

# High tannin grain sorghum as a possible natural anthelmintic for sheep and goats

## Final Report for LNE05-232

Project Type: Research and Education

Funds awarded in 2005: \$100,000.00

Projected End Date: 12/31/2009

Matching Federal Funds: \$52,161.00

Region: Northeast

State: Maryland

Project Leader:

[Niki Whitley](#)

UMES - Maryland Cooperative Extension

## Project Information

### Summary:

Small ruminants such as sheep and goats (as well as llamas and alpacas) offer alternative livestock opportunities for farmers. The small size of sheep and goats as well as the established demand for lamb (and growing demand for goat meat) has made sheep and goat production more popular, especially for limited acreage farmers.

The largest problem for sheep and goat producers is control of internal parasites (worms). The costs of internal parasite infection are numerous and can include chemical deworming expenses (preventative and post infection), lower body weight gains resulting in increased feed costs and lower income returns, and even death of the animals. With a dramatically growing number of worms resistant to all known anthelmintics (dewormers) being noted worldwide, the problem is reaching a critical stage.

Dewormer resistance among parasites has been theorized to be caused by problems such as misuse of the drugs, miscalculation of doses (giving too little dewormer) and inappropriate dewormer rotation techniques. Due to old research and advisement, proper internal parasite management has been ignored because dewormers were effective and easy to use. Now, other alternatives are needed.

A compilation of integrated methods to help control parasites has been developed by the Southern Consortium for Small Ruminant Parasite Control ([www.wormx.org](http://www.wormx.org)). The materials developed for integrated parasite management (IPM) training has been invaluable for teaching producers, Extension staff, veterinarians and other agricultural professionals in the proper methods for small ruminant parasite control. This project used those materials for such training sessions.

The majority of people participating in these trainings indicated that they learned more about parasite control and utilized methods learned on their farms. Continued training and impact evaluation is being conducted for the Northeast Region as well as nationwide through current national evaluation efforts supported in part through

this project (through June 30, 2009) and other funding/support efforts.

One of the methods for parasite control taught during the IPM training is the potential use of alternative plant dewormers (or control agents). The primary plant known to have such properties is sericea lespedeza (AU Grazer – a variety with high condensed tannins; CT).

Although sericea lespedeza is known to contain a high level of CT and sheep and goats grazing it have decreased worm eggs in their feces (lower fecal egg counts), this forage plant cannot be grown in all areas of the United States. Therefore, this study was designed to determine if a grain product (that could be shipped throughout the U.S.) with high tannin levels might also be a potential parasite control tool.

The grain tested in these studies was high tannin grain sorghum (milo). Three different varieties (with different levels) were tested in separate studies compared to a milo without high tannin levels. After animals that were dewormed were removed from the study, leaving only a small number of animals with data, it was found that the variety with the second highest level of condensed tannins seemed to have an effect on worm fecal egg counts, suppressing the increase in fecal egg counts seen over time in the control animals. Other aspects of parasite infection were not influenced with this or any other variety of grain sorghum fed.

Because a clear indication of effectiveness was not noted during the University-based trials, on-farm trials were not acceptable to the producer advisory council working with the project. Goats were used as the model for this study since sheep and goats share worms but, in general, the goat breed used in this study (and the most common in the U.S. – Boer and Boer crossbred) are known to be more susceptible to worms than sheep.

The results of these studies were disseminated to producers, Extension professionals and other scientists through a variety of avenues. Newsletter articles were developed, peer-reviewed abstracts published and a scientific manuscript submitted for potential publication.

## Introduction:

The largest problem for sheep and goat producers is control of internal parasites (worms). The costs of internal parasite infection are numerous and can include chemical deworming expenses (preventative and post infection), lower body weight gains resulting in increased feed costs and lower income returns, and even death of the animals. With a dramatically growing number of worms resistant to all known anthelmintics (dewormers) being noted worldwide, the problem is reaching a critical stage.

Dewormer resistance among parasites has been theorized to be caused by problems such as misuse of the drugs, miscalculation of doses (giving too little dewormer) and inappropriate dewormer rotation techniques. Due to old research and advisement, internal parasite management has been ignored because dewormers were effective and easy to use. Now, other alternatives are needed.

## Performance Target:

The objectives of the proposed project were to determine the effectiveness of high-tannin grain sorghum as a potential natural dewormer (or control method) for small ruminants and provide workshops to demonstrate use of the sorghum and methods for determining need for dewormer treatment (FAMACHA<sup>®</sup>, fecal egg counting).

