**INTERNAL PARASITE MANAGEMENT – A NEW WAY OF THINKING FOR CATTLE, HORSE, SHEEP AND GOAT OWNER/PRODUCERS**

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Parasites exist in livestock and are normal to the animal. Anyone that has had animals for any length of time sooner or later has had to contend with the control or management of parasites. Heavy parasite infections can kill animals while lesser infections can reduce profits due to decreased efficiency of production. This paper will focus on gastro-intestinal nematodes (GIN).

Only a few years ago, recommendations for control were based on the premise that anthelmintics should be used in a strategic manner to maximize animal productivity. This approach was used because it was known that sub-clinical parasitic infections are responsible for significant economic loss once clinical disease was noticed in a group of animals. Much economic loss in terms of animal productivity had already occurred in some animals. Dr. L. Gasbarre demonstrated in a trial in 2004 that control of sub-clinical parasites returned $50 per head treated. Parasite control was therefore aimed at preventing animals from becoming highly parasitized, thereby maximizing productivity. Keys to the success of this theory were the availability of inexpensive and effective anthelmintics. The drugs were cheap, easy to use and readily available. Unfortunately, locally, in the Southeast United States and worldwide, we have learned this approach was short-sighted and unsustainable. Parasites have developed resistance to individual drugs, classes of drugs and multiple classes of drugs. Research indicates that the resistance problem is occurring in sheep, goats, horses and cattle. The problem is very real in the Southeastern United States as warm humid climates are the number one environmental factor that encourages parasite reproduction. In fact, they have adapted to conditions that best favor forage production. So if forage is growing, you can bet parasites are being transmitted.

Parasites are very simple in all their biological systems except one and that is their ability to reproduce at a high rate and they have an extraordinary ability to remain on pastures.

Parasites have had millions of years to co-evolve with their hosts. They have taken advantage of that time to ensure that they can reproduce at high levels. Parasite infestations are quantitative. Unlike the flu, once you have the disease then you have a problem, for them it is all about the numbers, the numbers of parasites that are infecting the host. A producer needs to ask, how many larvae are available to the host. It is important for the producer to understand the parasite life cycle, in efforts to modify animal infection.

**Effects of GIN**

The single most effect of GIN is the suppression of appetite. This is in part an interaction with the animal's immune system by stimulating appetite suppressing cytokines. Another response by the immune system is making the intestine a poor place to live. Mammalian response is to get rid of anything foreign to it. You get rid of things in the gastrointestinal tract most effectively by forcing them out, therefore, the body masses explosive diarrhea because parasites are poor swimmers upstream. The body tries to flush them out and stimulates increased mucous production. Unfortunately, while the immune system it trying to rid the body of parasites; it also has created conditions not conducive to absorbing nutrients. GIN are stimulators of the immune system and because the immune system is a finite body, it can only handle so many things at a time. The immune system is highly regulated therefore you will see loss of certain aspects of the immune response in animals that are heavily to moderately parasitized.

**Historical Perspective**

Historically we controlled parasite infection rates by either modifying how many eggs were shed in the feces or by altering the time interval between fecal egg shedding and animal ingestion. Prior to the 1970's, most of the effort was aimed at modification of pastures and parasite survival. Over the past 40 years, producers have enjoyed the simplicity of using basically cheap, easy to use and relatively safe products with repeated dosing if necessary to kill GIN. Additionally, producers/owners have also developed an attitude that any parasite level is bad and therefore all parasites should be eradicated from the animals. Leading parasitologists have warned that wide-spread eradication of gastro-intestinal parasites is not feasible, nor advisable. Producers/owners need to re-think their approach to parasite infection rates, treatment methods and management practices as there are no new classes of parasite control products coming from the "research pipeline" for animal use. In short, the products that we have are the products we are going to have and once the GIN develop resistance; we will have nothing with which to provide effective treatment. Our traditional management over the past 40 years has enabled the strongest, most resistant parasites to survive and reproduce with great abandon. We are in a new era and we must adapt our management if we are to keep up with these rudimentary nematodes. So, throw out the traditional management and the thought "this is the way daddy did it."

If you haven't been following the literature lately, the concepts you are about to exposed to "fly" in the face of our thinking. For many of you, it will be all but impossible to let go of the concepts of "one dose" treats all, rotate products, treat everyone in the herd, flock or barn and treat based on the calendar. Not to mention that we actually want to have a "resident" parasite infection rate.

