Seedling Performance Associated with Live or Herbicide Treated Tall Fescue

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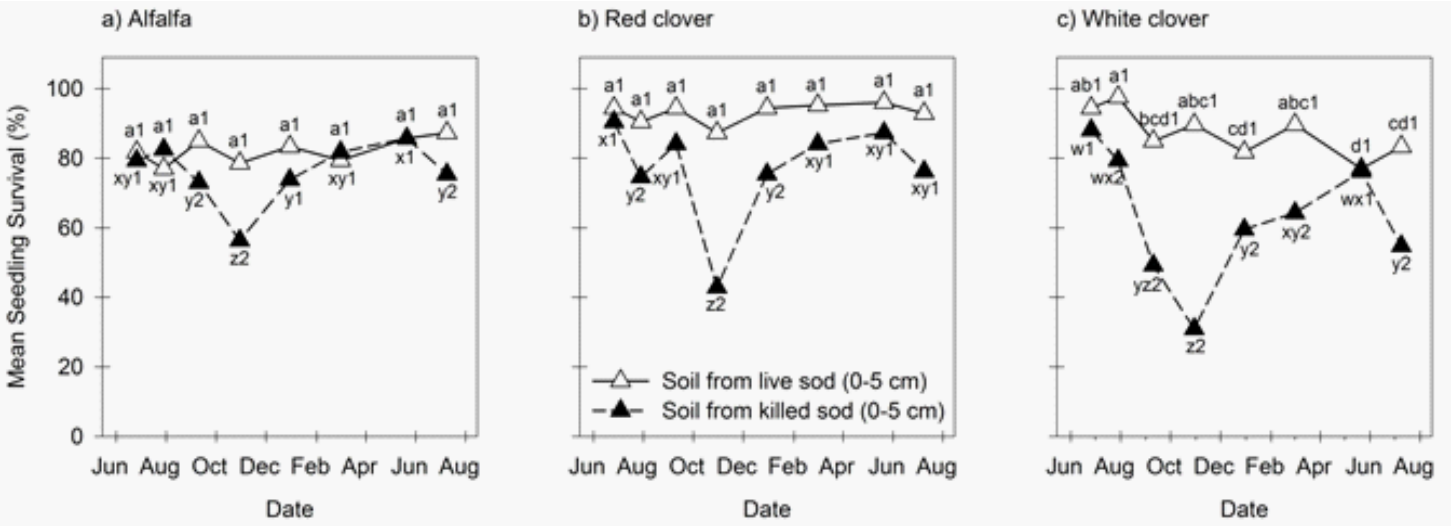
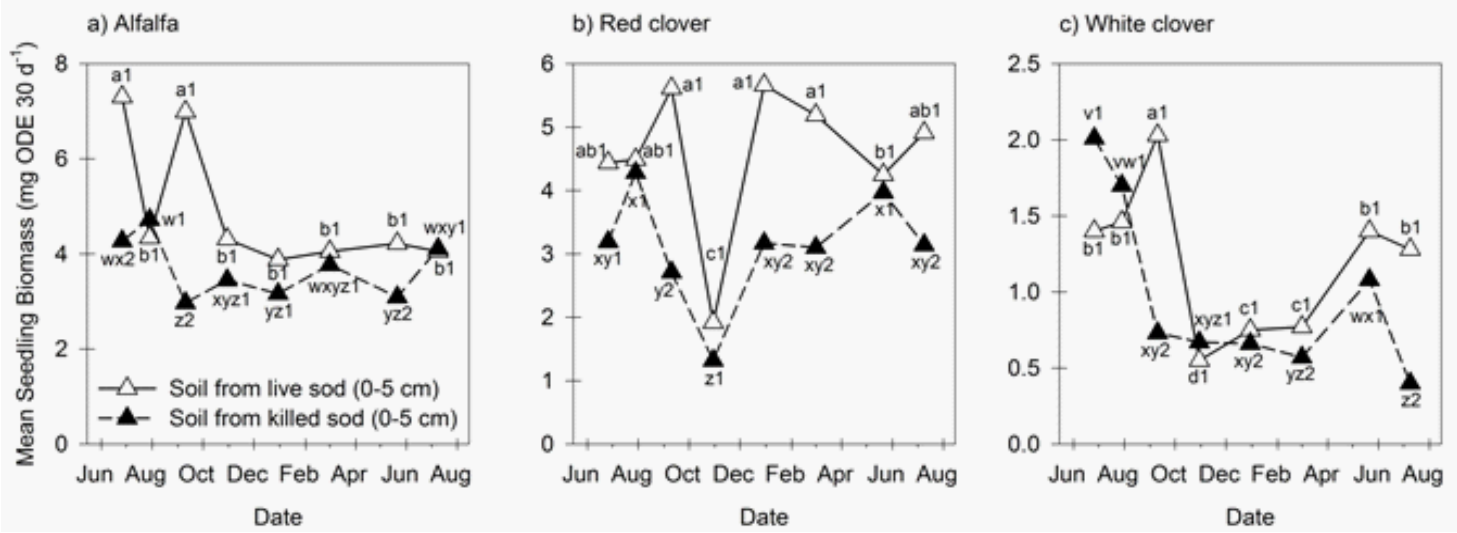
Tall fescue is an important forage grass which can host systemic fungal endophytes. The association of host grass and endophyte is known to influence herbivore behavior and host plant competition for resources. Establishing legumes into existing tall fescue sods is a desirable means to acquire nitrogen and enhance the nutritive value of forage for livestock production. Competition from existing tall fescue typically must be controlled to ensure interseeding success. Renovating existing stands of endophyte-infected tall fescue often includes chemical elimination of the preexisting stand, sowing an annual crop, and then either respraying or sowing the desired replacement crop. Planting into a newly killed sod may present a challenge because of the effects of decomposing crop residues or carry-over herbicide effects especially where crop residues remain on the soil surface. Presumed allelopathic (toxic) influences of host-endophyte associations could affect the success of renovating existing stands of endophyte-infected grasses or retard the success of attempts to interseed legumes into endophyte-infected stands as a means to ameliorate toxicity. It could be that, upon the death of fescue-endophyte associations, the substances produced by the association are released into the soil and subsequently affect germination and plant-microbe interactions, whereas if the integrity of the plant is not compromised in a living sward, the soluble constituents are retained in the existing structural components or leached out slowly.