The following performance target for this project was reached and exceeded: Of the

60 small ruminant producers engaged in the project, 20 will decrease chemical dewormer use through the use of grain sorghum as a natural dewormer and/or incorporation of the use of FAMACHA© or fecal egg counting. Through follow-up surveys of IPM training sessions, well over 20 producers reduced chemical dewormer use and/or saved money after IPM training through the use of FAMACHA©, fecal egg counting or other knowledge from the integrated parasite management training sessions.

## Cooperators

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## Research

Materials and methods:

Year 1: Dr. Lloyd Rooney and his student, Linda Dykes, at Texas A&M University measured tannin in several “high tannin” varieties of sorghum from the National Grain Sorghum Growers cooperative, Grain Sorghum Partners, Inc. A high tannin variety of sorghum stored by Grain Sorghum Partners, Inc. was shipped to UMES for a preliminary goat study. A low tannin variety had been grown at UMES for a Cooperative Extension demonstration plot and had been stored at UMES. A local

producer had a bad parasite problem and offered to skip a deworming so the animals would be naturally infected and then would sell them to UMES for the study. Only 16 of the 31 Boer crossbred goats purchased could be used (the others were too anemic and had to be dewormed right away). Goats were placed on a concrete slatted floor (to keep re-infection from occurring) and half were fed a diet of high tannin sorghum with a protein supplement and alfalfa pellets for fiber while the other half were fed a diet of low tannin sorghum with a similar mixture of other ingredients. All sorghum (for all studies) was “cracked” to allow for better digestion by the animals. Body weights, fecal egg counts, FAMACHA© scores and packed cell volume (PCV-to indicate true anemia) were collected on the goats weekly for 3 weeks. Because nearly all of the goats eventually had to be dewormed, it was concluded that this grain sorghum variety or feeding strategy did not seem to work. When all animals that were dewormed were removed from the statistical analysis, the fecal egg counts for animals fed the high tannin diet did not increase during the study while control fed goats did have higher fecal egg counts over the course of the study. However, producers and scientists were not convinced because of the low numbers involved. Everyone involved, including the producers, indicated that more research was needed.

Pasture shelters and pens were put in place for future “on-pasture” projects and breeding for research animals in Year 1 as well. Some animals that were purchased from the producer in the first Year were very wormy so they were kept for breeding for animals for this research so that we could be more confident of getting wormy offspring animals for testing.

Year 2: Boer and Boer crossbred goats were used in two studies in Year 2. Twenty-four animals were housed in individual pens, and for the first experiment in Year 2, as per collaborators advice, unlike the preliminary experiment, animals were removed from pasture when fecal egg counts indicated infestation and adult worms were allowed to “mature” in the animal for 28 days prior to the start of the feeding comparisons. They were fed a diet containing low tannin milo as a transition feed. After 28 days, as for the preliminary experiment, diets were changed to either high (treatment) or low tannin milo (control). Fecal egg counts and PCV were measured weekly beginning when animals were placed into the pens from pasture. Animals with PCV below 15% were dewormed. Gross eyelid color as a sign of parasitism was monitored between PCV testing periods. Fecal eggs counts decreased for all animals regardless of type of milo in the feed 1 week after treatment feeding began and remained steady until around day 21, when counts began to increase again. It is thought that a possible “self-cure” (which is known to happen, documented by other small ruminant parasite researchers) may have occurred.

The second Year 2 study was conducted like the preliminary (Year 1) study using a different “high tannin” milo variety. Again, there was no influence of treatment on fecal egg counts or packed cell volume. So, overall, in three studies, three different varieties of high-tannin grain sorghum were tested at a high level (70%) in the feed, and no clear effects on gastrointestinal parasite infection were found.

Year 3: Year 3 was a very dry year and very few goats exhibited signs of parasitism at the University or on producer farms. In addition, because the University farm studies indicated no real influence of high tannin grain sorghum on internal parasites, the producer advisory council indicated that they did not want to conduct on-farm studies. Instead, they continued to express interest in testing other potential dewormers. After presenting the research at the Southern Section ASAS (Animal Science) meetings in the Sheep and Goat Section, the PI was asked to join a group of scientists/veterinarians and extension personnel (Southern Consortium for Small Ruminant Parasite Control; [www.scsrpc.org](http://www.scsrpc.org)) studying alternative, holistic

methods for small ruminant parasite control. The group consists of forage experts, biochemists/chemists, animal scientists, geneticists and extension educators from the U.S. and other countries, including South Africa. Part of the efforts of this group includes analyzing tannin levels/types in plants to determine those with potential in fighting worms. The PI, Dr. Whitley, had requested that members of this group run tannin levels on the milo and some sericea lespedeza in Year 1 and 2, but were not able to do so until Year 3. The levels of tannin in all species of the high tannin milo/grain sorghum were significantly less than that found in sericea lespedeza. However, members of the group still felt that amounts/levels may not be as important as “type” and may still choose to use milo extracts for in vitro larval development assays.

