

**Virginia Tech
Shenandoah Valley Agricultural
Research and Extension Center
McCormick Farm
2017 Field Day Proceedings**



August 2, 2017



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Field Day Program

Shenandoah Valley Agricultural Research and Extension Center

Wednesday, August 2, 2017

12:00 – 1:00	Registration and visit with sponsors
1:00 – 1:10	Welcome , <i>David Fiske, Superintendent, Shenandoah Valley Agricultural Research and Extension Center</i>
1:10 – 1:20	Load wagons and travel to first stop
1:20 – 1:35	Silvopasture Update – <i>Adam Downing, Northern District Forestry Agent, Virginia Cooperative Extension, and Dr. Gabriel Pent, Ruminant Livestock Systems Specialist, Southern Piedmont AREC</i>
1:35 – 1:50	Emerald Ash Borer – The Good and the Bad – <i>Adam Downing, Northern District Forestry Agent, Virginia Cooperative Extension</i>
1:50– 2:00	Load wagons and travel to Forage Plot area
2:00 – 2:15	Summer Annual Forages: Uses and Benefits - <i>J.B. Daniel, Forage & Grassland Agronomist, USDA-NRCS</i>
2:15 – 2:30	Warm Season Grasses for Beef and Bobs - <i>J.B. Daniel, Forage & Grassland Agronomist, USDA-NRCS</i>
2:30 – 2:45	Opportunities with Solar Powered Watering Systems – <i>Alston Horn, Field Technician, Chesapeake Bay Foundation</i>
2:45 – 3:00	Herbicides for Fenceline Grass Suppression - Chemical Mowing – <i>Doug Horn, Extension Agent, Rockingham County</i>
3:00 – 3:15	Semi-permanent Posts & Bracing for use with High-tensile Electric Wire - <i>Alston Horn, Field Technician, Chesapeake Bay Foundation</i>
3:15 – 3:30	Load wagons and travel back to Bank Barn
3:30 – 3:50	Update on Sericea Lespedeza Grazing Experiment – <i>Dr. Ben Tracy, Crop and Soil Environmental Sciences, Virginia Tech</i>
3:50 – 4:10	Evaluation of the Feeding Value of Corn Gluten Feed in Forage-based Rations – <i>Dr. Bain Wilson, Department of Animal and Poultry Sciences, Virginia Tech</i>
4:10 – 4:30	Effects of Endophyte Infected Tall Fescue Consumption on Growing Cattle Performance and Prospective Mitigation Strategies – <i>Dr. Robin White, Department of Animal and Poultry Sciences, Virginia Tech</i>
4:30 – 4:50	Tools for Selecting Replacement Heifers – <i>Dr. Vitor Mercadante, Department of Animal and Poultry Sciences, Virginia Tech</i>
4:50 – 5:45	Visit with Sponsors – Feed Mill
5:45 – 6:30	Introductions and Comments from Special Guests – Bank Barn
	Pre-dinner Speaker – <i>Megan Seibel, Deputy Secretary of Agriculture and Forestry, Commonwealth of Virginia</i>
6:30	Dinner – Bank Barn

Silvopastures: SVAREC Update, Kentland Results and SPAREC Studies

Gabriel Pent¹, John Fike², Adam Downing³

Silvopasture is the purposeful and managed integration of trees, forages, and livestock. With appropriate management, these intensive, integrated management systems create beneficial interactions among the system components that result in more efficient resource use and greater economic output over the life of the system. Benefits of silvopastures can include increased forage yield or quality, reduced animal stress, improved tree growth and quality, greater farm product and ecosystem diversity and a number of conservation gains (Fike et al. 2004).

SVAREC project update

The SVAREC silvopasture project aims to demonstrate how a degraded hardwood stand on a medium quality site might be converted into a mixed-use forage and timber producing silvopasture.

The Woods

Prior to thinning, the wooded area was a mixture of various hardwoods namely green ash, black cherry, black walnut and hickory. Other species included: white oak, black oak, black locust, and American elm. The understory was dominated by non-native bush honeysuckle, multiflora rose, and spicebush. There was very little tree regeneration present. Along with an old home site, evidence suggests the area was pastured in the past, and some very large, mature white oak trees were present. The site (4.8 acres) had been fenced to exclude all livestock since the late 1990s. Most of the trees in the stand were smaller pulpwood sized trees, with an average diameter of 10.2". The area was considered fully stocked (an indication of full site utilization).

The basal area of this site averaged around 100 ft² /acre. (Basal area is a forestry unit of measure that sums the cross-sectional area of the trees on an acre.) In choosing how many trees to leave behind, we considered three factors: species, stem quality, and spacing. Our goal was to leave well-spaced trees of suitable quality and characteristics and a residual basal area of about 50 ft²/ac (50% of 100 ft²/ac). Black walnut and white ash comprise the majority of the selected species. Of the 196 trees in the residual stand, 39% are black walnut and 25% are white ash. Following harvest, the



Demonstration site, pre- (top) and post- thin (bottom).

Images available from the Virginia Information Technologies Agency (<http://www.vita.virginia.gov/isp/default.aspx?id=8412>) and the FSA's National Ag Imagery Program (<http://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/index>).

residual stand's average diameter was 9.8" (at 4.5 feet above the ground) and the average Basal area 25 ft²/ac due to the fact that some areas had no acceptable growing stock to leave in the residual stand.

Unfortunately, arrival of the non-native emerald ash borer in Virginia (first documented in 2006) has begun to change the composition of Virginia's forests. Emerald ash borer damage at SVAREC was first noticed in late winter (February) of 2017. A recent inventory of the 45 ash trees present one year ago found 18% dead, 38% in serious decline and 44% in relatively good shape. We expect within 2 years that all the ash will be dead.

We will be restocking the "Silvo" piece of these paddocks with new seedlings. Species under consideration include: black walnut, black locust, honeylocust, Kentucky coffee tree, and yellow poplar, and hickory species among others. These young trees will need protection from cattle browsing, trampling and rubbing damage for several years. The loss of the ash and need to add trees back will provide us opportunity to explore different protection methods.

The Forage

Because we have little information about forage species suitability within shaded sites, a blend of species were planted early November, 2014. The following year red clover was also seeded. The species mixture included: 'Select' endophyte-free tall fescue, 'Benchmark' orchardgrass, 'Remington' perennial ryegrass, 'Baron' bluegrass, 'Pradel' meadow fescue. Each forage species was broadcast at 5lb/acre along with cereal rye at 10 lb/acre (totaling 40 lb/acre).

Shade tolerance of these species is not well known and may vary by variety within species, so this seeding is a bit of a "stab in the dark". Generally, orchardgrass and meadow fescue are considered adapted to more shaded sites and meadow fescue has high digestibility. Tall fescue tolerates some shade as well, and although endophyte-free fescue is considered less tolerant of environmental stressors, it was chosen with the thought that these plants might be more successful in the buffered environment of the silvopasture. Of course, reducing alkaloid exposure is also desired. Perennial ryegrass and bluegrass are considered less shade tolerant but were added for their potential to fill gaps in the forage canopy in sunny areas and because the seed company was interested in seeing their potential use. Reed canarygrass is another shade tolerant species of interest, but seed of low alkaloid varieties were not available for planting.

Seedling recruitment was challenged by the broadcast application. Although drilling is preferred because a drill places seed in good contact with mineral soil, that was not possible in this site with rocks and stumps. An alternative in certain settings is to introduce livestock to work seed into the ground. We do think we observed better seed establishment where the site was mulched (vs. pushed with a blade). This also may be due to greater weed control, but likely the improvement reflects seed "catch", as they fell into (and stayed in) contact with soil.

The Livestock

Initial livestock behavior could be described as “nervous”. Young stockers were not particularly mindful of a single strand of hot wire, so the fencing needed bolstering. Our original intention was to compare a couple of stocking densities in order to see how the pasture responded to different residual heights. The goal was to leave two residual forage heights (3” and 6”) in two of the four paddocks to compare recovery and grazing days, but the early challenge with animal behavior limited our ability to manage this with any precision. In 2016, over the first month of grazing (April 28-Jun 20), steers (409 lb on entry) gained 2.49 and 2.14 lb/d for low and high stocking rates. In 2017, due to time limitations, we’ve simply managed a single group, grazing the pastures in spring using rotational stocking management. One observation from this spring is that steers display preference for certain tree species – specifically Kentucky coffee tree – that was not apparent with last year’s group. This hints at the potential for producers to use animal behavior for vegetation/landscape management.

Kentland Farm Research Results

Maintaining adequate livestock production in silvopastures will be a primary concern for most livestock producers because forage productivity slightly declines in some systems (Buergler et al., 2005; Kallenbach et al., 2006; Kyriazopoulos et al., 2013). Despite resource competition between forages and trees, the decrease in forage quantity might be ameliorated by an increase in forage nutritive value (Kallenbach et al., 2006; Neel et al., 2016). However in some cases, lower soluble carbohydrates (Buergler et al., 2006) and variable responses in terms of fiber digestibility (Fannon-Osborne, 2012) in silvopasture forages challenge this idea. Despite reductions in forage availability, most research has demonstrated no reduction in animal growth (Lehmkuhler et al., 2003; Kallenbach et al., 2006; Fannon-Osborne, 2012). The objective of this study was to determine the forage and animal response to hardwood silvopasture systems compared to open pastures, utilizing lambs as a model for cattle. What is compensating for reduced forage growth in some silvopastures – improved nutritive value in the forages or improved animal well-being?

Methods

In this study, black walnut (*Juglans nigra*) and honeylocust (*Gleditsia triacanthos* cv. ‘Millwood’) based silvopasture systems were compared with open pastures over three summers (2014-2016) at Kentland Farm in Blacksburg. Pastures were rotationally stocked with 5 to 7 crossbred lambs depending on forage availability. A rising plate meter was used to estimate pre-graze forage mass. Forage grab samples were collected and analyzed for nitrogen (N) and neutral detergent fiber (NDF) concentrations. Species percent cover was estimated every four weeks.

Lambs were weighed every four weeks to compare system gains. Time-lapse cameras documented sheep behavior every 60 seconds. Intravaginal temperature sensors were constructed from blank controlled internal drug release (CIDR) devices and small temperature loggers. These were set to remotely log temperatures every 10 minutes and then inserted into a subset of the ewes each week.



Figure 1: Lamb performance was compared in these open pastures (left) and black walnut (middle) and honeylocust (right) silvopasture systems in Blacksburg.

Forage characteristics and lamb performance

The forage productivity of the black walnut silvopastures was about 30% lower than the productivity of the honeylocust silvopastures and the open pastures. In one year (2016), the forage productivity in the honeylocust silvopasture exceeded that of the open pasture.

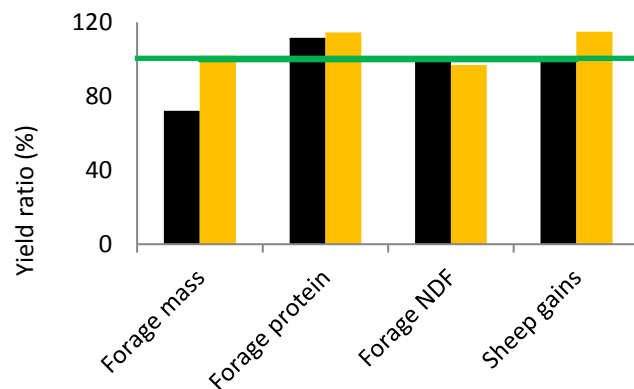


Figure 2: Although forage productivity in the black walnut silvopasture was lower than the other systems and there were little nutritional differences in the forages, lambs in the silvopastures gained as well or better than lambs in the open pastures (black = black walnut silvopasture; yellow = honeylocust silvopasture; green = open pasture).