To understand where we are and where we must go, it is important first to understand how we got into this situation to begin with. When anthelmintics first became readily available, we used them. We knew for whatever reason that we didn't always kill off all the parasites. Research indicated that not all products killed the parasites at all stages of life cycle development so when we treated, we might kill the adult but not the stages leading up to adulthood. We also knew that sometimes not all the adults were killed for whatever reason. So over a period of time the surviving GIN were un-phased by the product being used. As we targeted specific parasites, we increased the selection pressure, those remaining parasites genetically developed super-resistance. Basically, its immune system warded off the product yielding it ineffective.

The resident pool of GIN are termed "refugia." Refugia are the GIN that remain in the animal and they will play a major role in how we address GIN in the future. To further the resistance issue, producers/owners rotated products. All this did was to enable the development of resistance to a wider array of products. Research on a 4,000 head stocker operation in Southeastern U.S. showed cattle (2004) had resistance by Ostertagia and Cooperia to some products. Research on 44 equine farms with 1274 horses across 5 states indicated that 40% of equine farms had resistance in the small strongyle population. In 2001 Dr. Kaplan reported that 90% of goat/sheep farms in Georgia had multiple drug resistance to drug classes in the U.S. By the close of 2001 an additional 30% of those farms had resistance to yet a third drug class.

Research has also shown that not all animals in the herd have equal susceptibility or resistance to parasites. Younger animals are more susceptible but as animals age, they develop a natural level of resistance to low levels. Research has shown that 20% of animal shed 80% of the parasites while the other 80% of the animals in a herd shed very few. And many parasite life cycles favor conditions for warm, humid conditions and when birthing occurs. Culling criteria may include resistance factors as further genome typing occurs across species.

**Refugia**

Several leading parasitologists believe the current answer lies in the refugia. Refugia are the resident parasites in the herd. If refugia populations reside in the 80% of animals that are tolerant of parasites

they then harbor the genetic gene pool to “dilute” the genetics of the resistant parasites. When the parasites mate, they mate with GIN of less tolerance to current anthelmintics.

The concept is simple. Evaluate animals individually and only treat those that are moderately to heavily parasitized. Additionally only treat those animals with suitable anthelmintics. Do not rotate to another product until it is known that one is no longer effective on the current parasite gene pool.

Pasture management can go a long way in preventing resistance by minimizing the dependence on anthelmintics. Parasite larvae crawl up grass blades about 1 – 2 inches. Therefore animals that are not forced to graze forage close to the ground will ingest fewer larvae. A common practice has been to treat a herd with anthelmintics and then move the herd to a “clean” pasture. This is no longer a good practice. All that we are accomplishing is spreading “super resistant” worms to a clean field, while taking the genetically more susceptible worms out of the gene pool.

So how does one determine which animals need to be treated? In sheep and goats, the FAMANCHA method can be utilized. FAMANCHA is nothing more than comparing the pink eye tissues to a color chart that rates parasite loads on a scale of 1 – 5. Further information regarding FAMANCHA and ordering charts can be found on the Southern Consortium for Small Ruminant Parasite Control website: http://www.scsrpc.org/SCSRPC/FAMACHA/famacha.htm Producers are cautioned not to rely solely on this technique. Integrated approaches must be used to control GIN.

**Fecal Egg Counts**

Another method is to have fecal egg counts (FEC) conducted. While it is best to collect samples directly from the rectum, floor samples can be utilized. FEC can be used to determine which animals in a herd are the chronic shedders and which are not. Also from this data, test can be performed to determine which products are and are no longer effective in the GIN gene pool for a particular herd. For further information regarding FEC collection and submission, please refer to the attachment at the end of this paper under the heading of FECAL EGG COUNT DETERMINATION. FEC are conducted before treatment of animals with an anthelmintic and then tested once again about 10 days later. There should be at least an 85% kill or reduction of eggs.

Given the sampling program, four things will influence the value you get from a sample: the year you took it, the individual animal you took it from, the day you sampled and the error that is inherent in the assay. In a study by Gasbarre, 7,200 samples were collected from 800 animals. The research showed that the year didn’t make much difference. The day you sampled had little influence. The highest source of variation was between different animals (56%) and sampling error accounted for 36%. It is important to do as much as possible to account for and minimize this error.