Overall, in SCSRPC group meetings, it was decided that it is possible that the tannin in milo (grain sorghum) may not be the same type of condensed tannin that is thought to decrease fecal egg counts when fed via sources such as sericea lespedeza. After seeing these results and through discussions with Dr. Whitley, the farmer/producer advisory council (Lower Shore Goat and Sheep Producers Association) decided they would like to see alternative possible non-chemical dewormers tested and suggested a commercial “herbal” dewormer, garlic and/or tobacco.

The SCSRPC group (which included collaborators listed in this and earlier reports) found a method to pellet sericea lespedeza (SLP) that still allowed for effective reduction in fecal egg counts and requested that Dr. Whitley conduct a study involving the SLP. After consulting the advisory council of producers, it was agreed the study was warranted. The project was planned as a comparative treatment (milo, controls and SLP). However, the few animals available because of low parasite infestation only allowed for a small preliminary study for the SLP (since it showed greater promise than the grain sorghum). In the study, 9-13 goats per treatment (total 45 goats allotted to treatment to account for weight, sex and FEC) were used to look at effects of 0 (control), 20, 40 or 60% SLP on PCV and FEC in young growing kids naturally infected (from pasture grazing) with worms. Diets were mixed to have similar protein and energy levels and all goats had been supplemented with a comparable grain diet while on pasture. There were no differences in PCV and FEC due to treatment, however, after culturing feces to hatch the eggs and speciate the larva, it was noted that the control goats had the highest percentage of *Haemonchus contortus* (blood sucking worm) larva at 43% with the numbers for the sericea diets decreasing as the amount of sericea increased (with 20, 40 and 60% being 39%, 35% and 31% *H. contortus*, respectively). Although the SLP did not seem to influence FEC and PCV, the animals were not heavily parasitized by *H. contortus* (the primary “killer” parasite in small ruminants). This was known because the animals had normal FAMACHA© scores and PCV but high fecal egg counts. It did seem, however, that the sericea pellets may have specifically decreased numbers of *H. contortus* in the animals. So, if the primary worm load had been of this parasite as is seen in normal weather years, the sericea lespedeza pellets may have been a very effective alternative parasite control method. Therefore, more research is needed for this and other potential natural dewormers.

Year 4 (no-cost extension, 2008-2009) – Impact evaluation for NE FAMACHA trainings (those not yet evaluated for other projects) was conducted. In addition, the SCSRPC group was interested in a survey being developed to determine the impact of this study and associated FAMACHA trainings. Therefore, the PI is working with SCSRPC to coordinate impact of FAMACHA trainings not only for the NE region but for other States as well.

Research results and discussion:

The milestones were 1) 100 interested small ruminant producers will respond to flyers to gain understanding about parasite control through integrated methods, including potential natural dewormers 2) 60 producers will attend first workshop 3) 40 producers will attend second or third workshop 4) 20 producers will decrease chemical dewormer use through natural dewormers and using the FAMACHA© eye-lid color chart or fecal egg counting (farm visits, phone calls, interviews).

Before the project even started (due to a newsletter article about the plans for the project), 2 producers emailed to ask questions about the newsletter article describing the project plans. In addition, 3-4 producers called or stopped me in public to ask about hosting another parasite workshop.

With the collaborator, Susan Schoenian, over 200 interested producers were invited to a general small ruminant parasite control sessions as well as specific FAMACHA©/Integrated Parasite management (IPM) trainings. This process was accomplished over the entire project period, with a few occurring in Year 1. Over 150 registered and at least 100 attended workshops related to the project or trainings. The collaborator through which most of the IPM trainings were planned, Susan Schoenian, was unexpectedly conducting trainings with alternative grant funding. Since the overall efforts resulted in a greater response than what was planned for both projects combined (more producers were reached than the combined projects planned to reach), this was not considered a problem. Several Extension agents organizing trainings did not keep names and addresses from the training, so follow-up was often limited for those workshops. Follow-up impact evaluations were sent to 103 people and 26 responded. Results indicated that dewormer use was decreased by the majority of respondents. Continued impact evaluation for these types of training in the NE (and nationwide) is planned through Cooperative Extension Service funding.

