnancy or for 45 days after bull removal.
+ Safe in dairy heifers under 20 months of age.

The most efficient administration method for cattle is in the injectable form, as you are ensuring 100 percent of the drug gets into the animal at administration; proper injection site hygiene is important when using injectable dewormers. Drenches and pastes are also effective formulations, though producers must be mindful that the animal swallows all the drug. Topicals, or "pour-ons," are very widely used and can be effective if used correctly. Placement of pour-ons is essential to the effectiveness of the dewormer; the drug must be deliberately placed between the animal's shoulders and hips, directly along the spine. These animals must be dry both before and for a few hours after placement. A general rule of thumb should be remembered when using a pour on dewormer: *When treating one animal with a pour-on, you must treat every cow within tongue's length*. If only half of a herd housed in the same pasture is treated with a pour-on dewormer, animals could eventually become underdosed due to grooming. Feed-through dewormers, such as feed blocks or minerals, should be used with caution as allowing animals to self-dose leads to both under- and overdosing in a herd. Feed-through dewormers work best in situations where the dosage can be monitored, such as single-animal pens.

It is important to determine which dewormer classes are still effective in your operation. This is achieved by conducting regular FEC. A producer that is using an ineffective dewormer on their operation is potentially losing money on two fronts: the expense of the ineffective drug and the underperformance of the animal that the parasites are affecting. Being able to use dewormers in future situations is dependent on using drugs that work—and more importantly, removing drugs that don't — in the present.

Table 3. Targeted deworming periods for grazing cattle on Arkansas operations.

Production Stage	Target Treatment Period
Mature Cow	• ~30 days prior to calving • When parasite challenge is present
Calves	• Purchasing • At or near weaning • ~30 days after turnout to pastures • When parasite challenge is present
Replacement, Backgrounding and Stocker Cattle (under 2 years of age)	• Purchasing • Spring • Fall • When parasite challenge is present
Bulls	• ~30 days prior to breeding season • Spring • Fall • When parasite challenge is present

Note: Targeted deworming treatments should always be confirmed with fecal egg counts prior to administration.

Deworming the Beef Herd

Different stages of production animals require different parasite treatment targets. Table 3 outlines the general target time frame, as to when to deworm beef cattle. Mature cows over the age of 2 generally only need treatment once per year, generally within 30 days of calving. Treatment of lactating cows will elicit a higher milk production and will bring the cow into estrus more quickly. However, it should be noted that mature cows that have proper nutrition and live relatively stress-free lives tend to not need deworming treatments, so younger cows will display greater production improvements. Calves should be administered a dewormer at or around weaning, and whenever there is a parasitic challenge. Replacement and yearling calves should be dewormed in the fall and spring until they become mature. Bulls should be dewormed during the fall and spring, but also about a month before they are used for breeding. During breeding season, bulls tend to forego basic self-care, such as eating and drinking properly, therefore giving a dewormer before this period begins will allow the bull to be in the best shape before he begins his breeding activities.

Deworming the Dairy Herd

Though dairy operations tend to be managed differently than beef cattle herds, the PCP is similar (Table 3). Initial deworming of dairy calves should occur about 30 days after turnout onto grazing pastures (upon first exposure to pasture/parasites). Replacement heifers can be dewormed in the fall and spring until mature. Younger, lighter calves (under 400 pounds) should be monitored, and likely dewormed, more regularly than older, heavier calves due to a more naïve immune system. FEC should be considered when deciding to deworm dairy calves. As stated above, mature cattle tend to become less parasitized than young cattle, but dairy producers should consider treating cows at calving or in early lactation using an effective dewormer to gain the benefit of increased milk production. Blanket treatments can be considered, but it should be noted that cows with low parasite burdens as well as cows in mid-to-late lactation may not display an increase in milk production. Drug withdrawals are an important consideration when deworming dairy cattle and should always be followed.

Developing a Successful Parasite Control Program

When developing a successful, sustainable PCP, producers should use every tool and management practice applicable to their own, unique operation. The implementation of FEC will allow producers to see what is going on inside of the animal, assess the effectiveness of dewormers and identify animals that carry heavy parasite burdens. Using grazing strategies will help to reduce the parasitic pressure from pastures and allow for fewer heavily parasitized pastures. Deworming treatments targeted at specific parasites and during specific time frames will allow for more efficient activity against intestinal parasites. Another important part of a successful PCP is the consultation with your local veterinarian or cooperative extension agent, who can offer more information as to what methods will work most efficiently in your operation.

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FSA3045R-PD-8-2022