From a nutritional perspective, the forages in the silvopastures had slightly greater levels of protein, although this likely led to little difference in lamb performance as it was typically adequate for lamb growth in all systems throughout the study. The honeylocust silvopastures had slightly lower levels of NDF. This seems to have been driven by more clover in those systems, particularly in the first year following frost-seeding.

Lambs in the silvopastures gained as well or better than the lambs in the open pastures. Although the ADGs of lambs in the black walnut silvopasture exceeded the ADGs of the lambs in the open pastures, we stocked the black walnut silvopastures with fewer lambs because of the lower forage productivity. Thus, it is more appropriate to consider total system output. In this case, there was no

difference in the total animal productivity of the silvopastures compared to the open pastures. Even with the potential products available from the trees, the lamb outputs of the silvopastures were no different than the outputs of the treeless pastures. It is clear that something besides forage characteristics alone is driving animal performance in silvopastures.

Lamb behavior and body temperatures

From the analysis of the time-lapse imagery, we found that the lambs in the silvopastures grazed more frequently and more evenly throughout the midday hours compared to the lambs in the open pastures. The lambs in the silvopastures spent more time lying down. The lambs in the open pastures spent about 2 hours longer each day standing up. In addition to the extra energy expenditure of standing versus lying down, time spent lying down is a traditional metric of animal comfort. It is clear that the lambs in the silvopastures were more comfortable than the lambs in the open pastures.

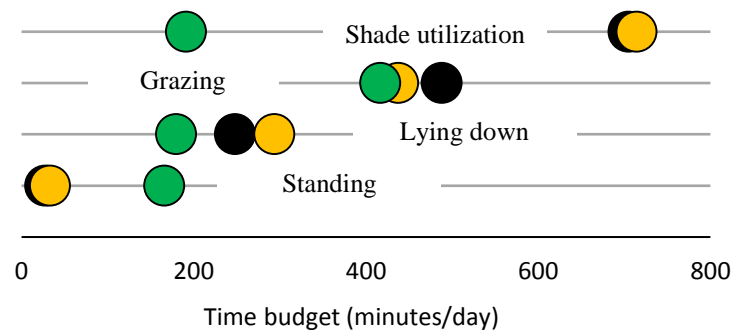


Figure 3: Lambs in silvopasture spent more time lying down and less time standing; (black = black walnut silvopasture; yellow = honeylocust silvopasture; green = open pasture).

The lambs were found to actively follow the shade of the trees, spending over 90% of the day within shade. As a result, the ewes in the black walnut silvopastures had 0.7 F° cooler vaginal temperatures than the ewes in the open pasture during the hottest hours of the day (1:00 – 5:00 PM). It is not clear why lambs in the honeylocust silvopasture had similar vaginal temperatures to lambs in the open pastures, but it could be because of less shade provided by honeylocust trees, consumption of more forage by lambs in these systems, reductions in nighttime cooling potential, or a combination of each of these factors. Both tree species modulated the effect of the environment on lamb body temperatures, though honeylocust trees had less of an effect. The variable effect of tree species on animal physiology may be an important consideration for producers designing a silvopasture system.

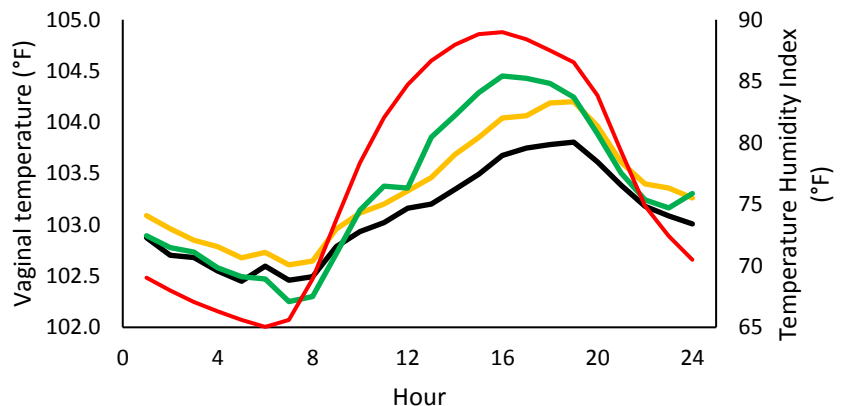


Figure 4: The black walnut trees kept lambs cooler during the hottest part of the day (Left hand axis: black = black walnut silvopasture; yellow = honeylocust silvopasture; green = open pasture; Right hand axis: red = Temperature Humidity Index of the farm).

Conclusion to Kentland study

Even with the potential products and ecosystem services rendered by the trees in these hardwood silvopastures, these systems had similar animal output compared to the conventional open pastures during the summer months. In addition, these silvopastures sheltered the lambs from ambient summertime conditions, leading to improved animal welfare compared to open pastures. The different products and services provided by both of these tree species should be an important consideration in silvopasture design.

Future Studies in Blackstone

We are beginning a study this summer on heifer performance and development in the silvopasture systems compared to the open pastures at the Southern Piedmont Agricultural Research and Extension Center in Blackstone.

Forty acres were converted to four different treatments over the past few years.

- Twenty acres were clear cut, of which:
 - Ten acres were planted back to alleyways of loblolly pine (*Pinus taeda*).
 - Ten acres were converted to open pasture.
- Twenty acres were thinned to silvopasture density, of which:
 - Ten acres contain mostly loblolly pine.
 - Ten acres contain mostly hardwood species.

The cool season forages planted in these treatments in 2016 are ready to support grazing livestock. Forage species and seeding rates included novel endophyte tall fescue (BarOptima PLUS E34) at 12.5 lb/acre, orchardgrass, alfalfa, and red clover at 5 lb/acre, and ladino clover, perennial ryegrass, and meadow fescue at 2 lb/acre. Similar work to the Kentland study is planned, although with cattle instead of sheep.



Figure 5: Heifers relaxing in the shade of this newly established silvopasture at the Southern Piedmont AREC in Blackstone.

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Emerald Ash Borer

Adam Downing
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Peer reviewed by: Lori Chamberlin, Forest Health Specialist - Va Department of Forestry
Eric Day, Extension Entomologist - Virginia Tech

EAB has become the most destructive and economically costly forest insect to ever invade North America. (Herms, 2014)

Background

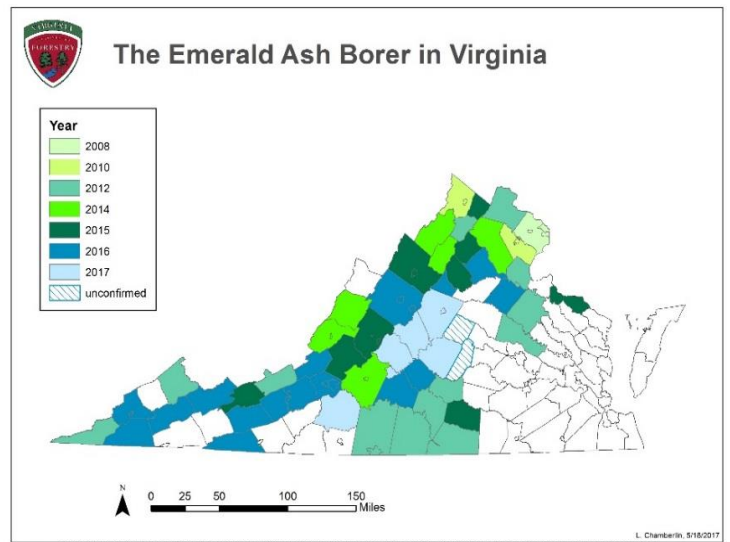
The Emerald Ash Borer (EAB) is a non-native insect. The accidental introduction of EAB to North America is believed to have arrived by way of shipping material, such as pallets, made from infested ash from China. Since its discovery in 2002 in North America, it has been confirmed in parts or all of 29 states and 2 Canadian provinces. EAB was first established in SE Michigan, in the early 1990's. Initial ash damage was mistaken for Ash Yellows for a decade.

North American Ash trees are highly susceptible, unlike the ash of EAB's native China. By 2003, millions of ash trees were dead in a 6 county area of SE Michigan and serious efforts began to better understand the biology of the insect and control its spread.

Initial control efforts included a quarantine restricting the movement of ash nursery trees, logs and related products from infested counties. An "ash-free firebreak" was also tried near Windsor, Ontario by removing all ash trees in a 3-6 mile wide swath around the known infestation. It was unsuccessful.

In Virginia, the Emerald Ash Borer was first detected in Fairfax County in 2003 and eradicated only to show up again in 2008, again in Northern Virginia. As of June 2017, it has been confirmed in over half of Virginia's counties.

Virginia's control efforts initially included quarantines of several counties and adjacent counties of known infestations. In 2012, the whole State was quarantined and added to the federal quarantine boundary thus allowing ash wood and plant material to move freely through Virginia and to/through other states that were also part of the federal quarantine.



Credit: L. Chamberlin, Virginia Department of Forestry.

Identification & Biology

EAB belongs to a group of beetles called “flat-headed borers”. All flat headed borers leave a “D-shaped” exit hole when they emerge from the wood as an adult, because of body shape of the emerging adult. The adult emerald colored beetle does little direct damage to the tree. While it feeds on ash leaves, it is not a significant defoliator.



Credit: Kenneth R. Law, USDA APHIS PPQ, Bugwood.org



Credit: J. Obermeyer, Purdue University

The larval stage of this insect is the killer. It tunnels just underneath the bark creating s-shaped galleries that girdle branches and eventually the trunk of the tree, resulting in death.

Early signs of damage are often unnoticed and not unique to EAB. Branch dieback, epicormic sprouting and thinning foliage can just as likely stem from construction damage as EAB. However, given the wide presence of EAB in Virginia any ash tree exhibiting signs of stress or decline should be suspect of Emerald Ash Borer.

A later sign of damage, however, is unique to EAB. “Blonding” results from Woodpecker activity. These natural predators go after the EAB larvae knocking off outer edges of bark, which changes tree’s the look significantly and can be easily identified



Source: Art Wagner, USDA, www.bugwood.org

Treatment options

Forest settings

At present, there are no economically viable control options for EAB for forested situations. Research continues into biological control options such as parasitic wasps native to China and Russia. While this holds some promise, it is unlikely to “save”

Virginia's ash due to the extent and abundance of EAB relative to the limited trial releases of the non-stinging wasp.

Fortunately, Ash make up only about 2% of the forests in Virginia. However, where ash occurs, it's often a dominant species in the canopy and so mortality can lead to significant local impacts. Where landowners have merchantable ash, a pre-emptive harvest should be considered. Once the trees have been infected with EAB, log value can decrease rapidly.

Landscape settings

For yard, street and park trees, **preventative** treatment is relatively easy and affordable.

Homeowners can purchase and apply imidacloprid or dinotefuran as a soil drench or granule respectively applied in April after bud break. Timing, application method and rate of material applied is critical. Research conducted in the mid-west found mixed results on efficacy of these chemicals in homeowner formulations but suggested the effectiveness variability may have been due to varying application rates. Other research found good control for small to medium healthy trees with annual application at high rates (maximum allowed on the label).

