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Demonstrating conversion of tall fescue pastures to native warm season grasses

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Introduction

While tall fescue (*Schedonorous arundinaceus*) is the predominant forage species in Virginia pasture systems, this cool-season grass has limited productivity during the summer months. In addition, most of the tall fescue in Virginia is infected with an endophyte that produces ergot alkaloids. These alkaloids can be toxic to livestock and induce vasoconstriction in cattle, which reduces their ability to regulate their body temperature. As a result, many livestock in Virginia experience severe heat stress during the summer months, resulting in impaired productivity and welfare. These stressed livestock often seek relief from heat within sensitive woodlands, surface waters, and riparian areas; thus, toxic tall fescue is at least partially responsible for woodland degradation and water impairment. Toxic endophyte-infected tall fescue also causes reproductive issues in pregnant mares including retained placentas, dystocia, and agalactia.

Tall fescue forms a dense sod, which is unconducive to travel by ground nesting birds, such as the bobwhite quail, a target species of the Working Lands for Wildlife (WLFW) partnership. The lack of appropriate habitat has been cited as a significant factor in the rapid decline in bobwhite quail (*Colinus virginianus*) numbers across Virginia.

Unlike cool-season grasses, which grow predominately in the spring and fall, warm-season grasses are most productive during summer months and have the potential to fill a large forage production gap in the southeastern US, known as the "summer slump." Native warm season grasses (NWSG) are well-adapted to this region's climate and soils, maintaining high productivity even in the summer months and with minimal inputs, in part because their roots can exploit water resources at greater depths than cool-season grasses. Their deep rooting potential also has value for carbon sequestration.

Figure 1. Cattle grazing a productive pasture of native warm season grasses during the middle of summer.

In addition to offering these production benefits and ecosystem services, NWSG have an important role to play in wildlife conservation. The robust, upright form and open space between plants in a NWSG stand provides the type of habitat required for foraging and nesting by bobwhite quail and other ground nesting birds. These grasses shelter small mammals and birds from predators, even after heavy snow events when left standing overwinter.

Native warm season grasses can provide food for livestock and wildlife alike. Under proper management, NWSG provide highly nutritious forage and can persist in pastures indefinitely. Unfortunately, their adoption has been minimal.

Lack of familiarity, historic challenges with establishment, and misperceptions and uncertainty surrounding nutritional quality and stand management largely account for farmer reluctance to adopt NWSG in Virginia. The purpose of this publication is report on a successful conversion to NWSG, as well as the utilization of these grasses for several years following establishment.

Conversion: Site selection, preparation, and establishment

A grazing system at Virginia Tech's Southern Piedmont Agricultural Research and Extension Center (SPAREC) in Blackstone, Virginia provides forage resources for various stocker cattle grazing research and demonstration projects. While the tall fescue present in this grazing system is entirely novel endophyte, the principles and process when converting a toxic endophyte-infected tall fescue field to NWSG would not differ from the practices utilized in this project.

A 16-acre field was identified at SPAREC for conversion. This field had some weed issues that needed to be controlled, and the land slope and soil type were conducive to renovation.

The key to successful conversion of cool-season grass pastures to NWSG is multiple application of herbicides for effective sod and weed control. These applications should be timed across multiple seasons to ensure that all categories and types of weeds are effectively controlled.

This project started in October of 2018 with an application of glyphosate (2 qt/ac plus surfactant). Cereal rye (*Secale cereale*) was seeded (1.5 bushel/ac) in late November as a cover and potential forage crop. This rye was eventually grazed by a small herd of cattle from May 9-20, 2019. No fertilizer or lime were applied throughout the duration of this conversion process (with the exception of a small amount of lime used as a seed carrier during seeding the native grasses).

Following grazing, the field was left fallow through the summer of 2019. The original plan was to seed the NWSG at this point, but due to unforeseen circumstances, this seeding was delayed. However, this delay helped provide for additional weed control. The fallow ground was maintained with a rotary mower through the summer (July), and some woody broadleaf weed species were spot-sprayed with a mixture of Remedy (1 qt/ac) and Cimarron (0.01 oz/ac). The field was sprayed with glyphosate (2 qt/ac) in mid-July.

