Use of a Brown Mid-Rib Sorghum x Sudangrass Hybrid in a Small Ruminant Parasite Control Program

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Introduction
A limiting factor to profitability in a pasture-based, small ruminant production system is internal parasite infection. In Ohio, the internal parasite of greatest concern is *Haemonchus contortus*, commonly known as the barber pole worm. Lactating ewes and lambs less than 8 months of age are particularly susceptible to heavy parasite infections. Reliance solely upon chemical dewormers (anthelmintics) is not a good control option. Frequent use of chemical dewormers leads to the development of chemical resistance by the parasite. Current research has documented *H. contortus* resistance to all of the classes of chemical dewormers available in the U.S. market. Consequently, parasite control strategies that minimize the use of chemical dewormers are needed.

During the summers of 2009 and 2010, funding provided by an NCR-SARE Research and Education grant permitted the investigation of the use of some nontraditional forages within a managed grazing system as a strategy to reduce the parasite burden in lambs. One of the forages used was a brown mid-rib (BMR) sorghum x sudangrass hybrid. Sorghum x sudangrass hybrids are warm-season annual grasses. BMR varieties (Photo 1) have increased palatability and digestibility, and they promote better animal performance than nonbrown mid-rib varieties. They are also capable of providing good animal weight gains in midsummer. Planting BMR sorghum x sudangrass into a tilled seed bed can create a clean pasture option for grazing lambs because tillage destroys infective parasite larvae.

BMR sorghum x sudangrass was chosen for our investigation because it may provide some small ruminant livestock owners with an attractive alternative pasture that would be parasite-free when initially grazed. In our investigation, BMR sorghum x sudangrass, rather than conventional grass/legume pastures, was used as an initially “safe” pasture to compare animal performance and potential worm egg count reduction from grazed chicory. A separate fact sheet will describe the chicory component of this investigation.
Agronomic Considerations

BMR sorghum x sudangrass hybrids are warm-season annual forages. They need to be planted into warm soils that are between 60 and 65°F. At these soil temperatures, the seed will germinate quickly and a dense stand will be established. Although sorghum x sudangrass will tolerate soil pH levels of 6.0 and lower, the Ohio Agronomy Guide recommends that soil pH be maintained between 6.0 and 6.5 for best results. Critical levels of soil phosphorus and potassium are 15 ppm and 100 to 120 ppm respectively. Similar to corn, the yield response of BMR sorghum x sudangrass is dependent upon nitrogen. The Ohio Agronomy Guide suggests split applications of nitrogen totaling between 60 and 100 lbs of actual nitrogen/acre to achieve yields of 3–6 tons of dry matter (DM)/acre.

Within the context of a parasite control program for sheep or goats, if the BMR sorghum x sudangrass is planted into a field that has been grazed during the spring months, then the field must be tilled before planting. No-till seeding is not recommended unless a year has passed since the last sheep or goat grazed the field. Tillage ensures that the parasite eggs and larvae are destroyed. The newly established BMR sorghum x sudangrass can be considered a safe pasture for young grazing lambs or kids for at least the first grazing pass. Drill the seed into a firm, weed-free, moist, seedbed at a depth of one-half to one inch.

The Ohio Agronomy Guide recommends a seeding rate for drilled plantings of 23–24 lbs/acre. Most seed companies recommend drilling around 30 lbs/acre or broadcasting the seed at 40 lbs/acre. On farms in Ohio, good stands have been achieved when fields were tilled and the seed was broadcast at a rate of 40 lbs/acre and then cultipacked.

Initial growth is generally suitable for grazing about 6 weeks after planting. Regrowth following defoliation can provide subsequent grazing opportunities. In Ohio, by mid-September, generally both day- and night-time temperatures are below what is required for optimum growth of warm-season forages, and the productivity of BMR sorghum x sudangrass will decline markedly.

Management Options: Opportunities and Challenges

Warm-season summer annuals such as BMR sorghum x sudangrass grow rapidly during the months of July and August when temperatures can exceed 90°F. Depending upon the soil fertility and the amount of nitrogen applied, total forage DM yield can be in the 3–6 tons/acre range. Nitrogen application at 30–50 lbs/acre following herbage removal is recommended.

BMR sorghum x sudangrass pasture paddocks should be grazed when they are in a vegetative growth stage. Under conditions of warm soil temperatures and adequate soil moisture, the forage will be at a 30-inch grazing height 45–50 days after planting. Grazing should begin when the plants are 24–30 inches in height. The grazing pass should end when there is a 6- to 8-inch plant residue. This residual will allow for best plant recovery and rapid regrowth. With this type of management and good growing conditions, a grazing pass can be made every 14–21 days.