Professional Arborists with an appropriate pesticide applicator license have additional options such as applying the above chemicals at higher rates or applying other products. Some of those other products contain the chemical emamectin benzoate which is typically applied as an injection. Research suggests this is the most effective insecticide both in terms of prevention and, to some extent, treatment of already infested trees. Injected directly into the stem of the tree, this application method results in faster uptake than a soil drench and can therefore "save" lightly infested Ash trees. Trees with more than 30% decline are unlikely to recover. This treatment is more expensive but provides control for 2-3 years.

References

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For more information:

- Insecticide Options for Protecting Ash Trees.
http://www.emeraldashborer.info/documents/Multistate_EAB_Insecticide_Fact_Sheet.pdf
- National status & resources: <http://www.emeraldashborer.info/>
- Emerald Ash Borer Control for Foresters and Landowners.
<https://www.pubs.ext.vt.edu/ENTO/ENTO-76/ENTO-76.html>

Summer Annual Forages

Matt Booher: Virginia Cooperative Extension, Crop Agent
Lane Grow: Southern States
David Fiske: Superintendent- Shenandoah Valley AREC

These demonstration plots were established to provide farmers with a look at some of the many species, hybrids, and varieties available for summer annual forage. Many of these forages can be a valuable tool when rotating a crop field into fall-seeded pasture, or as a targeted way to provide grazing during the summer slump. These plots were planted on June 19th and fertilized with 50 lbs. of nitrogen per acre (soybeans were inoculated, and not fertilized).

1. Switchgrass

2. Eastern Gamagrass

3. Summer cover crop mixture is a diverse mixture created for dual purposes of grazing and soil health improvement. It contains 5 species: cowpea, sorghum-sudangrass, sunhemp, sunflower, and turnip.

4. BMR pearl millet.

Milletts are lower yielding and slower growing than sorghum-type plants. However, they have smaller stems and are leafier. They do not present a risk of prussic acid poisoning.

Pearl millet is the preferred species for grazing since it has the ability to regrow well from multiple tillers. Forage quality will run about 60% TDN, 12% CP prior to heading. Grazing should begin at about 20" and stop at about 9-12". Dwarf varieties of pearl millet are shorter, with a higher leaf/stem ratio. BMR pearl millet is a new, low lignin variety with a higher digestibility than non-BMR pearl millets.

5. Sorghum-sudangrass.

Sorghum-sudangrass hybrids are taller, have larger stems and can be higher yielding than sudangrass. Sorghum-sudangrass hybrids are normally harvested for green chop or silage (medium dough stage) but may be used for pasture or hay if planted at a high seeding rate and harvested at 18 to 24 in. tall (regrowth is good but not as good as Sudangrass). The sorghum-sudangrass hybrids usually yield less than forage sorghums. Forage quality will be around 65 TDN, 16% CP in the vegetative state; as the plant matures quality will drop to around 55 TDN, 11% CP. The 'Greentreat 1731' hybrid is a gene 6 BMR, Brachytic dwarf with excellent standability.

6. Sudangrass.

Sudangrasses can be harvested as pasture, green chop or silage, but are best used for pasture. Yields of 3 to 4 tons/acre of dry matter or 10 to 12 tons/acre of green feed or silage are possible. It can be pastured 5 to 6 weeks after planting and may be cut or grazed multiple times (when regrowth reaches 18 to 20 in.) For best results, it should be grazed rotationally with a sufficiently heavy stocking rate to remove forage down to a 6 to 8 inch height in a few days. The pasture will grow rapidly when the cattle are removed for more total tonnage. Additionally, if the grazing period is short, cattle will be less likely to be grazing regrowth that is high in prussic

acid. It can be very difficult to dry for hay- a good strategy is to harvest early when plants reach around 30 in. tall. For silage, harvest in the medium dough stage at 65-70% moisture. Nutritional quality is good when plants are immature (about 70% TDN, 17% CP) and drops with maturity to around 55% TDN, 11% CP. The 'Greentreat' variety is a gene 6 BMR.

7. Soybean & forage sorghum mixture.

8. Forage sorghum. Forage sorghums are best harvested as silage, and should be harvested at the mid dough stage. Sorghum silage will run around 9% CP, 60% TDN. Most forage sorghums and forage sorghum hybrids are medium to late maturing; some long season and/or non-flowering types will need to be killed by frost to dry down enough for ensiling. Forage sorghum should be harvested for silage when the seed has reached the soft dough stage to ensure optimal forage quality. Beyond the soft dough stage seed hardens quickly, dropping in digestibility. At the soft dough stage most sorghum varieties will be around 70-75% whole-plant moisture, which can result in less than ideal ensiling. Selecting a variety with a dry stalk characteristic will help with this dilemma. Forage sorghums can also be harvested in the late-boot to early-head stage, wilted down to about 65% moisture, and ensiled. It is helpful to use a mower-conditioner to crush stems and use wider mower swaths to increase surface area for drying. Forage sorghums and sorghum hybrids can cause prussic acid poisoning under certain environmental conditions- mainly when grazed or fed as green chop. *The energy value of sorghum silage is about 85-90% that of corn silage (60% TDN, 9% CP).*

9. BMR Forage sorghum (split plot)

10. Foxtail (German) millet. Foxtail millet has been used as a summer annual hay and/or smother crop for a long time. Like pearl millet, foxtail millet does not present a risk of prussic acid poisoning. The similarities with pearl millet end there, as foxtail millet is actually more closely related to the weedy "foxtail". Foxtail millet is a "one cut" crop and will not regrow well after mowing or grazing. This makes it ideal as a smother crop prior to drilling in fall-planted small grains or forages.

Prussic Acid

Sorghum and sudangrass plants contain a compound called dhurrin, which can break down to release prussic acid (hydrogen cyanide, HCN). Sudangrass has low levels of this compound and rarely kills animals. Sorghum has the highest levels and sorghum-sudangrasses are intermediate. There is also considerable varietal difference in prussic acid content for all types of sorghums.

Dhurrin content is highest in young plants. Therefore, the recommendation is not to graze or cut for green chop until the plant is 18 to 20 inches tall. This also applies to young regrowth in pastures. After a drought, new shoots may appear and the grazing cattle will switch from the taller forage to the new tender shoots. In addition, do not graze or green chop for 10 days after a killing frost.

High levels of nitrogen fertilizer or manure will increase the likelihood of prussic acid poisoning as well as nitrate poisoning. Very dark green plant growth often contains higher levels of prussic acid.

Most prussic acid is lost during the curing process. Therefore, hay and silage are seldom toxic even if the original forage was. Do not leave green chop in a wagon overnight and then feed. The heat that occurs will release prussic acid and increase likelihood of toxicity in the feed.

- *'Prussic Acid Concerns' Dan Undersander, University of Wisconsin*

Thanks are due to Southern States for supplying the seed for this demonstration.



Natural Resources Conservation Service

Northern Bobwhite in Working Grasslands

Status: Declining

The northern bobwhite (*Colinus virginianus*) is often referred to as an "edge" species, seeking habitat where crop fields intersect with woodlands, pastures and old fields. Historical land uses favored bobwhite, but urban encroachment and changes in management practices have caused the bird's numbers to dip by more than 80 percent over the last 60 years.

Bobwhites depend on native grasslands, shrub thickets, and pine or oak savannahs found in the southeast and midwest. These habitats have the native grasses used for nesting, the wildflower seeds and insects that provide food, and the brushy cover used for safety. To help reverse bobwhite declines, NRCS is working with private landowners in eight states to manage for their habitat.

NRCS and the Northern Bobwhite

The northern bobwhite is a state-identified target species of the Working Lands for Wildlife (WLFW) partnership, a collaborative approach to conserve habitat on working lands. This new WLFW project is designed to help bring back the quail that were once an integral part of Virginia's farming way of life.

Eligible producers can get technical and financial assistance to implement various conservation practices to address habitat loss in much of the bobwhite range while maintaining or improving cattle production on their lands.

Participating states will focus on replacing non-native forage grasses with native forages that benefit bobwhite and other wildlife.



This new program offers a "win-win" for participating producers by enabling them to continue grazing on land with installed wildlife practices.

Actions

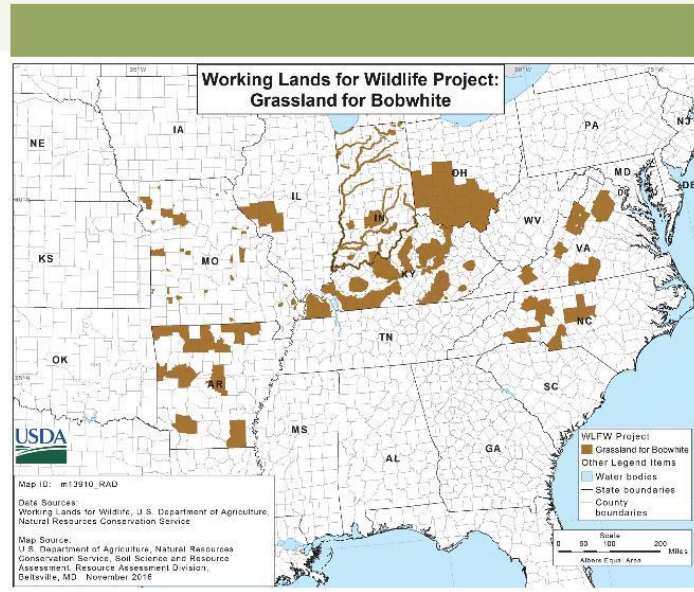
- Improve cattle production for grazing operations
- Restore native grasses to the agricultural landscape
- Improve soil health, water quality, and wildlife habitat on cattle farms

Priority Landscapes

Starting in October 2017, Virginia will conduct targeted habitat restoration activities **throughout the state** with a focus on the following counties: Augusta, Bland, Botetourt, Charlotte, Culpeper, Fauquier, Halifax, Madison, Orange, Pittsylvania, Rappahannock, Rockingham, and Wythe.

Available Practices

- Forage and Biomass Planting
- Prescribed Grazing
- Brush Management
- Herbaceous Weed Control
- Conservation Cover
- Prescribed Burning
- Fence
- Firebreak
- Tree/Shrub Site Preparation
- Livestock Pipeline
- Spring Development
- Tree/Shrub Establishment
- Watering Facility
- Upland Wildlife Habitat Management
- Early Successional Habitat Development/Management



Research shows that livestock and ground nesting birds can thrive together with moderate grazing pressure.

Outcomes and Impacts

Native grasses produce desirable returns and very inexpensive gain. By converting endophyte-infected tall fescue and other introduced species to native forages, producers can improve or maintain average daily weight gains, enhance soil health, and hedge against summer drought with fewer inputs.

Bobwhite and many other grassland birds and pollinator species also benefit when native vegetation is properly used in prescribed grazing systems. Positively impacted grassland birds include the:

Dickcissel, Grasshopper Sparrow, Eastern Meadowlark, Henslow's Sparrow, Eastern Kingbird, Field Sparrow, and Wild Turkey.