In mid-August, 2019, the field was sprayed again with glyphosate (2 qt/ac) and Remedy (1 qt/ac). Barley (*Hordeum vulgare*, 60 lb/ac) was seeded into the field on October 15 as a cover crop. The barley was terminated with glyphosate (0.5 qt/ac) on February 24, 2020, with the NWSG seed mixture planted on March 17, 2020.

Figure 2. Checking seed flow and planting depth while cross-planting the NWSG mixture in March 2020 in Blackstone, VA.

This mixture included 5 lb/ac of 'Niagara' big bluestem (*Andropogon gerardii*), 3 lb/ac of 'Georgia ecotype' indiangrass (*Sorghastrum nutans*), and 2 lb/ac of 'Camper' little bluestem (*Schizachyrium scoparium*). All seed rates were corrected for pure live seed (PLS), and all of the seed was donated for this project by Ernst Conservation Seeds (Meadville, PA). Pelletized lime was utilized as a carrier for this fluffy seed, and the seed was planted with a Truax

drill using the native grass seed box equipped with agitators to keep the seed flowing. The seed was planted at a targeted ¼" depth. The drill was calibrated to plant at half of the desired seeding rate, and the seed was cross planted by running the drill across the field twice.

Ten days following planting, Plateau herbicide (4 oz/ac) was sprayed over the field to control summer annual grassy weeds. The three NWSG species planted into the field are tolerant of this particular herbicide, but other native grasses, including switchgrass (*Panicum virgatum*) and Eastern gamagrass (*Tripsacum dactyloides*) are not tolerant of the active ingredient in this herbicide, imazapic. This herbicide provides effective pre-germination control of many summer annual grassy weeds, which are a substantial threat to the successful establishment of NWSG, for a couple months following application, depending on the weather.

Figure 3. Native warm season grass seedlings germinating in May 2020.

While the weedy grasses were effectively controlled by the Plateau herbicide application, a substantial amount of marestail (*Erigeron canadensis*) germinated and eventually outgrew the young NWSG seedlings.

Figure 4. Native warm season grass seedlings were evident in early summer of the establishment year, but there was also substantial broadleaf weed germination and cover.

Once these young grass seedlings had grown to the point of tillering in early July, an herbicide application of Duracor (12 oz/ac) and Cimmaron Plus (0.125 oz/ac) was sprayed on the field. This largely eliminated the broadleaf weed competition within a few weeks.

Figure 5. The native warm season grass stand by the end of the establishment growing season in August 2020.

The NWSG field was then left to senesce and enter dormancy naturally. The field was mowed with a rotary mower in January to remove the tall, standing dead herbage. The field was also divided into four, equally-sized paddocks for rotational stocking management. A nearby 16-acre field was also similarly fenced into four paddocks for a grazing systems comparison.

Grazing demonstration

The purpose of this project was to demonstrate and compare cattle performance on NWSG pastures to cattle performance on novel endophyte tall fescue pastures. While this demonstration project is not considered a replicated study with broad applicability, we believe that this case study provides farmers with some performance goals that they might expect out of fields converted to NWSG.

Figure 6. Cattle grazing the native warm season grass mixture during the first rotation in 2021 in Blackstone, VA.

Stocking management and methods

In the first stocking year (2021), 32 weaned steers from the Shenandoah Valley Agricultural Research and Extension Center (SVAREC) were used for an analysis of animal performance (average daily gains) on NWSG compared to animal performance on novel endophyte tall fescue.

Steers were weighed twice over a two-day period at the beginning and the end of the project to account for daily variations in body weight. The difference in starting and ending weight was divided by the total time on a given pasture to determine average daily gains for each treatment. Forage samples were collected for an analysis of forage availability and post-graze residual before and after every rotation to a new paddock. Forage from ten 1-ft^2 quadrats was harvested at random locations throughout the paddock during each sampling event. The NWSG were harvested to a height of 10”, and the tall fescue was harvested to a height of 4”. In addition to dry weight, the samples were analyzed for crude protein (CP), neutral detergent fiber (NDF), and acid detergent fiber (ADF) using near infrared spectroscopy (NIRS).