While spreading manure redistributes nutrients, it also distributes parasite larva throughout the pasture. Horse and cattle instinctively will not graze immediately around their manure piles, where larvae have been deposited. Larvae do not travel more than 12” from a manure pile. In Florida, most of the parasite transmissions occur in the fall and winter months. The intense spring and summer solar radiation will kill many larvae. Therefore, a new approach may be to stockpile/compost manure during the winter and spread manure during the summer months where solar radiation can kill any of the larvae, not killed by composting.

To implement any type of integrated parasite control program it is essential to know when loads will be highest, such as at lambing/kidding/calving/foaling. Where the young animals will stay at those high egg producing times and how pastures can be divided and rested in order to have eggs and larvae die. Often a 21 - 30 days pasture rest period is utilized to permit adequate forage re-growth, unfortunately that is not

generally long enough for many parasite cycles. Therefore managing forage height is increasing important to minimize egg/larval ingestion.

**Alternative Dewormers**

Most alternative dewormers have not been shown by scientific research to have any effect on the numbers of worms. Diatomaceous earth (DE) has popularity by some for controlling internal and external parasites. In many cases, DE is utilized in cases where producers also practice very good management. Additionally in many cases, the producers have very "clean" animals due to their management and do not have a significant parasite load to begin with.

**Conditions with Signs Similar to Parasitism**

Often, it is easy to assume animals are wormy if they are unthrifty, thin, have rough hair coats and the presence of diarrhea. However, it should be pointed out that stress brought about by weather extremes can cause sub-clinical parasitism to become extreme. Lack of good body condition into the winter will cause additional stress resulting in blood loss and death as compared to an animal on a higher plane of nutrition. It is the animal's lack of nutrition that causes the disease, GIN are the symptom.

**Conclusion**

Gastrointestinal worm control techniques will have to be integrated in order to reduce dependence on chemical deworming products. Parasite resistance has been well documented in the Southeast United States, throughout the United States and worldwide. The genetic adaptation by gastrointestinal parasites is making many products and family of products ineffective. What may work on one farm may not at another location.

Owner/producers will need to accept a certain level of parasites in their animals as normal and beneficial. These parasites will serve to dilute the resistant strains via mating to extend the effectiveness of the current anthelmintics on the market as the future of additional products becoming available is dim.

Pasture management will play an increased role in parasite control methods by reducing egg shedding and larval ingestion. Fecal egg counts will be used increasingly to determine infestation levels and product efficacy.

No one single method will be effective in managing parasite populations in the future. Producers will have to "re-think" their management strategies.

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FECAL EGG COUNT DETERMINATION

February 19, 2010

The research lab of Dr. Ray M. Kaplan offers laboratory services to veterinary practices as well as farmers and producers (institutions and researchers should contact the lab for the research service and price list) to aid in the management of livestock parasites. This document serves as a list of available services as well as the price and a brief description of each service provided by the Kaplan Lab. The instruction sheet and sample submission form is attached. Services can be arranged by contacting the lab at (706) 542-0742.

1. Fecal Egg Counts:
    a. 2 or 4 gram modified McMaster method - $12.00 per sample
    b. High sensitivity McMaster (8 epg sensitivity) - $15.00 per sample
    c. Wisconsin or Stoll method - $20.00 per sample

2. Coproculture and Larval Identification (fecal culture for -$100.00 per culture speciation of parasites present) -$75.00 each when multiple samples submitted.

3. DrenchRite Larval Development Assay* -$450.00 per assay
    a. Processing fee for un-testable sample -$50.00

4. PCV & TS (hematocrit and total protein) -$15.00 per sample
5. Blood smear examination (M. haemolamae) -$20.00 per slide
6. Fecal Sedimentation (test for liver fluke) -$20.00 per sample
7. Lectin Staining (quantifying relative percent of -$40.00 per sample H. contortus in a given sample)

* Performance of this test requires pre-arrangement with lab prior to collection and submission of sample.

Ray M. Kaplan, DVM, PhD, DipEVPC

Professor of Parasitology

PLEASE READ THE COLLECTION/ SUBMISSION PROTOCOL BEFORE COLLECTION TO ENSURE PROPER SAMPLE SUBMISSION.