How to Apply

Signups start in October 2017. Interested landowners in the project area should contact one of these service centers to learn more about opportunities available through the Northern Bobwhite in Working Grasslands Initiative:

Bonsack (Botetourt) – 530-977-2698
 Chatham (Pittsylvania) – 434-432-8146
 Charlotte Court House (Charlotte) – 434-542-5442
 Culpeper – 540-825-4200
 (Culpeper, Orange, Madison, and Rappahannock)
 Halifax (Halifax) – 434-476-1931
 Harrisonburg (Rockingham) – 540-433-2901
 Verona (Augusta) – 540-248-6218
 Warrenton (Fauquier) – 540-347-4402
 Wytheville (Bland and Wythe) – 276-228-3513

NRCS staff will work with the applicant to develop a conservation plan that will become the basis of an EQIP contract.

Learn more about working with NRCS by visiting www.nrcs.usda.gov/getstarted.

USDA is an equal opportunity provider, employer and lender.

Solar Watering Options to Enhance Grazing Management

Matt Booher, Extension Agent, Augusta County
Alston Horn, Field Technician, Chesapeake Bay Foundation



Figure 1. Using solar to pump water from nearby river.



Figure 2. Using solar to pump water from a small spring creek.

Solar powered pumps can be used in many cases where a well and/or electricity are not available, to pump water from springs, creeks, or other water sources. Moreover, they are portable and can be moved from farm to farm. Solar powered pumps are widely available online, and their cost has decreased considerably in recent years. Plug-and-go pump and panel systems, can be purchased for under \$3,000, (not including pipe or plumbing) with enough capacity to water around 50-90 cows in most cases. More capacity can be added by adding additional panels. Many considerations must be taken into account

when selecting a solar pump and panel, including the water source and flow, and pumping distance and height. Various types of pumps exist (diaphragm, sling, brushless), which each have their pros and cons. It is best to work with potential vendors or manufacturers to figure out what is the best fit for your scenario and to properly size and match the solar panel with the pump.

For additional information, contact the Augusta County Extension Office: 540-245-5750, mrbooher@vt.edu.



Figure 3. Using solar to pump water from an old springhouse.



Figure 6. In-stream water pick-up by a solar pump.



Figure 5. Solar pumping water from an old springhead.



Figure 4. Solar pump suspended in river.

Reservoirs

Since solar systems do not function well on overcast days, and do not work at all at night, you must account for some way to store energy or water. Excess solar energy that is produced can be stored in batteries, allowing the unit to run in cloudy weather or at night. However, batteries can be expensive. Using stored water in reservoirs is probably the least expensive and more reliable way to ensure water supply when the solar panel is not producing. An intermediate bulk container (IBC), also known as a cage tank or pallet tote, can be used as a very affordable reservoir. Plumbing multiple tanks together is a simple way to multiply reservoir size quickly. Plastic polyethylene water tanks are more expensive (roughly \$0.75-\$1.00/gallon of capacity) but are still an option.

Float valve selection

Most people's first instinct in valve selection is to use the cheap, automatic float valves that abound at many farm supply stores. These may work fine in situations where water is under high pressure and/or required rates of trough recharge are very low. The flow of this type of valve, however, is restricted by the diameter of the intake hole (usually set up for use with a garden hose), and by the small internal orifice necessary for the shutoff mechanism. Consider using full flow valves, which do not restrict the flow coming from the pipe, to recharge the trough more quickly. When selecting a valve, pay attention to the minimum amount of flow required for its operation. Some designs can be used even in cases of low-pressure or gravity systems. For a good example of the full flow valve concept, search for 'jobevalves.com' or 'apexvalves.co.nz'. A standard, brass, bob float valve available at plumbing supply stores can work well too.

Fenceline growth suppression

Doug Horn, Crops and Soil Extension Agent, Rockingham County

Matt Booher, Crops and Soil Extension Agent, Augusta County

Objective

Each year we receive several calls about products to suppress grass growth under electric fences. Primarily tall fescue seedheads elongate and ground out permanent electric fence lines. Several products are labeled for seedhead suppression of tall fescue and also allow grazing. This study was designed to examine the suitability of some of these products under field use conditions. Products included in the studies must not have any significant grazing restrictions.

Methods

Treatments Used at McCormick Farm

Product	Active Ingredients	Rate
Cimarron Plus	Metsulfuron + chlorsulfuron	0.5 oz/ac
Chaparral	Aminopyralid + metsulfuron	2 oz/ac
Roundup Ultra (41%)	Glyphosate	8 oz/ac
Check	No herbicide	

Treatments Used at the Mt. Solon Site

Product	Active Ingredients	Rate	Grazing Interval
Plateau	Imazapic	2 oz/ac	Not stated
Cimarron Plus	Metsulfuron + chlorsulfuron	0.5 oz/ac	0 days
Metsulfuron	Metsulfuron	0.5 oz/ac	0 days
Chaparral	Aminopyralid + metsulfuron	2 oz/ac	0 days
Cornerstone Plus (41%)	Glyphosate	8 oz/ac	0 days
Check	No herbicide		

The treatments were applied in early April once the tall fescue had initiated spring growth (labels suggest 6 inches) but prior to jointing. Fenceline spraying was done from one side centering on the fence. The nominal width of spraying was approximately 3 feet (about 1 ½ feet on each side of the fence). Both sites were sprayed at 80 gallons per acre with a calibrated backpack sprayer. Two passes were required to apply the total application rate. The 80 gallon per acre rate approximates a spray to wet treatment. A nonionic surfactant was included in each treatment as recommended on the label except for glyphosate. Each treatment was repeated 4 times at the Mt. Solon site. At the Shenandoah Valley AREC each treatment was only applied one time. The initial treatment was applied in early April. The same products were applied to previously untreated fenceline in early May to evaluate the effect of timing and growth stage on seedhead suppression.

Observations

The plots will be observed periodically throughout the summer. Observations will evaluate grass injury, weed control, effectiveness of seedhead suppression, growth reduction (height) and longevity of effect. Long term injury or thinning should be noted. The plots will be evaluated in late summer to see if a flush of annual weeds occurs from suppressing the perennials.

Results

Data was collected for the Mt. Solon site 4 and 8 weeks after treating. Plateau displayed the greatest growth reduction and seedhead suppression. Some grass injury was noted from Plateau. The metsulfuron containing treatments provided good growth reduction and seedhead suppression. Chaparral displayed more variability than the Cimarron Plus and metsulfuron treatments. Glyphosate reduced the initial growth of the grasses with minimal injury. The height of the seedheads was slightly less with glyphosate compared to the check plot but the number of seedheads did not appear to be reduced.

The treatments had the greatest effect on tall fescue seedhead production. Bluegrass and orchardgrass seedheads may have been suppressed slightly but the stands of these grasses were not uniform across the plots. Plateau definitely suppressed bluegrass and orchardgrass seedheads. Some other non-crop perennial cool season grass seedheads (i.e. bulbous oatgrass) were not suppressed by any of the treatments. A significant population of purpletop was present. The treatments were applied prior to purpletop growth initiation and had essentially no impact on the initial vegetative growth of purpletop. Most of the herbicides used provide effective control of several broadleaf weed species. The presence of other weed species was highly variable between the plots making it difficult to evaluate the weed control differences.

Summary of Observations for the Mt. Solon Site Eight Weeks After Treatment

Treatment	Rate	Seedhead Suppression	Growth Retardation	Brownness
Plateau	2 oz/ac	9	3.5	3.75
Cimarron Plus	0.5 oz/ac	6.25	2	1.5
Metsulfuron	0.5 oz/ac	6.25	2	2
Chaparral	2.0 oz/ac	4.5	1.25	1.5
Glyphosate	8 oz/ac	2.5	1	2
Check	None	0.5	0.25	0.5

Treated: April 14, 2017 Observations: June 8, 2017

Seedhead Suppression: 0 = no suppression 10 = no seedheads

Growth Retardation: 0 = no reduction in growth 5 = no new growth

Brownness: 0 = no brown 5 = maximum brown. The brownness rating was a combination of discoloration and the visibility of the dead overwintering grass blades. High visibility of the dead grass is an indication of slow new growth.

Cimarron Plus was most effective for seedhead suppression and growth reduction at the McCormick farm demonstration. Chaparral provided some seedhead suppression but not to the

extent of Cimarron Plus. Glyphosate at the chemical mowing rate of 8 oz/acre did an acceptable job of suppressing grass growth.

Discussion

A summary of the take home points based on our observations to date is listed below.

- Plateau at 2 oz/ac provided the best seedhead suppression and growth reduction. Some initial injury was observed. The rate was too low for significant broadleaf weed control. Seedhead suppression of bluegrass and orchardgrass was observed with Plateau.
- The metsulfuron containing products (metsulfuron, Cimmaron Plus and Chaparral) provided decent seedhead suppression. Seedhead suppression was not complete but greatly reduced compared to untreated areas. Some broadleaf weed control was noted on bush honeysuckle and multiflora rose. The growth of tall fescue was noticeably reduced.
- Seedhead suppression was variable between the plots with Chaparral.
- Seedhead suppression may not be realized for other grass species. In particular, none of the treatments suppressed bulbous oatgrass.
- Glyphosate at the chemical mowing rate of 8 oz/ac is effective at reducing the topgrowth but does not reduce the number of seedheads. Some of the seedheads appeared shorter than untreated areas.
- Fenceline spraying should probably be conducted at least 2 to 3 feet on each side of the fence. The 1 ½ feet band in our studies could still allow unsuppressed seedheads to lay over onto the fence.
- All of the herbicides used only require very low rates to be effective. It is easy to over apply the products using a hand gun sprayer. Carefully calibrate the hand gun to the technique you feel most comfortable with to provide consistency. Over application could result in death of the desirable grasses.
- The inclusion of 2,4-D, triclopyr or dicamba may be desirable to clean up most broadleaf weeds while making the treatment. Tank mix compatibilities were not evaluated in our trials. Plateau cautions not to tank mix with 2,4-D.
- Our studies used the label guidelines of spraying after spring greenup with at least 6 inches of new growth but prior to the grass jointing. In 2017 these conditions occurred in early April. The results may vary with different application timings.

Notice: Because pesticide labels can change rapidly, you should read the label directions carefully before buying and using any pesticides. Regardless of the information provided here, you should always follow the latest product label when using any pesticide. If you have any doubt, please contact your local Extension Agent, VDACS regulatory inspector, or pesticide dealer for the latest information on pesticide label changes.

Virginia Cooperative Extension does not endorse these products and does not intend discrimination against other products which also may be suitable.

Semi-permanent Fencing Options to Enhance Grazing Management

Matt Booher, Extension Agent, Augusta County
Alston Horn, Field Technician, Chesapeake Bay Foundation

Posts

There are several options available for durable; self-insulating; and in some cases, flexible, posts for high-tensile fence systems. While alternative posts made of non-conductive materials may not differ in cost to steel posts, they possess several advantages over them. A non-conductive post is self-insulating and therefore does not require insulators, a cost savings and a guarantee against electrical shorts caused by broken insulators or insulators made of inferior materials that may lose current to a metal post as they age. Flexible posts allow the fence to move with impact or pressure from livestock, wildlife, and fallen tree limbs.



*Manual post driver
and pilot driver*

Any of the posts described here can be installed by making a pilot hole to the desired depth and then driving the post in with a manual post driver. Manual pilot drivers that reverse-hammer to remove the driver are recommended. With a pilot hole, posts can be installed by hand even in rocky ground. Producers desiring a more permanent installation should place posts to a depth of 18", otherwise 12" is fine. Once installed, holes are easily field-drilled in the posts at the desired height for the wires. A cotter pin placed around the wire and through the hole allows the wire to float freely while attached to the post. Wire can also be threaded directly through the holes.