Table 1. Grazing initiation and rotation dates during the 2021 and 2022 growing season.

	2021	2022	2023
Initiation	June 11	May 11	May 9
Rotation 1	July 8	June 9	June 16
Rotation 2	Aug. 6	July 7	July 20
Rotation 3	Sept. 2	July 29	Sept 6

In 2021, the steers on each type of forage were rotated to a fresh paddock on or around every seven days. The steers were stocked on the pasture on June 11, and each paddock in the grazing systems was grazed three times through the summer. Due to a high forage availability, 20 steers were stocked on the NWSG at the start of the grazing season, while 12 steers were stocked on the tall fescue pastures. However, the stocking on the NWSG was reduced to 12 steers on July 8. Due to the late start to grazing that season, much of the NWSG was mature and was subsequently trampled by the steers, resulting in slower regrowth after the first rotation.

In 2022, steers were sourced from the same farm and the pastures were managed similarly to year one. The project also began about one month earlier in year two. Sixteen steers were stocked on each pasture on May 11. The steers were stocked on each paddock three times for about seven days per paddock. However, due to a drought, the steers were pulled from these treatment pastures one week early, at which point the study was concluded for the year.

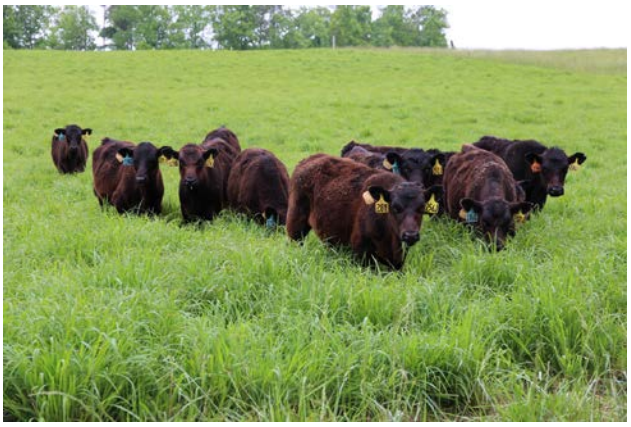

Figure 7. Steers grazing native warm season grasses in May 2022.

While the stocking methods employed in the first two years allowed for a reasonable comparison of average daily gains across two types of pastures, the true carrying capacity or animal grazing days produced on an area basis could not be determined with this arrangement. Thus, in the third year of the project, 32 steers were managed in a single herd, all of the four-acre paddocks were split in half, and the larger herd was stocked on these paddocks for 3-4 days or until an insufficient forage threshold was reached. Steers were removed from NWSG pastures between July 3 and July 20, 2023 to allow for adequate pasture regrowth.

Figure 8. Steers grazing novel tall fescue in May 2022.

Figure 9. Steers on novel tall fescue in August 2022 during drought conditions in Blackstone, Virginia.

Forage and steer productivity

Steer grazing days in 2021 were higher for the first rotation due to the greater stocking rate. However, even with the greater stocking rate, the forage was underutilized and the steers trampled a substantial portion of the NWSG.

Figure 10. Delayed grazing resulted in trampling and underutilization of native warm season grasses in 2021.

Forage yield was also greater for the NWSG than the tall fescue early in 2022, but in both years, the NWSG had slowed substantially in growth by the end of the season, with similar forage yield to the tall fescue. The tall fescue had more protein and lower fiber than the NWSG, but this did not translate to a difference in animal performance.

Table 2. Average forage dry matter (DM) yield (lb DM/acre) of native warm season grass and novel tall fescue during each rotation of the 2021-2023 grazing seasons in Blackstone, VA.

