Root biomass and decomposition of summer annual forage mixtures under grazing management

Department of ANIMAL AND VETERINARY SCIENCES

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Introduction

Warm-season annual forages support forage production, organic matter accumulation and soil health. The incorporating of legumes into mixtures helps to reduce inorganic nitrogen (N) fertilizer input while improving diet quality and soil fertility. Although root systems play an essential role in nutrient cycling due to the amount of biomass and exudates accumulated and allocated belowground, they have not bee studied extensively. The goal of this study was to determine root biomass and decomposition of warm-season annual forage mixtures under grazing management.

Materials and Methods

- Location: Edisto REC, Blackville, SC
- Forage treatments:
  - ❖ Grass: pearl millet (PM) + crabgrass (C)
  - ❖ Mixture 1: PM + sunnhemp (SH) + soybean (S) + cowpea + radish
  - ❖ Mixture 2: PM + C + SH + S
- Experimental design: Randomized complete block design with three replicates.
- Mixtures were planted in April 2023 and managed under rotational grazing from July through September 2023.
- Root biomass samples were collected to 8 in depth in mid-July (Fig. 1). The sampling area was 8 x 8 in and 4 to 6 sampling sites were randomly selected in each paddock. Samples were washed, dried, and weighed.
- Samples were incubated in 4 x 8 in ANKOM in-situ bags with 10 g of sample each. Incubation periods used were 0-, 3-, 7-, 14-, 28-, and 56-days starting July 26, 2023.
- The samples were dried until constant weight, grounded to pass a 0.04-in screen, and then analyzed for lignin and acid detergent fiber (ADF) concentrations.

Figure 1. Root sampling and washing process on pastures.

Results

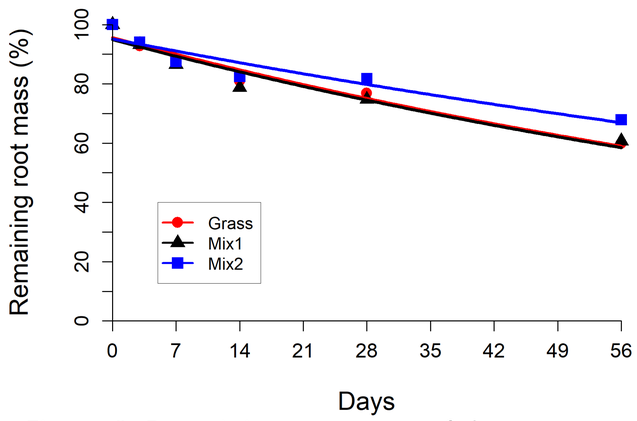

Figure 2. Remaining root mass of three summer annual mixtures.

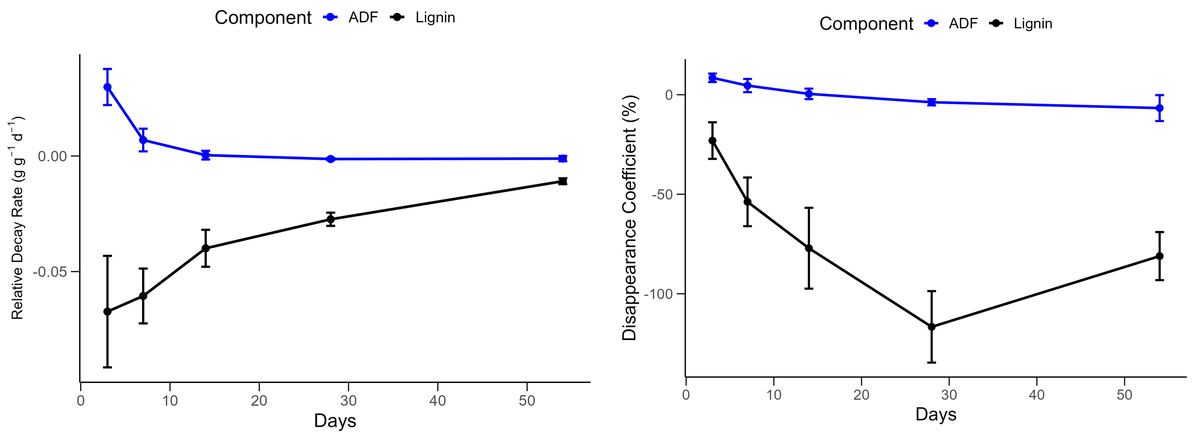

Figure 3. Relative decay and disappearance coefficient for lignin and ADF.

- There were no significant differences among treatments for root biomass (P=0.61), remaining root mass (P=0.18), remaining lignin (P=0.54) and remaining ADF (P=0.44) on root samples.
- The root biomass averaged 16,450, 16,065 and 13,787 lb./ac for Mix2, Mix1 and Grass treatments, respectively.
- Lignin concentration and remaining root mass (Fig. 2) was affected by the incubation period (P<0.01). Lignin's relative decay rate increased over time (Fig. 3), while the increase in the lignin disappearance after day 28 is most likely due to the re-polymerization of lignin.
- There was an incubation period x treatment interaction for ADF concentration (P<0.01; Fig. 3). The rapid initial ADF decay indicated that more labile carbohydrates were degraded quickly, but after 7 days, more recalcitrant fractions persisted.

Conclusions

Further analyses are necessary to better understand root decomposition, while our preliminary results show that these annual forage mixtures can potentially contribute to soil organic matter incorporation.