The post described below can be removed with an inexpensive, handheld T-post puller available at most farm supply stores. For smooth posts without lugs it is necessary to use a small wedge of wood to help grip the post.

G2 Poly Posts by Powerflex Fence are a hollow post made of a blend of polypropylene, resin, and UV stabilizers. They are self-insulating, very fliexible with good memory as well as great strength and rigidity. Available in lengths from 4 to 6 feet and 1 1/3" or 2 3/8" in diameter, they



Powerflex 'Poly post'



Posts flex with impact & return to upright position

are comparable in price to a metal T-post of equal length. Resistance to pullout is excellent and better than a hard fiberglass post. These posts have a 20-year warranty and are available directly from Powerflex Fence (powerflexfence.com, 888-251-3934) or through one of their distributors.

Round PVC posts by Timeless Fence are similar in design to the G2 Poly post but are made of recycled PVC with a UV protective coating. They are available with or without wire holes pre-drilled, at various lengths all in a 1 1/3" diameter. These posts have a 20-year guarantee and are available directly

from Timeless Fence (plastic-innovation.com, 1-800-788-4709) or through one of their distributors.



Fiberglass sucker rod

Oil field sucker rods have been repurposed as fence posts for years. Many are made of steel, but fiberglass sucker rod posts are available and offer another non-conductive option for semi-permanent fencing. These posts are very strong and work well as a regular line posts or boss posts where more strength is needed. The type that we have tried runs 1.2" in diameter, 5-6 feet long, with pre-drilled holes for attaching wire. We have found them to be very economical. They are not treated for UV protection and sometimes splinter. These posts can also be driven by hand if a pilot hole is made. Visit the Twin Mountain Fence Company website or contact them at 1-800-527-0990

for more information on availability in your area.

Timeless fence posts are a plastic T-post manufactured by Plastic Innovation. Made of recycled materials, they contain a non-conductive, rigid PVC core and a protective UV coating. A lifetime warranty on materials and a 20- year guarantee on the white UV coating is advertised.



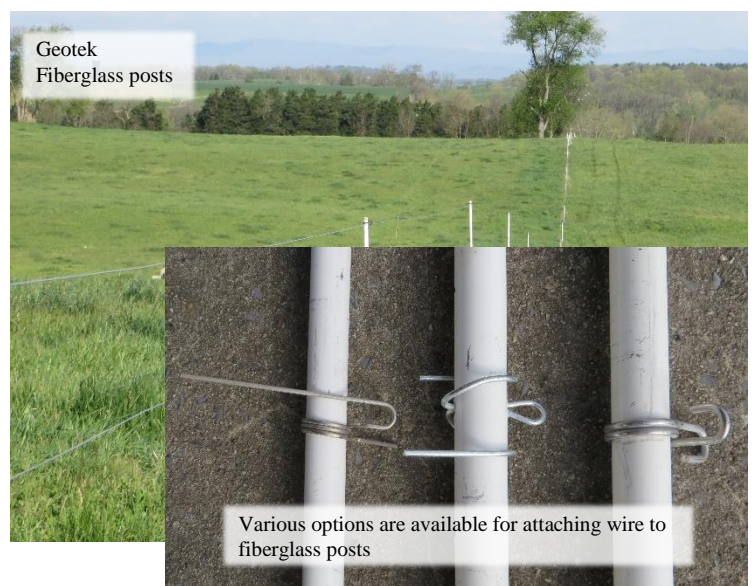
They are available in a 1.5" or 1.75" T-profile and lengths from 4-8 feet long. They are pre-drilled every 3 inches of their length and work best if you plan to run the high tensile wire, or electric poly braid directly through the holes, but can also be attached using standard T-post clips. These posts are very flexible yet strong, and so are sturdy enough for woven wire as well. They should be installed by first making a pilot hole



with a drill and wood boring auger bit or pilot driver. Timeless fence is sold through authorized sellers, a list of which can be found at their website (plastic-

innovation.com) or by calling 1-800-788-4709.

Drive-in fiberglass posts are widely available, inexpensive, and commonly used. One of the largest manufacturers of fiberglass posts is Geotek (aka: AFC, Common Sense Fence), which markets through numerous distributors. Since fiberglass tends to splinter over time, many are treated with a plastic or UV protectant coating to help minimize splintering. For example, in the case of Geotek posts you may see this coating marketed as SunGuard®. Fiberglass posts are available in many diameters and lengths that work well alone or in combination with other types. Numerous plastic and metal clips



and snaps are available for attaching high tensile wire. Posts are also available pre-drilled for use with a cotter pin to attach wire. Although these posts are strong and work well, they can be difficult to drive in rocky ground and their resistance to pullout is not great.

Pasture Pro posts are manufactured by PasturePro Fence from a wood/plastic composite. They



are self-insulating, strong, and flexible. Rigidity and memory after flexing are not as good as the Polyflex posts; sometimes posts with a lot of pressure on them become permanently bowed. Resistance to pullout is excellent and better than a hard fiberglass post. Pasture Pro posts are available in lengths from 4-7 feet and also come in several diameters and colors. They are comparable in price to metal T-post. These posts are easy to drill in the field, and can be easily installed by first making a pilot hole and then driving with a hand



held post driver. There have been claims among producers that the wood component of PasturePro posts may absorb water over time. However, we performed studies using fence built with posts that had been submerged in water for two weeks, and found

that it maintained the same charge as fence built with new, dry posts. Pasture pro posts are manufactured by - and available directly through - Kencove Farm Fence Supplies online (kencove.com) or through distributors. Also, check with local retailers in your area.

Bracing

The EZ End brace, marketed by Powerflex Fence, is a fiberglass brace that fits into a metal frame that rests entirely aboveground. It is easily and quickly installed by hand without the use of large equipment. There is an offset piece at the corner of the frame, into which one of two



types of ground anchors is attached. The first is a 24" long auger-style anchor that is drilled into the ground using a standard socket; the second is a rock-anchor, which is comprised of two 24" steel rods that are driven in the ground at opposite angles. The auger-style anchor is best suited in textured soils, while the rock anchor works best in very rocky ground. This brace installs in minutes and is extremely strong and well suited for multiple wire fence. We found it to be a good fit in terrain where rocks, tree roots, etc. would have made driving or digging posts difficult. They are available in 3-and 4-foot heights and run around \$60 each.

The Wedge-Loc brace system uses a set of aluminum sockets and wedges to build a brace out of standard metal T-posts. Various options are available for building diagonal, H, or corner braces.



These install very easily and university testing has shown they can maintain tensile loads of 1,500 lbs. per brace. They are available through

online retailers such as Kencove Farm Fence Supplies and NASCO Farm and Ranch, or through numerous dealers that can be found on the Wedge-Loc website.

Cost of alternative, semi-permanent options

Using the options covered in this guide, single or double strand high-tensile fencing averaged less than \$0.20/foot for materials. Additionally, a Continuous Conservation Initiative (CCI) government cost share program exists in some Conservation Districts of Virginia, that offers a \$1/foot reimbursement for privately built stream exclusion fence. Effective, adaptable fencing is part of the foundation of good grazing management; alternative options allow producers to put up fence in situations where it may have previously been too costly or difficult to do so:

	Manufacturer/ distributor	Website	Telephone
<i>G2 PolyPost</i>	Powerflex Fence	powerflexfence.com	888-251-3934
<i>Pasture Pro Post</i>	Kencove Fence	kencove.com	800-536-2683
<i>Plastic T-Post, plastic round</i>	Timeless Fence	plastic-innovation.com	800-788-4709
<i>sucker rod post</i>	Twin Mountain Fence	twinmountainfence.com	800-527-0990
<i>Sunguard fiberglass post</i>	Geotek	geotekinc.com	800-533-1680
<i>EZ End brace</i>	Powerflex Fence	powerflexfence.com	888-251-3934
<i>Wedge-Loc brace</i>	Wedge- Loc	wedgeloc.com	800-669-7218
<i>pilot driver & cotter pins</i>	Kencove Fence	kencove.com	800-536-2683

The resources listed are only suggested as sources, they do not necessarily imply endorsement

Update on Sericea Lespedeza Research

Ben Tracy, Department Crop and Soil Environmental Sciences, Virginia Tech

We are currently in the 2nd year of a grazing trial that involves sericea lespedeza and tall fescue mixtures. Despite its bad reputation as a weedy nuisance in rangelands, lespedeza may have a place in our tall fescue-based grasslands. The utility of sericea as a forage has been explored by agronomists over the years mostly in the south where it is sometimes referred to as ‘poor man’s alfalfa’. In fact, sericea lespedeza was the focus of a breeding program at Auburn University that produced several cultivars including a grazing tolerant variety called AU-Grazer that is commercially available today.

Sericea lespedeza is a perennial, warm-season legume. The plant is a short-statured, shrubby and highly drought tolerant. It also is widely adaptable, growing best in warm to hot climates and thriving in many different soils. In fact, lespedeza seems to do best in more marginal soils, and this may be part of the reason it can be invasive in some situations. Lespedeza also contains chemical compounds called condensed tannins, which when consumed by livestock could produce some positive effects like lower intestinal parasite loads, reduced methane production, protection against bloat, and better protein digestion. We are especially interested in how tannins in lespedeza might interact with tall fescue toxins. Some evidence suggests that the tannins could bind fescue toxins and render them less harmful to livestock. Our overall goal with this grazing trial is to see if we can create a highly stress tolerant pasture by combining tall fescue and sericea lespedeza. Ideally, such a pasture will not only produce a stable forage base to combat weather variations, but possibly generate some positive health benefits to cattle as well.



Image 1. Steers grazing a Sericea lespedeza strip planted within a tall fescue plot. Lespedeza strips accounted for 30% of the plot area. Photo taken in spring 2017.

To test this idea, we set up a grazing experiment several years ago at the Virginia Tech Shenandoah Valley AREC. In 2014, we established ~ 1 acre paddocks that contained toxic KY-31 tall fescue and non-toxic tall fescue. About 30% of the fescue was killed the following spring with Roundup and planted to lespedeza (Image 1). For comparison, we did the same using alfalfa in adjacent paddocks. We let the paddocks establish over 2015 and then starting grazing them in May 2016 using newly weaned steers. Sericea took a while to come on but was growing well by early June. Alfalfa established well and definitely was preferred by the steers. By year 2

however, alfalfa stands declined significantly due to grazing pressure. We did not know how the steers would respond to the lespedeza, but as time went on some interesting trends were noticed. For one thing, the steers clearly seem to be eating more lespedeza when it is paired with the toxic K-31 fescue. When paired with non-toxic fescue, steers barely touch lespedeza (Image 2). We can only speculate on why this is happening. One interesting hypothesis is that the steers may be ‘self-medicating’ themselves by eating lespedeza (and associated condensed tannins) to help de-toxify the harmful fescue. When grazing the non-toxic fescue, the steers maybe feel fine so avoid lespedeza. We are collecting more detailed information on grazing patterns this year (Image 2). Weight gain data suggested that steers did just as well on lespedeza as alfalfa, but the trends were not consistent. Overall, we are still a long way from making any recommendations regarding use of *Sericea lespedeza* in tall fescue pastures, but the study will continue for at least one more year. Kelsey Brennan, a new graduate student in the Department of Crop and Soil Environmental Sciences, will be doing her Master’s thesis research on this project. She is currently collecting data from the experiment and should finish late next year.