## **Participation Summary**

### **Education**

Educational approach:

#### **NEWSLETTERS:**

Maryland Sheep and Goat Producer Newsletter (a.k.a. "Wild & Woolly") available at: [www.sheepandgoat.com/news/main.html](http://www.sheepandgoat.com/news/main.html)

Vol. 4, Issue 1 February 2005

Vol. 5, Issue 2, Summer 2006

Vol. 5, Issue 3, Fall 2007

The newsletter articles were best for presenting the information to producers (and the advisory council and Lower Shore Goat and Sheep Producer Association meetings). Producers responded by contacting me about interest in the project/information.

#### **ABSTRACTS:**

Peer reviewed abstract: N. C. Whitley, J. E. Miller, J. M. Burke, D. Cazac, R. Subburathinam and L. Dykes. 2007. Influence of high tannin grain sorghum on gastrointestinal nematode infection (GIN) in goats. *J. Anim. Sci.* 85 (Suppl 2):35.

The abstract was valuable in gaining the collaborators among the Southern Consortium group. The invitation to participate with this group led to interest in and efforts to evaluate the impact of integrated parasite management trainings nationwide. In addition, new projects have been developed to study other

alternatives to dewormers, with a more widespread potential impact.

Influence of sericea lespedeza pellets on gastrointestinal parasite fecal egg counts in goats. For publication/presentation at the National MANRRS (Minorities in Agriculture, Nat. Res.&Related Sciences) conference in student competition in 2008 by graduate student, Shannon Uzelac.

The abstract published for this meeting allow for information about this topic to be provided to students and scientists throughout the region.

#### MANUSCRIPT

Peer reviewed manuscript submitted: N. C. Whitley, J. E. Miller, J. M. Burke, D. Cazac, D. J. O'Brien, L. Dykes and J. P. Muir. Effect of high tannin grain sorghum on gastrointestinal parasite fecal egg counts in goats.

The manuscript will allow for information to be spread throughout the scientific and Extension community.

No milestones

## Additional Project Outcomes

Project outcomes:

### Impacts of Results/Outcomes

Year 1: In this study, FAMACHA© and packed cell volume (PCV) were not 100% related in these goats (a very few that were not anemic still had a 4 or 5 FAMACHA© every week, indicating anemia). Based on this, for scientific reasons, we used PCV to determine deworming schedule for the entire study instead of FAMACHA©. Because there are no cases of nice pink eyelids having low PCV and the opposite is also rare, FAMACHA© is an excellent tool for producers and was/will be stressed as one of the best methods for “fighting” parasite resistance to dewormers in small ruminants. Indeed, we did note an overall negative relationship between FAMACHA© score and PCV (as red blood cells when down because of anemia, FAMACHA© scores went up to also indicate anemia). It is well documented that the FAMACHA© system definitely reduces the amount of chemical dewormers used, which is better for the environment and is more economical for producers as well. The advisory council of producers utilized for this project (primarily the Lower Shore Goat and Sheep Producers Association) was engaged in the project from the beginning. One of the members actually suggested trying this grain after hearing about sericea lespedeza. This group provided some of the producers responding to workshop advertisement about the project and parasite training to address Milestone 1.

Year 2: Fecal eggs counts decreased for all animals regardless of type of milo in the feed 1 week after treatment feeding began and remained steady until around day 21, when counts began to increase again. It is thought that a possible “self-cure” (which is known to happen, documented by other small ruminant parasite researchers) may have occurred.

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Year 4 (no-cost extension, 2008-2009) – At a general small ruminant parasite workshop in New Jersey (120 registered), 56 people raising an average of 8.22 animals each responded to a survey about problems with internal parasites. Not surprisingly for persons with small flocks, only 37% indicated a problem with parasites and all (plus some that said no problem for a total of 43.2%) indicated that the problem was not bad- that they dewormed every 8-12 weeks and the dewormers worked. Nearly all respondents (97.5%) indicated that they would use a non-chemical dewormer if it were proven to work. A FAMACHA© workshop held in PA was evaluated for short term impact. Participants returning evaluation instruments (9) indicated an increased knowledge of 35.6% in understanding that *Haemonchus contortus* is the number one problem parasite and its primary symptom is anemia, which dewormer is used for tapeworms, how to use eye lid color scoring to decrease dewormer use and that goats need a higher dose of dewormers than other species. Integrated parasite management discussions with the Lower Shore Goat and Sheep Producers Association included a survey of producers as well. The participants returning the survey (5) indicated that 100% were already either using FAMACHA© or simple eye lid color evaluation to determine when to deworm their animals. However, results indicated that 2 of the 5 (40%) did not feel they had a problem with parasites on their farm. Follow-up with those producers has since determined that they had animal losses to parasites since the meeting, indicating that they were just not previously aware of the problem. All respondents indicated that they were interested in non-chemical dewormers, were interested in the results of this project and learned more about NE SARE through the PI of this project.