PLEASE CONTACT THE LABORATORY TO ENSURE LAB PERSONNEL ARE AWARE SAMPLES ARE BEING SUBMITTED. (706) 542-0742

Sue Howell or Bob Storey, Dept. of Infectious Disease, College of Veterinary Medicine
501 D.W. Brooks Dr., University of Georgia, Athens, GA 30602

DIRECTIONS FOR FECAL SAMPLE SUBMISSION FOR FECAL EGG COUNT (FEC), COPROCULTURES AND LECTIN STAINING:

It is best to collect samples directly from the rectum, however, feces can be collected off the ground if the animals are first put into a shed with a clean floor (free of bedding, grass and dirt). Feces are easily

collected from the rectum of mature animals using a latex glove with a little OB lubricant or KY jelly. The size of the sample that is needed to perform the test depends upon the tests requested per animal (several pellets (FEC) to a golf ball or lemon size clump for coproculture or lectin stain). We can always dispose of extra feces – better to include too much than too little.

On the day of collection, it is critical that feces be kept cool to prevent hatching of eggs, but care must be taken not to get the samples too cold because this will inhibit hatching. At the time of collection, feces should be placed in a cooler containing ice packs to keep the sample cool and can be placed in the refrigerator overnight. However, if requesting the coproculture, feces should not be kept refrigerated more than 48 hours as prolonged chilling will inhibit hatching of eggs making it impossible to perform the coproculture. We have also found that samples in direct contact with ice packs for 24 hours often do not hatch well. Therefore, if kept cool with ice packs, place something like newspaper, cardboard, etc, over the ice pack to prevent the samples from touching the ice packs. Because of the problem with cold-inhibition, fecal collections should be shipped the same or the next day. If feces are to be shipped to the lab, it is important that air be excluded from the feces as much as possible to prevent the development of nematode eggs prior to their isolation and testing (see below).

SAMPLE PREPARATION (for shipping):

We currently recommend two different methods for packaging samples for fecal egg counts, coprocultures and lectin staining (see below). Samples can be sent by priority mail, so long as they arrive in our lab within 3 days of collection. Samples should not be exposed to extreme temperatures (i.e. do not freeze or leave in the sun). Refrigeration is not needed and is not desirable after samples are processed to exclude air. If the samples will be hand-delivered to the lab within 48 hours, then they can be kept cool and do not need "air-exclusion processing".

1. Utilize the "Reynolds Handi-Vac" system which utilizes a small handheld vacuum pump and special zip lock type bags for vacuum sealing. The Reynolds Handi-Vac kit is available at most grocery stores and at Walmart for around $10.00. The sample is placed in the Reynolds Handi-Vac bag and sealed. The Handi-Vac pump is used to evacuate all of the air out of the bag, providing an anaerobic environment that will delay the hatching of the nematode eggs until they arrive at our lab. Place a piece of tape over the vacuum seal to keep the bag air tight. Label the bag with the species (sheep, goat, llama, etc), farm name, and date of collection.

2. Samples may also be placed in individual baggies. Compress the pellets together and exclude the air as much as possible before sealing the ziplock on the baggie. Label the bag with the species (sheep, goat, llama, etc), farm name, and date of collection. Ship by overnight or priority express*.

* If using the US Postal Service for the overnight delivery, be sure to check ahead of time to make sure they deliver to Athens, GA. With FedEx or UPS there should not be any problems.

INFORMATION TO BE INCLUDED WITH SAMPLE: (Submission form attached).

1. Owner name and contact information (including email and fax if available)
2. Name and contact information of veterinarian
3. Species and breed of animals
4. Number of animals feces were collected from, and manner of collection (from rectum or ground)

5. Date of last deworming and drug used

A check must be submitted with the sample. Samples received without payment may be discarded unless prior arrangements have been made. (This policy was required because we have had instances where payment was never received for the services provided despite repeated attempts to collect).

FOR MORE INFORMATION CONTACT:

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e-mail: jscb@uga.edu or bstorey@uga.edu

Please include Sue Howell or Bob Storey on the address when shipping the sample.

**Kaplan Lab Clinical Submission Form**

Client Name:

Farm Name (if applicable):

Client Address:

City, State, Zip:

Home Phone Number:

Cell / Other Number:

Fax Number (if applicable):

E-mail Address:

Name of Veterinarian / Clinic:

Address:
City, State, Zip:

Phone Number:

Cell / Other Number:

Fax Number (if applicable):

E-mail Address:

TESTS REQUESTED:

NUMBER of SAMPLES:

DATE of COLLECTION:

Animal Species / Breed Submitted:
Last Deworming Date and Dewormer Used:

Manner Samples were Collected (from Ground or Rectum):