Animal Performance and Soil Health of the Production System

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Rationale

Kentucky 31 tall fescue (TF) is the most widely cultivated forage in the U.S. totaling over 35 million planted acres. After rapid adoption, farmers noticed poor growth performance, reproductive issues and overall poor body condition of animals grazing this forage. The reason for these symptoms were ergot alkaloids produced by a fungal endophyte within the fescue plant. The best option for improving plant and animal performance is achieved by planting a novel endophyte TF variety (NE). A renovation strategy that best manages for profitability, animal performance and forage value without compromising soil health is needed to effectively transition away from toxic TF in the southeast U.S

Treatments

Three renovation strategies will be evaluated for impact on soil health, forage value, profitability, and animal performance. Strategies include: 1) control (C) , 2) renovation to NE after a single season of a simple mixture grass cover crop (1-SM), 3) renovation to NE after three seasons of a simple mixture grass cover crop (3-SM), 4) renovation to NE after three seasons of a complex mixture cover crop (3-CM).

Methods

Renovation and maintenance costs will be quantified to provide economic analysis of each strategy. Soil from each strategy will be analyzed for macronutrients, bulk density, soil organic carbon and nitrogen prior to renovation and following NE establishment to determine impact on soil health from each strategy. This study examines several aspects from the whole beef cattle production system and each piece will be crucial when providing educational assistance to producers.

Objective

Determine effectiveness of three renovation strategies for toxic infected tall fescue by measuring:

- **Profitability during the transition period**
- **Growth performance of cattle grazing cover crop**
- **Soil health**
- **Presence of wild-type endophyte-infected tall fescue**

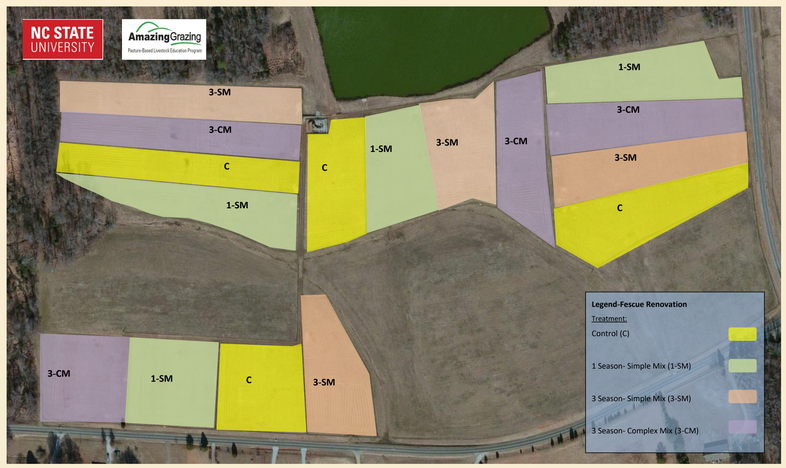

Figure 1. Renovation treatment for individual paddocks

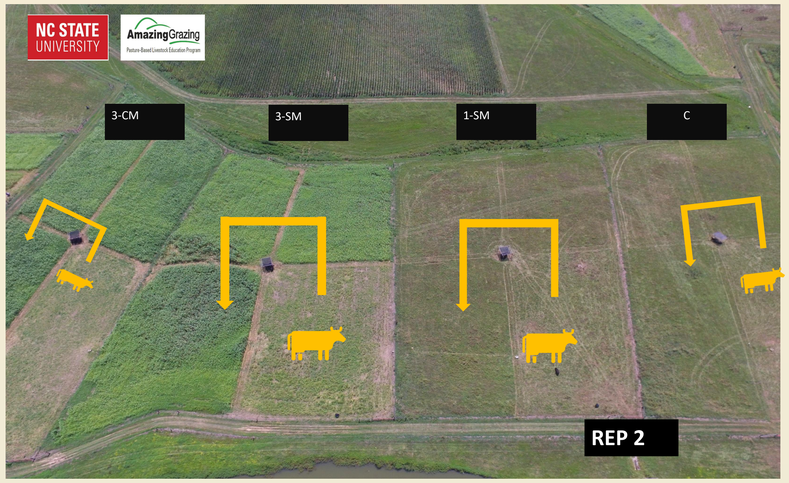

Figure 2.Illustration showing 7-day grazing rotation of Rep 2.