Project information has been reported in the Maryland Sheep and Goat newsletter (Wild & Woolly) as well as in presentations at 5 producer meetings and a meeting of the SCSRPC group as well as a meeting of the recently formed SCC-081 research exchange group. A scientific abstract has been published and a presentation given at professional meetings (included several Extension personnel from across the US in the audience). The information from the research projects has recently been submitted as a manuscript to a peer-reviewed journal (Small Ruminant Research). There continues to be much interest in natural dewormers for goats and sheep. The input of the advisory council of producers who indicated a great interest in natural or alternative dewormers had a great impact, resulting in potential research into alternative natural dewormers such as garlic, pumpkin and papaya seed among others.

## Economic Analysis

An impact evaluation survey showed that after integrated parasite management training, 84% of farmers dewormed LESS often than before their training and 66% indicated they saved more than \$80 due to changes made on their farm after the workshop; 14% indicated they saved \$5 to 40 and 19% indicated they saved \$41 to 80. Respondents indicated they saved money through fewer deworming treatments (100%) and fewer animal deaths (37%).

## Farmer Adoption

Impact evaluation included a follow-up survey involving multiple choice questions sent out to 103 farmers (ones attending FAMACHA training who provided email addresses that were still valid when the survey was conducted). Of the 103 farmers receiving the survey, 26 responded, giving a response rate of 25.2%. Respondents were from MD (8), WV (4), IL (4), PA (3), VT (3), VA (2), NY (1) and NC (1). The majority (62%) of respondents had less than 50 animals, 19% had 50-75 animals, and 19% had over 100 animals. The majority of farmers indicated they used macrolytic lactones (like ivermectin and moxidectin; 50%) or nicotinic (like levamisole or morantel tartrate; 19%).

When asked if their FAMACHA/Integrated Parasite Management workshop made a difference in their ability to control/monitor parasitism in their flock, 100% of the farmers said “yes” and 77% indicated they had less of a problem with worms after their training (19% said the same and one farmer said their problem was worse). All but one farmer was using the FAMACHA eyelid color chart to make worming decisions. FAMACHA scoring was conducted once or twice a month for 50% of respondents, 3 to 6 times a year for 8% of respondents, 2 times a year for 17% of respondents and irregularly or seasonally for 25% of respondents.

After their training, 84% of farmers indicated they dewormed LESS often than before their training, 16% dewormed the same amount and none dewormed more often. Of those responding, 66% indicated they saved more than \$80 due to changes made on their farm after the workshop; 14% indicated they saved \$5 to 40 and 19% indicated they saved \$41 to 80. Respondents indicated they saved money through fewer deworming treatments (100%) and fewer animal deaths (37%).

The most popular practices respondents adopted after the workshop included rotational grazing (77%), genetic selection (change breeds or culling susceptible animals; 58%), increasing height of plants being grazed (46%), and using grain supplementation on pasture to improve nutrition (42%). Others included fecal egg counting (35%), weighing animals before treatment (35%), deworming prior to parturition (31%), reducing stocking rates (23%), Multispecies grazing (19%), oral dosing of worm medicine (15%), planting a forage containing condensed tannins (12%), and identifying worm species through fecal egg identification or DrenchRite testing (8% each).

Assessment of Project Approach and Areas of Further Study:

### Areas needing additional study

Continued research is needed into alternative dewormers, especially those containing condensed tannins. Producers consistently ask questions we can not answer yet due to lack of research like “how much do I have to feed of condensed tannin containing forages and for how long”. Although a new dewormer has been developed for sheep in New Zealand, it is not known if it will ever reach the U.S. If

this product (Zolvix®) eventually becomes available for use in the U.S., continued integrated parasite management training will be critical for maintaining its effectiveness.

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or SARE.



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