Using tall fescue symbiotic diversity to improve pasture resilience and sustainability

Alayna A. JACOBS[1], Jim A. NELSON[1], A. Elizabeth CARLISLE[1], Mahtaab BAGHERZADEH[1], Huihua JI[2], Victoria STANTON[3] and Rebecca L. McCULLEY[1]*

[1]*Department of Plant & Soil Sciences, University of Kentucky, Lexington, KY, USA*

[2]*Kentucky Tobacco Research & Development, University of Kentucky, Lexington, KY, USA*

[3]*Department of Statistics, University of Kentucky, Lexington, KY, USA*

*Corresponding author: Rebecca.mcculley@uky.edu

Tall fescue-dominated pastures cover 14 million ha in the eastern US and support 8.5 million beef cattle, making continued productivity and sustainability a high priority. Most tall fescue stands are infected with the symbiotic fungal endophyte *Epichloë coenophiala*, which improves grass growth and productivity in hot weather and under heavy grazing. Compounds produced by the most common tall fescue cultivar and strain of the fungus ('KY 31' common toxic strain) are harmful to grazing animals and lead to economic losses. Alternative fungal strains that do not produce alkaloid compounds toxic to grazing animals were selected and inoculated into grass cultivars to create novel endophyte-grass associations and these have been commercially available to producers for over two decades. Though novel individual tall fescue-endophyte symbioses have been evaluated for forage production and stand longevity, there is little information about the performance of mixed stands that contain multiple tall fescue cultivar endophyte symbiotic combinations. It was hypothesised that increasing fescue symbiotic diversity in stands would increase pasture resilience and sustainability by promoting fescue dominance and productivity and increasing soil carbon pools. Using custom seed mixes, six levels of increasing symbiotic diversity were established with plant and soil parameters compared after five years. Consistent with the hypothesis, more symbiotically diverse stands produced more fescue biomass (+12%) in the fall and limited the invasion of other weedy grass species, while also increasing soil carbon and nutrient pools. The most symbiotically diverse stand emitted more soil carbon dioxide than the least-diverse stand, perhaps due to greater root growth. These results show that increasing symbiotic diversity represents a new, readily adoptable, and effective strategy for increasing soil fertility and tall fescue productivity.

ISSN 2463-2872 (Print) ISSN 2463-2880 (Online) https://doi.org/10.33584/rps.18.2025.3828