Figure 3A. Collection of soil to establish baseline soil health measurements

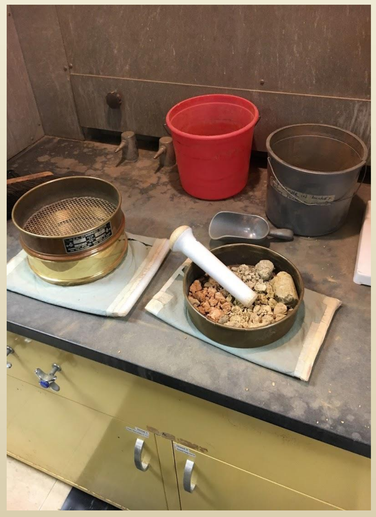

Figure 3B. All samples were ground to pass through 4mm screen prior to analysis.

Baseline Soil Data

	Depth		
	0-10 cm	**10-20 cm**	**20-30 cm**
Bulk density (g/cm3)	1.11 ± 0.08	1.42 ± 0.07	1.42 ± 0.12
pH	5.8 ± 0.2	6.2 ± 0.4	6.4 ± 0.5
Cation Exchange Capacity (meq/100cc)	10.8 ±1.3	9.2 ± 1.6	10.2 ±1.8
Mineralizable C (mg/kg/3 d)	462 ± 88	102 ± 20	53 ± 7
Mineralizable C (mg/kg/ 24 d)	1246 ± 224	268 ± 57	141 ± 21
Basal soil respiration (mg CO2-C/kg soil/day)	89 ± 16	19 ± 4	10 ± 2

Experimental Calendar

On **8 March 2017**, soil samples were collected from all paddocks to develop baseline soil health measurements (Fig 3A,3B).

- On **8 May 2017**, all paddocks were cut and baled for dry roll hay.
- On **31 May 2017**, treatment 3 and 4 paddocks were sprayed with glyphosate at 2.0 Qt/A.
- On **9 June 2017**, 18 (kg) N/ha applied via liquid N to treatment 3.
- On **10 June 2017**, the first season of cover crops for treatment 3 and 4 were planted using a no-till drill.
- On **1 August 2017**, 32 steers were randomly assigned to one of the four treatments.
- 2nd season of cover crop to be planted in **October 2017**.
- 3rd season of cover crop to be planted in **May 2018**.
- Novel-endophyte tall fescue to be planted **October 2018.**
- Soil samples to be taken in **March 2019** to assess soil health.
- Collect tall fescue seedheads in **May 2019** to obtain endophyte data.
- Economics of conversion calculated for each treatment.

Expectations

- ADG, grazing days and carrying capacity are expected be higher for the cover crop treatments in comparison to tall fescue.
- Production is expected to be higher for cover crop treatments in comparison to tall fescue
- Presence of wild-type endophyte-infected tall fescue is expected to be higher in 1-SM in comparison to 3-SM and 3-CM.
- Recouping costs of transitioning to novel-type endophyte-infected tall fescue is expected to be greater for 3-SM and 3-CM in comparison to 1-SM.
- No-till renovation with cover crops is expected to uphold or increase Mineralizable C at 0-10 cm in treatments 3-SM and 3-CM.

Selected References

- Langdale, G. W., Moldenhauer, W. C. 1995. Crop residue management to reduce erosion and improve soil quality: southeast. U.S. Department of Agriculture, National Agricultural Library. Vol. 39.

Acknowledgements: This research made possible by **NC Agricultural Foundation, Inc.** **NC Cattlemen's Association** **Center for Environmental Farming Systems**.