Image 2. Grazed *sericea lespedeza* in a plot with toxic fescue (left) and ungrazed *sericea* in a non-toxic fescue plot (right). June 2017.

Corn Gluten Feed as a Protein and Energy Supplement in Forage-Based Beef Production

T.B. Wilson, K.N. Hardin

Department of Animal and Poultry Sciences, Virginia Tech

Introduction

Increased demand for corn for ethanol production has driven corn grain prices higher, creating additional incentive to find substitutes for corn in beef rations. With increasing corn prices, cattle producers have increased inclusion of corn co-products in ration formulations. Traditionally, corn coproducts have been utilized primarily as energy supplements, but with increased demand and price of corn, corn co-products are now utilized as energy and protein supplements in beef rations because corn co-products such as distillers grains (DGS) and corn gluten feed (CGF) provide sources of highly digestible fiber and moderate protein content.

Previous research indicates that nutrient composition values for DGS and CGF obtained via chemical analysis are not fully representative of animal performance. The feeding value of corn co-products varies with basal diet formulation and inclusion rate of the co-product. Most research focusing on the feeding value of DGS and CGF has been conducted in feedlot settings. However, data report the energy value of DGS is higher than corn in forage-based diet.

While the feeding value of CGF has been studied extensively in feedlot rations, data quantifying the feeding value of CGF in forage-based diets are scarce. Quantifying the feeding value of CGF in forage-based rations allows for more precise ration formulation, resulting in more predictable animal performance, directly impacting producers utilizing forage-based systems.

Materials and Methods

To evaluate the feeding value of CGF in a forage-based diet 45, Angus \times Simmental steers (840 lbs., 12-14 months old) were stratified by body weight and sire and allotted into 6 groups. Treatments were randomly assigned to each group. Steers were fed treatment rations for 63 days from March 30th to June 2nd. Steers were housed in the dry lot, Calan gate facility at the Shenandoah Valley AREC. Steers were fed mixed orchardgrass hay ad libitum and received either corn or CGF supplements formulated for target gains of 1.0, 2.0, and 3.0 lbs. ADG. Corn supplements were balanced for each targeted level of ADG and feeding level was calculated as a percentage of body weight. Cattle fed CGF were then supplemented at the same percent of body weight, to compare supplements at equivalent feeding levels. Supplements were fed daily at 8 am at 0.14, 0.56, and 0.96% body weight. Individual dry matter intake (DMI) was recorded daily and feed refusals were collected and weighed every 7 days. Steers were weighed every 14 days. Supplement feeding level was updated weekly to account for changes in supplement dry matter content and every 14 days to account for changes in steer body weight.

Results and Discussion

Initial and final body weights were not different among treatments. Average daily gain increased with level of supplement, as expected. Steers fed CGF gained faster than those fed corn. Hay dry matter disappearance tended to be 0.5 lbs. greater for cattle fed CGF compared to the group fed corn. Dry matter intake increased as supplement feeding level increased. Supplement F:G was greater for corn-fed cattle, indicating supplement conversion was better for

cattle supplemented CGF. Supplement F:G was more desirable for cattle supplemented at 0.14% of body weight relative to cattle supplemented at 0.56% or 0.96% of body weight. Overall F:G ratio between corn- and CGF-fed cattle was not statistically different; however, cattle supplemented at either 0.56% or 0.96% of BW were more efficient than cattle fed 0.14% of BW.

Taken together, these findings support that supplementing hay-fed beef cattle with CGF enhances growth (higher ADG) and efficiency (lower supplement F:G) compared to a corn control. There may also be an optimum level of supplementation for cattle consuming forage-based diets, however more data are needed to make conclusions. In summary, CGF provides a readily available and economical source of both energy and protein to cattle producers in Virginia.

Take home messages:

- CGF is an economical, readily available protein and energy supplement to forage-based beef production systems in Virginia
- In a forage-based diet, cattle supplemented CGF had higher ADG than corn-fed cattle
- Cattle supplemented CGF had more desirable supplement F:G than those supplemented corn
- Cattle fed supplement at 0.56% BW had the most efficient supplement F:G
- Overall F:G was most efficient for the cattle fed supplement at 0.56 and 0.96% BW
- Cattle fed supplement at 0.14% BW were least efficient

Acknowledgements

This research is supported by the Virginia Agricultural Council. Special thanks to Mr. David Fiske, and the Shenandoah Valley AREC farm crew for making this project possible.

Table 1: Steer average daily gain (ADG), dry matter intake (DMI), and feed efficiency (F:G) for corn gluten feed (CGF) and corn supplemented rations

Item	Supplement Type		SEM	Feeding Level (% BW)			SEM	<i>P</i> -value	
	Corn	CGF		0.14	0.56	0.96		Supp	Level
BW, lbs									
Initial	838	843	18	845	838	839	22	0.85	0.97
Final	975	997	21	954	985	1019	26	0.03	0.23
ADG, lbs/d	2.14	2.41	0.09	1.70	2.31	2.82	0.12	0.03	<0.01
Feed Intake, lbs. DM									
Supplement	4.9	5.0	0.1	1.3	4.9	8.7	0.1	0.53	<0.01
Hay Disappearance	14.0	14.5	0.2	14.6	14.0	14.2	0.2	0.09	0.29
Overall	18.9	19.5	0.3	15.9	18.9	22.9	0.3	0.12	<0.01
Feed:Gain									
Supplement	2.15 ^a	1.92 ^b	0.03	.82 ^a	2.16 ^b	3.13 ^b	0.09	0.03	<0.01
Overall	9.15	8.57	<0.01	9.94 ^a	8.40 ^b	8.26 ^b	0.52	0.32	0.05

Figure 1: Average daily gain of steers supplemented corn or corn gluten feed (CGF) at various percentages of body weight.

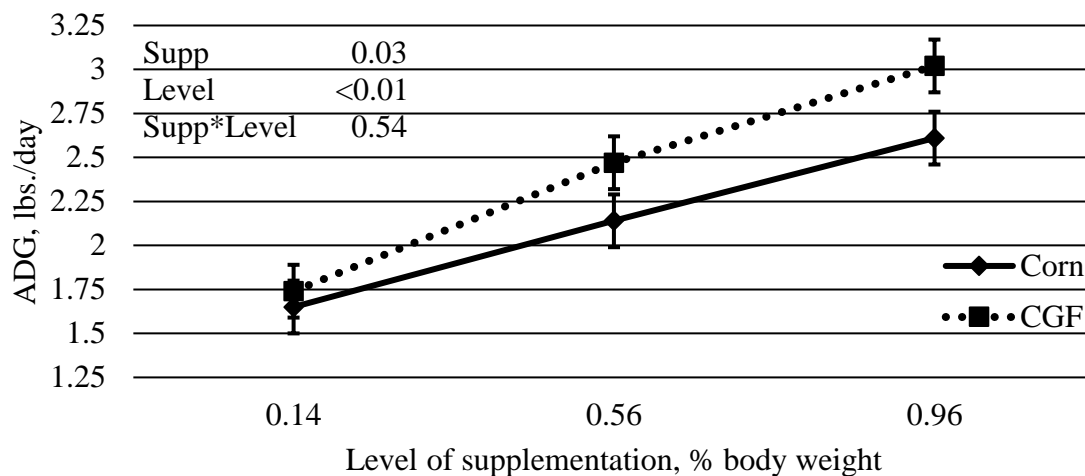
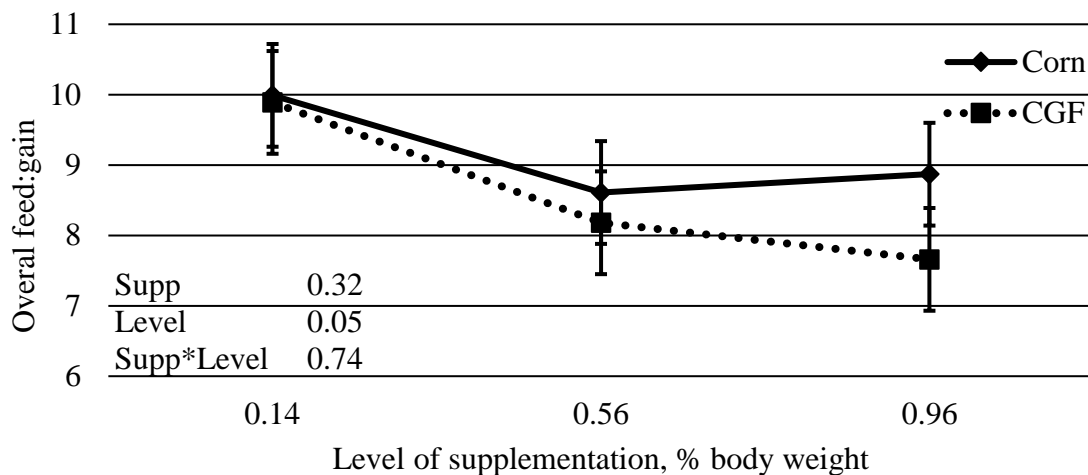


Figure 2: Overall feed:gain of steers supplemented corn or corn gluten feed (CGF) at various percentages of body weight.



Effects of Endophyte Infected Tall Fescue Consumption on Growing Cattle Performance and Prospective Mitigation Strategies

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Background

In the southeastern U.S., endophyte infected tall fescue (E^+F) accounts for approximately 33% of pastureland (Smith et al., 2009). Cattle consuming E^+F have impaired growth and reproduction compared with cattle consuming uninfected forage (Paterson et al., 1995). Consuming E^+F inhibits fiber digestion (Hannah et al., 1990; Matthews et al., 2005) which is problematic because grazing cattle use fiber as a primary energy source. Fiber is broken down by microbes in the rumen to produce energy precursors (volatile fatty acids; VFA). These VFA are absorbed across the rumen wall into the blood and are transported around the body to provide energy for vital functions like weight gain and reproduction. Impaired fiber digestibility will limit energy available for growth and may be a primary cause of the depressed growth rate and poor feed efficiency of cattle consuming E^+F .

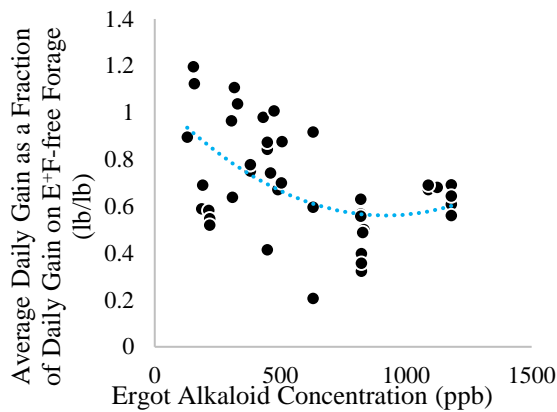


Figure 7. Preliminary data from a meta-analysis of the relationship between ergot alkaloid concentrations and average daily gain as a fraction of daily gain on a toxic ergot free forage.

VFA are acidic compounds and as they are produced they decrease rumen pH. Rumen microbes specialized at digesting fiber are particularly sensitive to pH and many do not survive at acidic (low) pH. As such, one potential cause of the poor fiber digestion observed when cattle consume E^+F is reduced rumen pH. Supplementing animals with bicarbonate to replace that which would have been recycled from the blood back into the rumen may help maintain whole-system buffering capacity, stabilize the rumen environment, facilitate uptake of VFA, and improve growth performance of cattle consuming E^+F .