The objective of our work was to compare the germination and early seedling development of three pasture legumes (alfalfa, red clover, and white clover) planted in soil collected from a live (L) or herbicide killed (K) tall fescue sward. We hypothesized that establishing legumes in endophyte-infected fescue sods would improve with time after the sward was treated with herbicide. We also compared germination and early seedling development of tall fescue infected with either a naturalized endophyte (E+) or a nontoxic endophyte (MaxQ), or devoid of endophyte (E-), in soil collected from live or glyphosate-killed tall fescue swards. Our premise was that endophyte infection would benefit tall fescue seedling establishment.

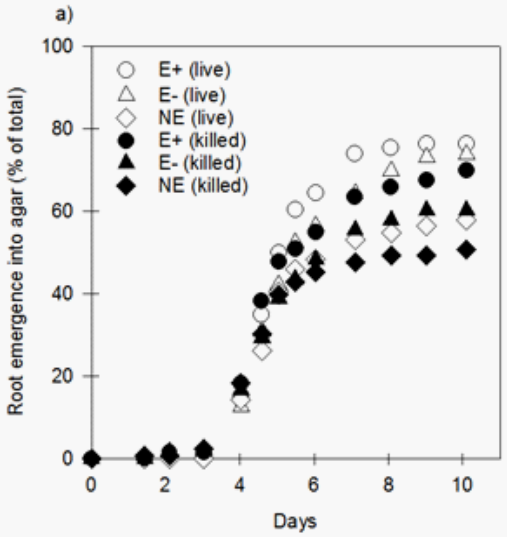
After 30 days, seedlings were larger and present in greater numbers when grown in L soil rather than K soil. Root growth of legumes (especially white clover) and tall fescue (especially MaxQ) were not as vigorous in K soil as L soil. While shoot biomass was similar for all cultivars of tall fescue in L soil, MaxQ produced less herbage when grown in K soil. Our data suggest establishing legumes or fescue cultivars may not be improved by first killing the existing fescue sod and seedling performance can exhibit significant interseasonal variation, related only to soil conditions.

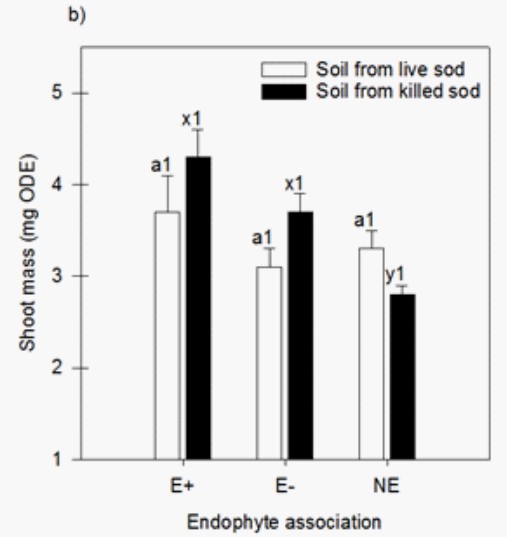


Final seedling survival (n = 7). Significant differences among sample dates are denoted by lower case letters while differences between soil from a living intact tall fescue sward (L) and soil from a glyphosate-killed tall fescue sward (K) are denoted with numbers.



Average seedling biomass normalized to a 30 day value (n = 7). Significant differences among sample dates are denoted as above.





Results from microcosm soil tests suggest efforts to improve tall fescue pastures by introducing legumes or fescue cultivars with novel fungal associations are not favored by first killing the existing fescue sod. Instead, seedling performance may be inhibited by conditions associated with soil from killed tall fescue such as herbicide residue, plant decomposition products, or presence of disease organisms and insects, although these aspects were not quantified at this time.

The data also indicate that seedling performance in fescue sods can exhibit significant variation among soil sampling dates, related to soil conditions, independent of climatic conditions influencing plant growth.

We cannot yet surmise how long the patterns we observed in our studies persist; however, if the results from the microcosm work can be verified under field conditions, avoiding the use of herbicides complies with and facilitates organic agricultural practice and reduces expenses and environmental concerns in conventional production systems.

Patterns of (a) root emergence after 10 days and (b) average shoot biomass normalized to a 30-day value (mean, SEM, n=7) for Jesup tall fescue infected with naturalized endophyte (E+), a novel endophyte, Max Q, AR542, (NE), or noninfected (E−) grown in soil from a living intact tall fescue sward (L) or in soil from a glyphosate-killed tall fescue sward (K). Significant interactions denoted to the left.

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