Like any other pasture plant, quality is related to the stage of growth and maturity. A BMR sorghum x sudangrass plant at a 24- to 30-inch vegetative growth stage (Photo 2) is high-quality forage.
It is not unreasonable to expect plant crude protein (CP) levels to be in the high teens, depending upon the amount of nitrogen applied to the stand. Total digestible nutrient (TDN) levels can be in the 68–72% range. There is an opportunity for good lamb/kid performance when grazing lambs/kids are provided this level of quality forage in a clean pasture where little to no infective parasite larvae are ingested.

The challenge in using BMR sorghum x sudangrass is managing the rapid growth and the corresponding decline in forage quality. Once the plant gets beyond the boot stage of growth, quality declines rapidly (Photo 3).

Similar to other forages, the CP and TDN content decreases while fiber levels as measured by acid detergent fiber (ADF) and neutral detergent fiber (NDF) increase. Our experience in Ohio, working with BMR sorghum x sudangrass over the course of this and other studies, has been that the plant can advance from a high-quality vegetative stage to the early heading stage within a 10-day time period. Early heading stage quality generally results in whole-plant CP levels of 12–14% with TDN levels averaging 56–59%.

There are a couple of management options that can be utilized in a grazing system to provide the high-quality forage needed by young grazing lambs or kids. One is to strip graze across a paddock of BMR sorghum x sudangrass with a high stocking density. Under this scenario, lambs/kids should be moved to a new forage allotment every day. The goal is to graze across the entire paddock within a 7- to 10-day period. The other option is to utilize staggered plantings of BMR sorghum x sudangrass. The goal here is to provide varying planting dates that permit the movement of lambs/kids into succeeding paddocks that are each at the 24- to 30-inch growth stage as lambs/kids finish grazing the previous paddock.

In addition to the management challenge presented by the rapid growth and maturation of the plant, a grazer should be aware of some potential animal health care issues common to warm-season annuals such as BMR sorghum x sudangrass. Prussic acid (hydrogen cyanide) and nitrate poisoning may occur under certain conditions. While a full explanation of these conditions is beyond the scope of this fact sheet, a key concept is that any stress condition that retards the growth of the plant, such as drought, increases the prussic acid and nitrate levels in sorghum x sudangrass plants.

There is a greater chance of prussic acid poisoning when plants are grazed before they are 18 inches in height. High nitrogen fertilization rates increase the potential for nitrate poisoning under stressful plant growth conditions. High nitrogen fertilization rates also increase the levels of cyanogenic glucosides in the plants, which can be converted to prussic acid. Finally, precautions must be taken if BMR sorghum x sudangrass is grazed during the fall when frost threatens, since prussic acid can be released from plant cells when they are frost damaged.

Ohio On-Farm Results

During the 2009 and 2010 growing seasons, a BMR sorghum x sudangrass forage (FSM Brand Cow Candy) was grown on three farmer-cooperator farms as part of an NCR-SARE-funded research and education project to examine nontraditional forages in a managed grazing system for the control of gastrointestinal parasites in sheep. The farms were located in Athens, Knox, and Wayne Counties in Ohio. The goal each year was to get the forage planted by the end of May or the first few days in June, when soil temperatures are close to 65°F. This planting schedule, combined with adequate soil moisture, provided forage ready to be grazed by mid-July. The intent of the study was to make two grazing passes through this forage each year with weaned lambs. Each grazing pass lasted 14–21 days.

BMR sorghum x sudangrass forage DM yield in lbs/acre, and forage quality, as measured by percentages of CP, TDN, ADF, and NDF, are shown in Table 1 for 2009 and Table 2 for 2010. Quality and yield samples were taken at the beginning of each grazing pass. The date in the table refers to the beginning of each grazing pass by farm location listed by county.
Table 1

<table>
<thead>
<tr>
<th>Farm</th>
<th>Date</th>
<th>DM Yield</th>
<th>CP%</th>
<th>TDN%</th>
<th>ADF%</th>
<th>NDF%</th>
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</thead>
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<tr>
<td>Athens</td>
<td>7-9</td>
<td>2750</td>
<td>13.3</td>
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<td>9-4</td>
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<td>62.0</td>
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<tr>
<td>Knox</td>
<td>7-23</td>
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<td>17.0</td>
<td>58.0</td>
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<td>53.1</td>
</tr>
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<td>20.1</td>
<td>56.0</td>
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<td>9-1</td>
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<td>11.5</td>
<td>56.0</td>
<td>34.6</td>
<td>59.9</td>
</tr>
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</table>

As the tables illustrate, there were delays in the starting grazing date for the parasite study for most farms in at least one of the study years. These delays were unrelated to the availability of the BMR forage, which was initially ready for grazing by early- to mid-July on each farm in each year. In cases where the initial growth could not be used for the parasite study, the forage was harvested either by worm-free sheep or mechanically. Therefore, DM yield figures in the tables do not reflect the total quantity of forage that could have been grazed in a more intensive management system. In addition, the DM yields in the tables do not reflect the DM that was added during the grazing pass. In July and August, growth rates were measured at about 150 lbs of DM/acre accumulation per day.