In this study, we tested the idea that: 1) supplementing bicarbonate will improve growth performance and feed efficiency of heifers consuming E^+F ; 2) improving growth rates of heifers consuming E^+F will contribute to improved fertility and reproductive tract development.

Description of the Experiment

Experimental procedures were conducted using protocols approved by the Virginia Tech Institutional Animal Care and Use Committee (IACUC Protocol Number 16-086).

Experimental Design and Treatment. The experiment was conducted using a randomized complete block design with a 2x2 factorial arrangement of treatments. Fescue seed and supplementation strategy served as experimental factors. Fescue seed supplementation consisted of either E^+ seed (1,320 ppb ergot alkaloid) or E^- seed (11 ppb ergot alkaloid), fed at 1.5 kg/d. Sodium bicarbonate was used as a supplement and was fed at a rate of 0.25 kg/d or 0 kg/d. Bicarbonate supplementation rate assumed 4.5 g bicarbonate-C/kg $BW^{0.75}$ were irreversibly lost each day and 15% of that loss must be replaced in the diet. Collectively the treatment combinations

included high ergot alkaloid seed with (E⁺B) or without (E⁺) bicarbonate and low ergot alkaloid seed with (E⁻B) or without (E⁻) bicarbonate.

Animals, Diets, and Management. A cohort of 48, 8 month old heifers (589 ± 53.1 kg, 8 ± 1.2 months of age) were blocked by body weight and assigned to treatment combinations. Cattle were housed in a dry lot and fed via Calan gates at the Shenandoah Valley Agricultural Research and Extension Center (Steele's Tavern, VA), in order to record individual feed intake.

Cattle were fed once daily at 08:00 a ration comprised of corn silage and a vitamin and mineral premix with supplemental bicarbonate or fescue seed, as required by each treatment. Silage was fed ad libitum and individual daily feed offerings were adjusted based on the previous day's refused feed to target 10% refusals. Fescue seed, sodium bicarbonate and a commercial vitamin/mineral premix were top-dressed within 30 minutes of feed delivery by mixing into the top 1/3 of the silage in the feed bunk. Reported composition of the commercial vitamin/mineral premix was: 12% Ca, 4.0% P, 20% Na, 10% Mg, 0.32% S, 1.0% K, 1,000 ppm Cu, 30 ppm Co, 100 ppm Se, 5,000 ppm Zn, 1,500 ppm Mn, 451,000 IU/kg Vitamin A, 123,000 IU/kg Vitamin D, and 495 IU/kg Vitamin E.

Body Weight and Average Daily Gain. Body weight was measured at the start of the experiment and every 2 weeks thereafter to determine body weight and body weight gain throughout the experiment. Initial and final BW were collected twice on consecutive days. The BW measurements were collected consistently between 4 and 6 h post-feeding and pens of animals went through the chute in the same order. Average daily gain was calculated based on body weight gain over the entire experimental period and for each 2 week data collection interval.

Feed Intake and Feed to Gain Ratio. Individual feed intake was measured using the Calan gate feeding system. Daily feed provided was measured and cataloged by a Data Ranger and refusals were collected at 07:00 h daily and weighed. Feed intakes were averaged every 2 weeks and matched to body weight gain data to evaluate feed to gain ratio.

Reproductive Tract Evaluation. Reproductive tract scores were performed monthly via transrectal palpation and ultrasonography. Reproductive tract scores were assigned on a 3 point scale: 1, tract appears less developed than average; 2, tract appears to have average development; and 3, tract has average development and has a corpus luteum.

Results

Throughout the experiment, animals consuming E⁺ had significantly lower DMI than animals on the E⁻ diets (**Figure 8**). Because these animals consistently consumed less feed on a daily basis, it was expected that they would also have impaired growth performance.

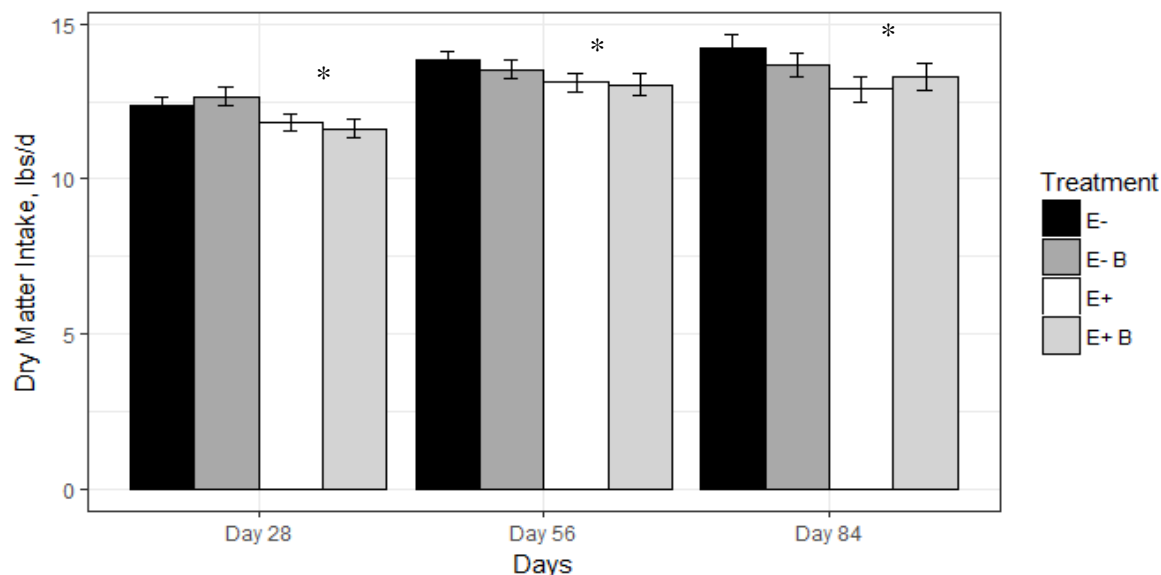


Figure 8. Dry matter intake (lbs/d) of heifers on days 28, 56, and 84 of the experimental period for the low endophyte (black), low endophyte plus bicarbonate (dark grey), high endophyte (white), and high endophyte plus bicarbonate (light grey) treatments.

Despite the lower dry matter intake, heifers consuming E^+ did not consistently have reduced body weight gain compared with the E^- heifers (Figure 9). In the early period of the experiment, the E^- treatments had improved ADG compared with the E^+ treatment and bicarbonate improved growth responses; however, the results were too variable to see statistically significant differences. By day 56, there was greater separation between E^- and E^+ and the E^+B treatment had improved growth compared with E^+ . By day 84, ADG was significantly reduced by bicarbonate but was not affected by fescue seed type.

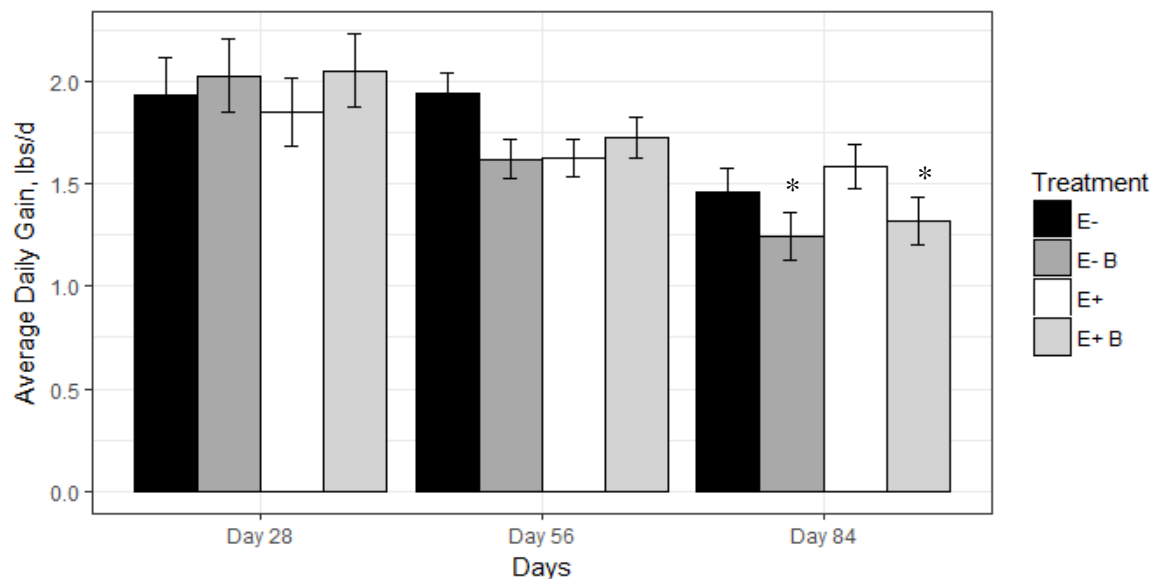


Figure 9. Average daily gain (lbs/d) of heifers on days 28, 56, and 84 of the experimental period for the low endophyte (black), low endophyte plus bicarbonate (dark grey), high endophyte (white), and high endophyte plus bicarbonate (light grey) treatments.

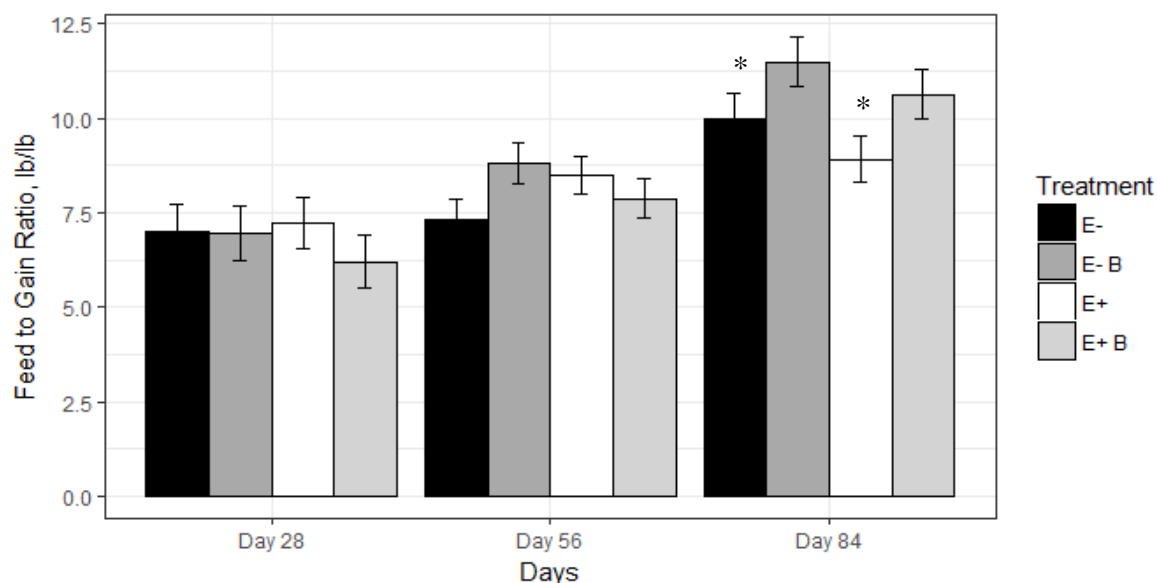


Figure 11. Feed to gain ratio (lb/lb) of heifers on days 28, 56, and 84 of the experimental period for the low endophyte (black), low endophyte plus bicarbonate (dark grey), high endophyte (white), and high endophyte plus bicarbonate (light grey) treatments.

