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Goat Pasture Management

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Parasites and pastures

One of the best outcomes of parasite control program is the reduction of number of parasites that the goats are exposed to. This can be accomplished by managing pastures in a way that will reduce the parasitic load. There are several ways to do this:

1. Take a hay crop. This type of pasture can be incorporated into a dose-and-move program in which goats are grazed on one pasture in the early grazing season and then moved to another goat pasture which was used for a first cutting of hay. another move before the end of the grazing season will probably provide the best parasite control.

2. Incorporate annual pastures into the grazing system and drag some implement in the stubble before planting.

3. Incorporate into the grazing system plants containing high concentrations of tannins. Alternatively, incorporate fodder shrubs that contain high concentrations of tannins, such as black locust.

4. Graze a contaminated pasture with another livestock species. The goat parasite larvae cannot survive in the gastrointestinal tract of another herbivore species. This does not apply to sheep, which share worms with goats. Another approach is to use a first-grazer, second-grazer system with two livestock species.

5. Use control grazing practices to optimize pasture production. This is a better practice than continuous grazing on the same pasture because goats will return to the same areas where their favorite plants are growing. Those areas will then become heavily infected by gastrointestinal parasite larvae.

6. In extensive situations with an abundance of pasture land compared to the number of goats, allow the goats to have plenty of forage, thus giving them the opportunity to select the most nutritious parts of plants. In such situations, goats will not graze close to the ground and ingest many gastrointestinal parasites.

7. Put goats in a browse area, such as a woodlot, when hot, humid environmental conditions favor the rapid life cycle of gastrointestinal parasites. By browsing, goats will not consume forage close to the ground where the parasite larvae are located — up to 5 inches from the ground level. In addition, many browse plants have the additional benefit of harboring high tannin concentrations. Tannins have been shown to reduce fecal egg counts and possible gastrointestinal parasite larvae numbers.

8. Always put goats with the highest nutritional requirements on the best quality pastures. Good nutrition allows a more effective immune response to fight gastrointestinal parasites.

9. Rest a pasture. Unfortunately, it takes a long time for the worm eggs and larvae to die off if the pasture is just left empty. A year or at least an entire grazing season is required, which is usually impractical.

Control Grazing and Strip Grazing

The basic principle of control grazing is to allow goats to graze for a limited time, leaving a leafy stubble, and then to move them to another pasture, paddock or sub-paddock. Smaller paddocks are more uniformly grazed and surplus paddocks can be harvested for hay. The pasture forage plants, with some leaves still attached, can then use the energy from the sun through photosynthesis to grow back without using up all of their root reserves. Even brush will need a recovery time if it is being used as forage for goats. Without this rest period, the goats can kill the brush through continuous browsing.

Under control grazing, legumes and native grasses may reappear in the pasture, and producers often report that the pasture plant community becomes more diverse. Control grazing can be used to improve the pasture, extend the grazing season and enable the producer to provide a higher quality forage at a lower cost with fewer purchased inputs. Control grazing can also be useful in reducing internal parasite problems if meat goat producers are careful to move the goats to a new pasture before the forage plants are grazed too short– less than 4 inches. In addition, the use of the FAMACHA system to selectively deworm goats will overcome the problems of pasture infestations by resistant intestinal nematodes due to increased refugia. Refugia is the proportion of nematodes that provide a pool of susceptible genes and dilutes dewormer-resistant genes in that population.

Strip grazing can be easily superimposed on control grazing in large paddocks by placing movable electric fences ahead and behind the goats, giving them sufficient forage for two to three days. Strip grazing is very effective and results in high pasture utilization because, otherwise, goats will not graze soiled forage well. Strip grazing results in high average daily gain, increased gain per acre and rapid improvement of body condition when pasture is vegetative and of excellent quality, such as during cool weather when plant quality declines slowly. Strip grazing is very effective with stockpiled fescue during late fall and early winter. Strip grazing is not recommended when pasture is of low quality because of reduced goat selectivity.

Control Grazing Versus Continuous Grazing

Control grazing allows the manager a better utilization of the forage at hand because this grazing method gives more control over grazing animals. During periods of fast growth, the excess forage can be harvested for hay. Control grazing can stretch forage availability and the grazing season as spring forage growth slows during the hot summer months. It also slows the gradual predominance of less palatable, less nutritious plants because goats are forced to consume all plants before moving on. Another level of managerial control is achieved by having more than one pasture. Under a control grazing system:

- goats are easier to handle and more docile because they are in frequent contact with humans when fences, water tanks and mineral troughs are moved;
- plants that are sensitive to close and continuous grazing will persist longer and produce better;
- less forage is wasted by trampling and soiling;
- urine and dung are distributed more uniformly;

- managerial and observational skills of the producer will improve because goats will be observed more frequently, and pasture species and productivity will be evaluated more carefully.