Table 2

<table>
<thead>
<tr>
<th>Farm</th>
<th>Date</th>
<th>DM Yield</th>
<th>CP%</th>
<th>TDN%</th>
<th>ADF%</th>
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<tr>
<td>Wayne</td>
<td>8-13</td>
<td>2509</td>
<td>21.6</td>
<td>62.0</td>
<td>32.4</td>
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<td>4055</td>
<td>18.3</td>
<td>59.0</td>
<td>37.5</td>
<td>64.0</td>
</tr>
</tbody>
</table>

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Lessons Learned

Over the course of the two-year project, on-farm observations, conversations with farmer-cooperators, and data collection and analysis provided some teachable moments. Listed below are some of the lessons we learned regarding the use of BMR sorghum x sudangrass for growing lambs.

- BMR-sorghum x sudangrass can provide a safe pasture for grazing lambs for at least one grazing pass. To ensure that parasite eggs and infective larvae are destroyed, the forage should be established by tilling the soil before planting if the field has been used for grazing the same spring.

- Subsequent grazing passes can provide a lower risk for lambs to pick up infective worm larvae, compared to regrazing conventional grass/legume pastures. Animals eat the leaves and tender upper stems, which are well above the level to which worm larvae can migrate (2–4 inches). However, lambs will eat other annual grasses and forbs in the BMR sorghum x sudangrass stand if they are numerous, and these plants may be contaminated by worm larvae after the first grazing pass. If the BMR sorghum x sudangrass will be grazed multiple times by lambs during the summer, we suggest a targeted selective deworming strategy be used prior to the first grazing pass to keep worm contamination low and to reduce selection pressure for dewormer resistance. (See our fact sheet titled, Strategies for Coping with Parasite Larvae on Pastures in the Springtime on Ohio Pastures.)

- The standard grazing recommendation for BMR sorghum x sudangrass is to leave a 6- to 8-inch residue. This is difficult to accomplish with sheep if the plants are 24–30 inches tall when the animals are turned in. Sheep tend to graze the plants lower than 6–8 inches when plants are in the high-quality vegetative growth stage.

- If a grazing residue of less than 6–8 inches is left, the recovery time to the next grazing pass is increased.

- The use of a warm-season annual forage such as BMR sorghum x sudangrass has the potential to produce a large quantity of high-quality forage during the hot summer months when cool-season pastures are declining in production.

- Managing BMR sorghum x sudangrass to take advantage of the growth and quality, while at the same time using it to decrease the parasite burden of grazing lambs, represents a significant management challenge because of the rapid growth characteristics of the plant.

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Summary and Conclusion

The planting and subsequent grazing of BMR sorghum x sudangrass by itself is not an effective parasite control strategy. However BMR sorghum x sudangrass has the potential to be used as one tool within the context of an overall parasite control strategy. It can provide a safe pasture capable of producing high-quality forage for grazing lambs for a defined time period. Farmers need to carefully weigh the cost of establishing an annual forage against the potential benefit that could be gained in their management system.

Our on-farm experience in Ohio over the course of two years demonstrated that there are significant management challenges in using BMR sorghum x sudangrass due to the rapid maturation of the forage. Over a 10-day time period, forage quality can decline from a high level down to the point where a grazing lamb’s nutritional requirements are not met. Use of staggered planting dates could possibly provide a wider grazing window for young weaned lamb/kid use than these data reflect. Clipping to maintain quality could also be used as a management strategy. However, both staggered planting dates and clipping require additional management, better planning, and cooperative weather, and both result in increased costs.

Possibly the best management strategy for lambs/kids would be to mob graze the BMR sorghum x sudangrass with a high stocking density over a 3- to 5-day time period. Subsequent regrowth could be similarly harvested, but the farmer will need additional safe forage on which to graze the animals during the regrowth period. In the bigger picture, use of BMR sorghum x sudangrass may not provide enough return from a parasite management perspective to make the practice worthwhile; although it could be a valuable strategy on a farm with parasite resistance to multiple dewormers. On the other hand, mature ewes and does, and especially dry ewes/does, are better able to take advantage of rapidly maturing forage and the subsequent decline in forage quality since their nutrient needs are low. They may be a more appropriate animal class to utilize BMR sorghum x sudangrass.