There was no impact of fescue seed type or bicarbonate on feed to gain ratio at day 28 or 56; however, bicarbonate significantly increased feed to gain ratio by day 84 (**Figure 11**). These results suggest that there was a negative impact of bicarbonate supplementation on animal efficiency and that bicarbonate is not a good strategy for alleviating fescue toxicosis.

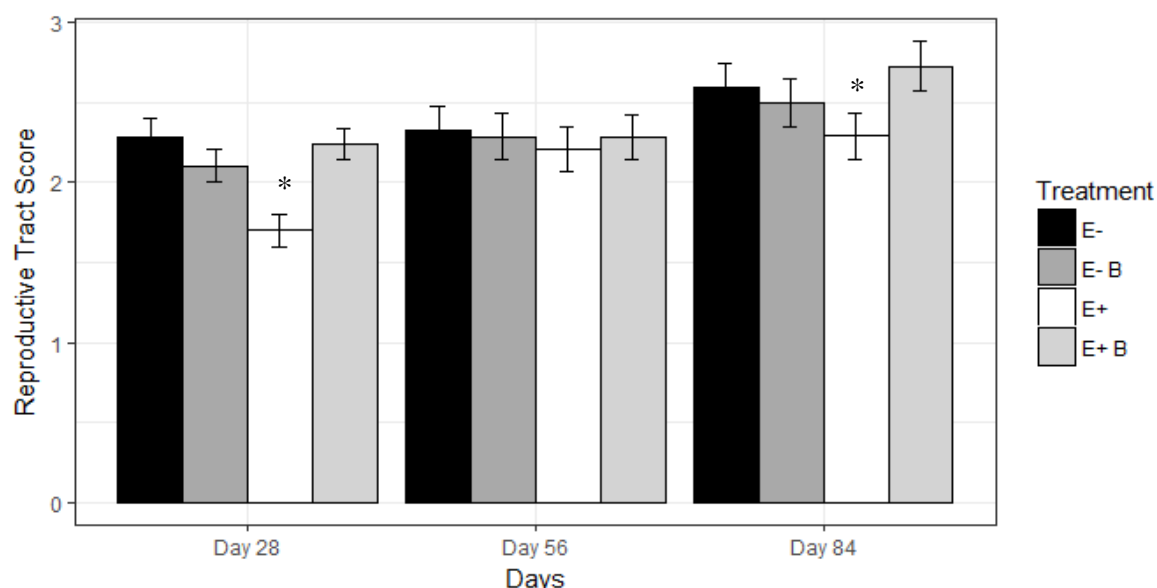


Figure 10. Reproductive tract score of heifers on days 28, 56, and 84 of the experimental period for the low endophyte (black), low endophyte plus bicarbonate (dark grey), high endophyte (white), and high endophyte plus bicarbonate (light grey) treatments.

Despite the lack of impact of fescue seed feeding on animal performance metrics, fescue seed type and bicarbonate supplementation did influence reproductive tract score (**Figure 10**). At

day 28, the un-supplemented E⁺ group had lower reproductive tract scores than the other groups. Similarly, at day 84, the E⁺ group supplemented with bicarbonate had the highest reproductive tract scores. This suggests that bicarbonate can help to improve reproductive tract development of heifers consuming endophyte infected tall fescue because the E⁺B group had significantly better performance than the group consuming E⁺ alone.

Study Limitations

This study relied on seed feeding to approximate how cows consume ergot alkaloid in pasture settings. Unfortunately, the expected differences in productivity associated with ergot alkaloid toxicity were not observed. There are several limitations of the study that may be related to this inconsistency. For example, the study was conducted over the winter and the weather did not reflect temperatures typically associated with fescue toxicosis. Additionally, the seed was not very digestible and so it is possible that the animals did not receive a large portion of the ergot alkaloid fed because of this indigestibility. Finally, the base ration was corn silage which had a fairly high starch content. Given the potential for energy coming from starch, it is possible that the fescue seed feeding did depress fiber digestibility and we did not see the corresponding production effects because the diet contained more readily available energy from starch.

Summary and Key Findings

- Feeding cattle bicarbonate did not improve performance or ameliorate the negative impacts of endophyte infected tall fescue consumption on growth and feed efficiency.
- Feeding cattle seed as an experimental model of endophyte infected tall fescue consumption does not appear to generate results consistent with performance assessments conducted on cattle consuming pasture.
- One major reason this trial may present different results than those conducted on pasture may be temperature. This trial was conducted over the winter and it is possible that the lack of fescue results was because of the lower temperature than would typically be occurring for pastured cattle over the summer period.

Acknowledgements

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Tools for Selecting Replacement Heifers

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Selecting replacement heifers is a serious business and it needs to be done right. If we fail, the future of our operation might be at risk. Our replacement heifers are the future of the herd, and we need to make sure they are the best animals in the ranch. If you are in the cattle business chances are you enjoy sitting by the fence and admiring beautiful heifers and cows graze. However, how pretty a heifer looks doesn't say much about how productive she will be. Phenotype should play a role in replacement heifer selection, but you need to look further to make sure you are selecting the best animals in your herd, the ones who every year will get pregnant, wean heavy calves, and stay in the herd for the long run. Identifying these females will require more than a good eye for pretty heifers. The only way we can excel on our selection is by combining data analysis and the technology available, so that our selection decision is not only based on looks, but also on performance records. Here are a few things to consider when selecting replacement heifers:

Management. You cannot manage what you don't measure. Keeping accurate records on your herd is extremely important. Having individual records that includes date of birth, dam and sire information, birth weight, weaning weight, body condition scores (at calving and breeding) and health records can aid and should guide your decision to keep a replacement heifer. A long term study revealed that the period in which a heifer calf is born during the calving season will affect performance throughout their lives.

A heifer calf that is born during the first 21 days of the calving season will reach puberty at an earlier age, will become pregnant early in the breeding season, will wean heavier calves, and will stay longer in the herd when compared to heifer calves born after the first 21 days of the breeding season. Keeping heifers that are born early in the calving season is a simple strategy that only requires keeping accurate birth records, but can greatly impact your operation and the longevity of your cows.

Nutrition. The traditional target weight of 65% of mature body weight at breeding for heifers has been challenged. Research has demonstrated that heifers developed to as low as 53% of mature body weight achieved similar pregnancy rates during the first breeding season when compared to heifers developed to 67% of mature body weight. The longevity in the herd of those heifers was not affected as well. Independently of which target weight you choose, keep in mind that management changes should be done slowly and not suddenly. Also, it is important to never allow your heifers to lose weight, even if the target weight has been reached. Heifers should be in an increasing plane of nutrition, especially during breeding. Allowing heifers to lose weight may affect puberty achievement and impact reproductive performance.

Another important thing to remember is the management of these heifers after their first parturition. First-calf heifers require special nutritional attention to ensure a positive nutritional plane that allows for continuous growth, lactation, and resumption of the reproductive function. Reproductive function is tightly connected to nutrition and females with a poor body condition score will have an extended period to return to cyclicity compared to females with adequate body condition score and in a positive plane of nutrition. A fast return to cyclicity will drastically improve the chances of a female to become pregnant early on in the subsequent breeding season.

Phenotype. We all like pretty cows, but you should look beyond the characteristics that define a heifer as pretty in your opinion. Consider the soundness of the physical structure of the heifers. Make sure feet and legs are strong and no conformation problems are present. Categorize heifers by frame, and use that information to maintain or make changes to the average frame size you would like in your herd. Keep in mind that large cows have greater feed requirements compared to moderate and small frame cows.

In addition, measuring pelvic area in heifers is an easy way to remove females that are too small and avoid dystocia problems later on. Pelvic area is a measurement of the birth canal and it is related to the overall size of the heifer, heifers with a smaller pelvic area are more likely to have difficulty during parturition. Pelvic measurement can be performed by a trained technician or veterinarian using a pelvimeter, a special instrument designed to measure the vertical diameter (between the symphysis pubis on the floor of the pelvis and the sacral vertebrae) and horizontal diameter (between the left and right ileal shafts). Both measurements are used to determine the pelvic area. Keep in mind that extremes are not recommended, a really large pelvic area is not necessary better and can lead to parturition problems just as well as a really small pelvic area.

Reproduction. Making sure that our replacement heifers are reproductively sound is important to guarantee that replacements will be able to get pregnant, deliver a calf, and get pregnant again as a first-calf heifer. Reproductive tract score is a procedure that determine if a heifer's reproductive system is sound and developed. The score is determined by a trained and experienced technician or veterinarian, and it ranges from 1 (immature reproductive tract, pre-pubertal heifer) to 5 (well-developed reproductive tract, pubertal heifer). The procedure is done by rectal palpation and examination of the size of uterine horns and size and structures (follicles and corpus luteum) present in the ovaries. Heifers with a reproductive tract score of 5 by the beginning of the breeding season have a greater chance to become pregnant early in the breeding season, and therefore calve early in the breeding season. This will allow more time for the heifer to recover from parturition, regain body condition, and resume cyclicity, all of the things necessary to guarantee a maximum chance to become pregnant again early into the next breeding season.

Take advantage of your veterinarian and make sure that when he comes out to your ranch to measure pelvic area and give reproductive tract scores, he is also developing a herd health protocol to ensure all vaccinations are given properly and at the ideal age to guarantee that your replacement heifers are healthy, can perform to the best of their genetic capacity, and get pregnant as early as possible.

Behavior. Another thing to consider when selecting replacement heifers is behavior and temperament. We all understand the risks of having aggressive animals in the herd. Aggressive cows will put you and your family at risk, in addition to causing damage to your facilities. But if you are still not convinced that aggressive animals need to be culled, there is scientific evidence that aggressive cattle have poor performance compared to non-aggressive cattle. A study done with replacement heifers showed that heifers exposed to a protocol of acclimation using human interaction and frequent cattle handling from weaning to the start of the breeding season, reached puberty at an early age and had greater pregnancy rate during their first breeding season, when compared to heifers that were not exposed to the acclimation protocol and had minimal human interaction.

Technology. After you have established a protocol to keep reliable individual animal records, a relationship with your veterinarian, and have a nutritional plan to develop your replacement heifers, then you should take advantage of the current available technologies to help you select the best heifers in your herd and improve their chances of getting pregnant early by sires of the highest genetic potential.

Estrus synchronization is a powerful technology that can induce puberty and maximize the number of heifers that have reached puberty by the beginning of the breeding. This can be used strategically when feed resources are scarce and heifers are not in adequate body condition. In addition, estrus synchronization allows for the use of fixed-time artificial insemination that can maximize the number of heifers that become pregnant early into the breeding season and by genetically superior sires.

Another important technology available to help you select your replacement heifers are genetic markers. There are several tests available and it can be done to answer different questions, such as parentage determination, presence of genetic disorders, and selection of specific traits. It is important to know what you want to answer before buying and performing the test, and then determine how you are going to use that information to make your selection. There are tests available that can help predict differences in calving ease, docility, milk production, average daily gain, and fertility. However, keep in mind that these tests are designed to help you select your animals, but should not be used independently of all other tools discussed earlier.

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