Conversely, control grazing may not be beneficial because of:

- high cost;
- unsatisfactory layout such as long, narrow paddocks or wet and dry areas within the same paddock;
- overstocked pastures;
- an overly long rest period between grazing, resulting in maturing of available forage, lowering nutritive value and fewer young green leaves;
- pastures dominated by low-forage quality.

Continuous grazing or stocking means that goats are maintained on one pasture for the entire grazing season. Therefore, the goat makes the decision as to where to graze, when to graze, where to congregate and to selectively graze unless the stocking rate is too high. Goats may overgraze the plants they prefer and undergraze other, less preferred plants if the stocking density is not adjusted as conditions change. Forage availability may be ideal, too high or too low during different periods of the same grazing season. Therefore, adjusting the stocking density as needed greatly improves forage utilization. Temporary fences can be used to fence off portions of the pasture and harvest surplus forage for hay. Finally, certain forage species such as switchgrass, big bluestem, indiangrass and johnsongrass are not suitable for continuous grazing unless the stocking rate is low enough to maintain a 6- to 8-inch leafy stubble.

Co-and Multi-Species Grazing

The differences in feeding behavior among cattle, sheep and goats uniquely fit each species to the utilization of different feeds available on the farm. These differences should be considered in determining the best animal specie to utilize a particular feed resource.

Feeding behavior is also important in determining whether single or multi-species will best utilize available plant materials. Most studies indicate greater production and better pasture utilization are achieved when sheep and cattle or sheep, cattle and goats are grazed together, as opposed to grazing only one specie at a time. This is especially true where a diverse plant population exists. Because of the complimentary grazing habits, the differential preferences and the wide variation in vegetation within most pastures, one to two goats can be grazed with every beef cow without adversely affecting the feed supply of the beef herd. The selective grazing habits of goats in combination with cattle will eventually produce pastures which are more productive, of higher quality and with little weed and brush problems.

Judicial mixed-species grazing can have additional benefits. Because gastrointestinal parasites from goats or sheep cannot survive in the stomach of cattle and vice versa, mixed-species grazing will decrease gastrointestinal parasite loads and slow resistance of gastrointestinal parasites to conventional dewormers. Several strategies can be used to one's advantage. In fields with a low parasite load, animals can be grazed together, or animals with the highest nutritional requirements can have access to the field first, followed by the animal species having lower nutritional requirements. A variation of co-grazing with nursing animals is to have openings in the fence giving forward access to ungrazed pasture to young stock. Alternatively, in a field infected with a high load of goat or sheep parasites, cattle should be grazed first, followed by goats or sheep.

Non-chemical Alternative Control Methods

Mixed/Alternate Livestock Species Grazing

For the most part, each livestock species harbors its own parasite fauna, except that sheep and goats have the same parasites. Only one worm species is known to be found in essentially all livestock species and that is *Trichostrongylus axei*, a minor abomasal worm that is of little concern. If practical, cattle and goats can be grazed together where each consumes the parasites of the other, which, in turn, reduces available infective larvae for the preferred host species. If co-grazing is not preferred, cattle and goats can be grazing alternately on the same pastures. Again, each consumes the others parasites and when returned to the same pasture, available infective larvae have been reduced. Both livestock species should gain from this over time. The one situation that requires some care with this strategy is, the presence of young calves. Calves can become infected with *H. contortus*, but problems in the calves should still be much less than those in the goats.

Pasture Rotation

The concept of pasture rotation or rotational grazing to break the parasite cycle has been tossed around for years. The main reason to use pasture rotation is not for parasite control but to provide the most nutritious forage for growth and development. If animals are grazed correctly, most forages reach the next most nutritious stage in about 30 days. Therefore, many rotation schemes have the animals returning to pastures at around 30-day intervals. Unfortunately, this 30- day interval is also about the same time necessary to ensure that the previous worm parasite contamination has now been converted into the highest level of infectiousness for the next grazing group. Thus, 30-day rotation schemes may actually lead to increased worm parasite problems. In fact, heavy exposure over a short period of time can lead to disastrous clinical disease and losses. Rotation schemes of two to three months have been shown to have some effect on reducing pasture infectiousness in tropical and subtropical environments in the southeastern United States, but in more temperate environments, infectiousness can extend out to eight to 12 months, depending on the conditions. For the most part, it is impractical to leave pastures ungrazed for such extended periods of time. Some success at reducing infectiousness can be achieved by cutting pasture for hay between grazing periods. It should also be emphasized that, when rotation schemes are used, stocking rate is usually high and the resultant increase in contamination may make the problem worse.