Forage Type	Rotation 1	Rotation 2	Rotation 3
2021			
NWSG	4,233	1,697	1,036
Novel Tall Fescue	1,283	1,142	945
2022			
NWSG	2,224	2,654	560
Novel Tall Fescue	1,120	1,098	514
2023			
NWSG	2,935	2,066	2,682

Table 3. Average crude protein content (%) of native warm season grass and novel tall fescue during each rotation of the 2021-2023 grazing seasons in Blackstone, VA.

Forage Type	Rotation 1	Rotation 2	Rotation 3
2021			
NWSG	9.3	12.3	14.0
Novel Tall Fescue	12.2	14.7	14.7
2022			
NWSG	13.0	11.1	10.3
Novel Tall Fescue	12.5	11.6	10.6
2023			
NWSG	14.3	12.8	11.3

Table 4. Average neutral detergent fiber content (%) of native warm season grass and novel tall fescue during each rotation of the 2021-2023 grazing seasons in Blackstone, VA.

Forage Type	Rotation 1	Rotation 2	Rotation 3
2021			
NWSG	66.9	64.4	60.5
Novel Tall Fescue	59.3	56.2	55.4
2022			
NWSG	60.5	63.0	63.7
Novel Tall Fescue	61.6	65.1	67.0
2023			
NWSG	58.2	64.2	65.2

Table 5. Average acid detergent fiber content (%) of native warm season grass and novel tall fescue during each rotation of the 2021-2023 grazing seasons in Blackstone, VA.

Forage Type	Rotation 1	Rotation 2	Rotation 3
2021			
NWSG	36.2	33.2	29.6
Novel Tall Fescue	31.0	29.4	28.8
2022			
NWSG	36.1	38.7	38.7
Novel Tall Fescue	34.6	37.0	38.0
2023			
NWSG	36.2	38.1	39.3

In both years, steer performance was very good compared to what might be expected when stocked on a toxic endophyte-infected tall fescue pasture during the summer. There was little difference in steer average daily gains in both years on both types of pastures. When converted to gain per acre, the NWSG pastures produced more liveweight gains over the summer season than the tall fescue pastures. (Note that these data are observational only and do not indicate statistically evaluated comparisons.)

Table 6. Average daily gain (lb/day) of steers grazing native warm season grass or novel tall fescue during each rotation of the 2021-2023 grazing seasons in Blackstone, VA.

Forage Type	Rotation 1	Rotation 2	Rotation 3
2021			
NWSG	0.91	1.43	1.68
Novel Tall Fescue	1.23	1.45	1.64
2022			
NWSG	3.50	1.31	1.36
Novel Tall Fescue	3.28	0.65	1.44
2023			
NWSG	2.42	1.09	1.27

Due to the varied stocking rate, the best comparison of animal performance would be adjusted to a measure of yield per unit area. In 2021, the NWSG pastures yielded 93 lb of cattle weight gain per acre, while the novel tall fescue pastures yielded 83 lb of weight gain per acre. In 2022, the NWSG pastures yielded 154 lb of weight gain per acre, while the novel tall fescue pastures 132 lb weight gain per acre. When the NWSG pastures were stocked more densely in 2023, the gains per acre increased substantially to 320 lb of cattle weight gain per acre for the season.

Conclusions

When converting a field of cool-season grasses to NWSG, proper planning and preparation is key to establishment success. Multiple sprays and clean seedbed preparation will help minimize weed competition in the establishment year. The strategic and repeated use of herbicides will also help minimize competition.

Once established, these NWSG can be very productive. For improved utilization and grazing efficiency, it is important to start grazing these

grasses before they become overly mature in the spring and to maintain heavy, but flexible stocking densities depending on the weather and forage growth.

While the establishment period of converting pastures to NWSG is relatively long compared to establishing annual forages, once established these grasses are very productive and can result in an excellent summer grazing resource for farmers in Virginia. As this demonstration indicated, growing cattle on NWSG can have similar average daily gains to cattle on novel endophyte tall fescue, while the potential for higher stocking rates during the summer months on NWSG can result in greater levels of animal gain per unit of area compared to cool season forage-based pastures.

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