Copper Oxide Wire Particles

Copper oxide wire particles (COWP) have been marketed for years as a supplement for livestock being managed in copper deficient areas. COWP come in adult cattle, calf and ewe boluses — 25, 12.5 and 4 grams, respectively. Only cattle boluses are available in the United States. Due to potential toxicity in sheep, only one dose per year is recommended. It is also well-known that copper has some anthelmintic activity against abomasal worms, but not other gastrointestinal worms. That makes it a very narrow-spectrum product. But, in view of the potentially devastating problem of anthelmintic resistance by *H. contortus*, recent work has revisited the possibility of using COWP to specifically target *H. contortus*. Such work has shown that as little as a gram or less and 2 grams may remove substantial numbers of *H. contortus* in lambs and ewes, respectively. Similar work in goats has not been tested adequately to establish what is needed, but similar doses may be appropriate. As mentioned, copper has to be used cautiously in sheep because toxicity can develop due to accumulation in the liver. Toxicity may not be an issue in goats as they have been reported as not being that sensitive to excess copper intake. Thus, higher doses and/or more treatments during haemonchosis season may be useful in goats.

Condensed Tannin containing Forages

An approach to parasite control that has not been adequately explored in the US is use of medicinal plants with anthelmintic properties. There is growing evidence in work from New Zealand and Europe that grazing or feeding of plants containing condensed tannins (CT) can reduce FEC, larval development in feces, and adult worm numbers in the abomasum and small intestine. There are a number of CT-containing forages that grow well throughout the southern US, but most of these have not been tested for their potential anthelmintic properties. Preliminary tests with sericea lespedeza (SL, Lespedeza cuneata), a CT-containing perennial warm-season legume, have shown positive effects of reduced FEC in grazing goats, and in sheep and goats in confinement when the forage was fed as hay. In addition, an effect on reducing worm burden has also been reported. Similar results have been observed using CT-containing quebracho extract for small intestinal worms, but not abomasal worms.

In addition to its potential use in controlling worms, SL is a useful crop for limited resource producers in the southern USA. It is adapted to hot, drought climatic conditions and

acid, infertile
soils not suitable for crop production or growth of high-input forages, such as alfalfa. It can be
overseeded on existing pasture or grown in pure stands for grazing or hay. Farmers could
increase profits by marketing SL anthelmintic hay, or using it themselves and reducing their
deworming costs. In South Africa, SL has been reported to increase profits with rangeland
farmers by bringing poor, drought-prone, infertile land into useful production for sheep, and any
anthelmintic uses would increase the value of SL even further. The same is true in the southern
US, which has a climate and soils ideal for growth of this plant.
In addition to hay, SL is being evaluated in the form of meal, pellets and cubes to be fed as a
supplement to grazing animals or as a deworming method under temporary short-term confinement.
SL processed products are expected to become available in the near future.

Genetic Improvement

There is considerable evidence that part of the variation in host resistance to worm infection is under genetic control in goats and sheep. Resistance is most likely based on inheritance of genes which play a primary role in expression of host immunity. Based on survival of the fittest management conditions, several goat and sheep breeds are known to be relatively resistant to infection. Such breeds include: goat – Small East African, West African Dwarf and Thai Native; sheep – Scottish Blackface, Red Maasai, Romanov, St. Croix, Barbados Blackbelly and the Gulf Coast Native. Katahdin sheep have been considered as being more parasite resistant, but studies to document this are few and not conclusive. Using resistant breeds exclusively or in crossbreeding programs would certainly lead to improved resistance to worm infection, but some level of production might be sacrificed. While such a strategy may be acceptable to some, selection for resistant animals within a breed is also a viable option. Selection for resistant lines within breed has been demonstrated with goats (Scottish Cashmere) and sheep (Merino and Romney). Within breed, animals become more resistant to infection with age as their immune system becomes more competent to combat infection. However, some animals within such a population do not respond very well and remain relatively susceptible to disease. This means that the majority of the worm population resides in a minority of the animal population. It would
make sense to encourage culling practices (based on FEC, PCV, FAMACHA©, etc.) where these minority “parasitized” animals were eliminated, thus retaining more resistant stock. To augment this process, finding sires that throw relatively resistant offspring, would speed up this process. This approach has been used successfully in goats (Scotland) and sheep (New Zealand and
Australia), but it may take quite a long time (up to 8-10 years) to achieve satisfactory

results. Heritabilities for FEC, a common measurement for assessing parasite burden, range from 0.17 to 0.40 which is quite good. Thus, selection for resistance and/or selection against susceptibility using a measurement such as FEC has been moderately successful. The real benefit to this approach is that reliance on dewormer intervention for control can be reduced, thus conserving the activity of such dewormers for when they are needed.

Nematode-Trapping Fungi

Research with nematode-trapping fungi in Denmark with beef cattle, horses, and pigs has demonstrated the potential of nematode-trapping fungi as a biological control agent against the free-living stages of parasitic worms in livestock under both experimental and natural conditions. The concept of using microfungi as a biological control agent against worms was introduced as early as the late 1930s and early 1940s. These fungi occur ubiquitously in the soil/rhizosphere throughout the world where they feed on a variety of free-living soil nematodes. These fungi capture nematodes by producing sticky, sophisticated traps on their growing hyphae. Of the various fungi tested, *Duddingtonia flagrans* possesses the greatest potential for survival in the gastrointestinal tract of ruminants. After passing through the gastrointestinal tract, spores of this fungus are able to trap the developing larval stages of the parasitic worms in a fecal environment. This technology has been successfully applied under field conditions with cattle, sheep and goats. This is an environmentally-safe biological approach for control of worms in goats under sustainable, forage-based feeding systems. To date, the only delivery system is incorporating the fungal spores into supplement feedstuffs that have to be fed daily. This requires a management system that can accommodate daily feeding to ensure that all animals consume an equivalent amount of feed. To achieve adequate control of larvae in the feces during the transmission season, spores have to be fed for a period of no shorter than 60 days. This can be expensive and time consuming. A bolus prototype is being developed which would allow a single administration where spores would then be slowly released over a 60 day period. This product is not available at this time.

Vaccines

As a consequence of drug resistance among worms of grazing ruminants, efforts have increased in recent years to develop functional vaccines. This has been made possible by newer technologies in gene discovery and antigen identification, characterization and production. Successful vaccines have been developed for lungworms in cattle and tapeworms in sheep. The most promising vaccine for nematodes has been what is called a “hidden gut” antigen and it specifically targets *H. contortus*. This antigen is derived from the gut of the worm and when administered to the animal, antibodies are made. When the worm ingests blood during feeding, it also ingests these antibodies. The antibodies then attack the target gut cells of the worm and disrupt the worm's ability to process the nutrients necessary to maintain proper growth and maintenance. Thus, worms die. This vaccine has been tested successfully in sheep under experimental conditions and has had limited success under field conditions. Reasons for this are unclear. Effect of this vaccine on *H. contortus* in goats has not been evaluated. The one drawback to this vaccine is that the antigen is normally "hidden" from the host and a number of vaccinations may be required to maintain antibody levels high enough to combat infection. This may be quite expensive. In addition, massive numbers of whole worms are necessary to extract limited amounts of antigen; therefore, this will only be practical when methods are derived to artificially make the antigen so that it can be mass produced at a lower cost. Vaccines for other worms that do not feed on blood have focused on using antigens found in worm secretory and excretory products. These antigens do have contact with the host and should stimulate continuous antibody production. However, protection has been quite variable and marketing such products has not been pursued. Vaccines are not available at this time.

Integrated Approaches

The control of worms traditionally relies on grazing management and/or dewormer treatment. However, grazing management schemes are often impractical due to the expense and the hardiness of infective larvae on pasture. Currently in the US, there are only 3 dewomers approved for use in sheep and 2 in goats. The 3 for sheep are levamisole (Levasol and Tramisol, oral drench), albendazole (Valbazen, oral drench) and ivermectin (Ivomec for Sheep, oral drench). The 2 for goats are fenbendazole (Safeguard/Panacur, oral drench) and morantel tartrate (Rumatel, feed additive). Use of any other dewormers or other methods of administration are not approved and constitute extra-label use. There are FDA rules and regulations governing use of such drugs where extra-label use may be necessary. The evolution of dewormer resistance in worm populations is recognized globally and threatens the success of drug treatment programs. In South America, South Africa, and the southeastern US, prevalence of resistance to dewormers has reached alarming proportions and threatens future viability of small ruminant production. In the only comprehensive study in the US on prevalence of dewormer resistance in goats, 90% of all farms had resistance to 2 of 3 drug classes and 30% of farms had worms resistant to all 3 drug classes. Fortunately, the one dewormer that may still remain effective in some circumstances is moxidectin (Cydectin). However, there are now several reports of moxidectin resistance. There is an urgent and increasing need to develop alternative strategies that could constitute major components in a sustainable worm control program.. The most promising of these methods that are immediately applicable are smart drenching, copper-oxide wire particles and FAMACHA©.

An integrated approach using these current methods should have an immediate impact on productivity and profitability of small ruminant production systems in the

southeastern US and other regions where *H. contortus* and/or other worms can be a problem. Producers will be able to reduce overall dewormer usage by integrating an alternative compound (copper-oxide wire particles) with identification of animals in need of treatment (FAMACHA©) and adopting smart
drenching procedures, thereby reducing cost of production while improving animal health and productivity. Lower frequency of deworming will also reduce potential environmental impact of excreted anthelmintics and will decrease the development of resistance, thereby prolonging the usefulness of available dewormers. This integrated approach will provide a cornerstone for inclusion of future environmentally sound worm prevention and control technologies to secure a sustainable, growing small ruminant industry.
Integration of other methodology/technology certainly will be instituted when evaluation is complete and ready for use.

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