

Forage Grass Allelopathy in Birdsfoot Trefoil Pasture Establishment



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Fig 2: Sheep grazing birdsfoot trefoil

Methods

- Eight forage grass species were cultivated under controlled greenhouse conditions (Fig. 3). At 60 days, root exudates were obtained by leaching soil with 500 ml of distilled water. Leaf tissues were clipped 2.5 cm above the soil
 - Varieties/species used: 'Inavale' orchardgrass (*D. glomerata*), 'Peak' smooth brome (*B. inermis*), E+ 'KY-31' tall fescue (*F. arundinacea*), 'Barfleo' timothy (*P. pratense*), 'Barsprinter' perennial ryegrass (*L. perenne*), 'Chiefton' reed canarygrass (*P. arundinacea*), 'Balin' Kentucky bluegrass (*P. pratensis*), and 'Pradel' meadow fescue (*F. pratensis*)
- Leaf extracts were prepared by soaking 15 g of ground, dried leaf tissue in 100 ml of distilled water for 24 hrs. Six, two-fold serial dilutions of the filtered extract were prepared.
- Captured root leachates from each grass species were filtered and six-fold serial dilutions of each were prepared.
- Filter papers in sealed dishes were wetted with 2.5 ml of each leaf and root extract dilution and 20 'Norcen' BFT seeds were germinated in each plate. Four replicates of each species at each concentration were used
- Percent germination and radicle length were measured after 10 days incubation at 22 C.

Abstract

The major limiting factor in small ruminant production is gastrointestinal nematode (GIN) infection. Severe cases can result in low weight gain, decreased milk production, and even death. Some tanniniferous forages such as birdsfoot trefoil (BFT Fig. 1) can suppress GIN infection while also providing dietary benefits (Fig. 2). BFT can reseed itself, but it has proven difficult to establish in pasture. This project assessed inhibitory allelopathic interactions between common forage grasses and BFT. Extracts of leaf matter from eight common forage grasses were used to assess allelopathic inhibition in BFT germination. Inhibition of BFT germination increased with concentrations of extracts, and was greater with extracts from KY-31 tall fescue, meadow fescue, reed canary grass, and perennial ryegrass.

GIN Infection

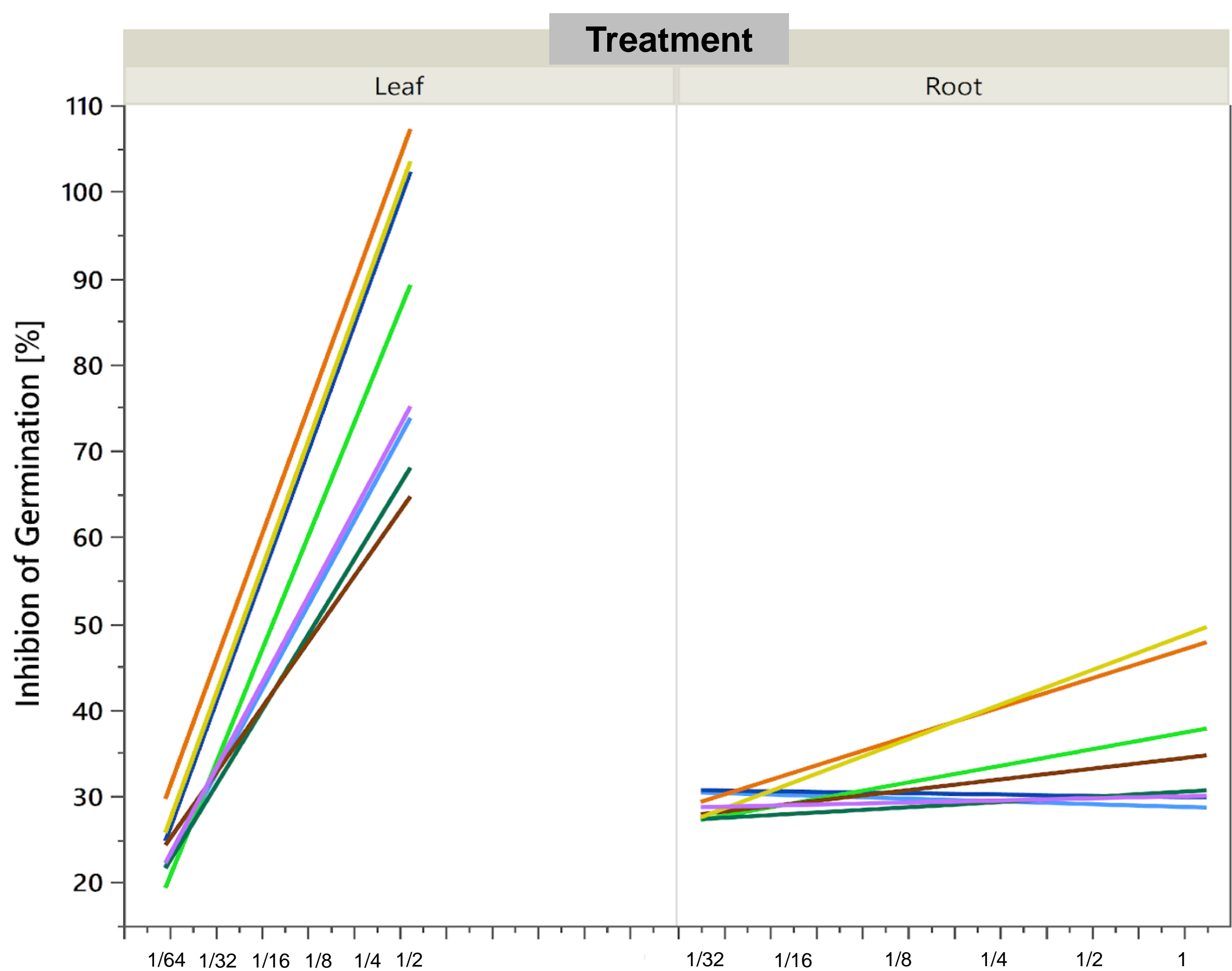
- Annually, GIN infection costs small ruminant producers \$430,000,000
- Organic producers lose the ability to sell at an organic premium if infected sheep are treated with medication
- H. contortus* resistance to conventional treatment is increasing rapidly and rendering many anthelmintics ineffective



Fig 1:: Birdsfoot trefoil

Results

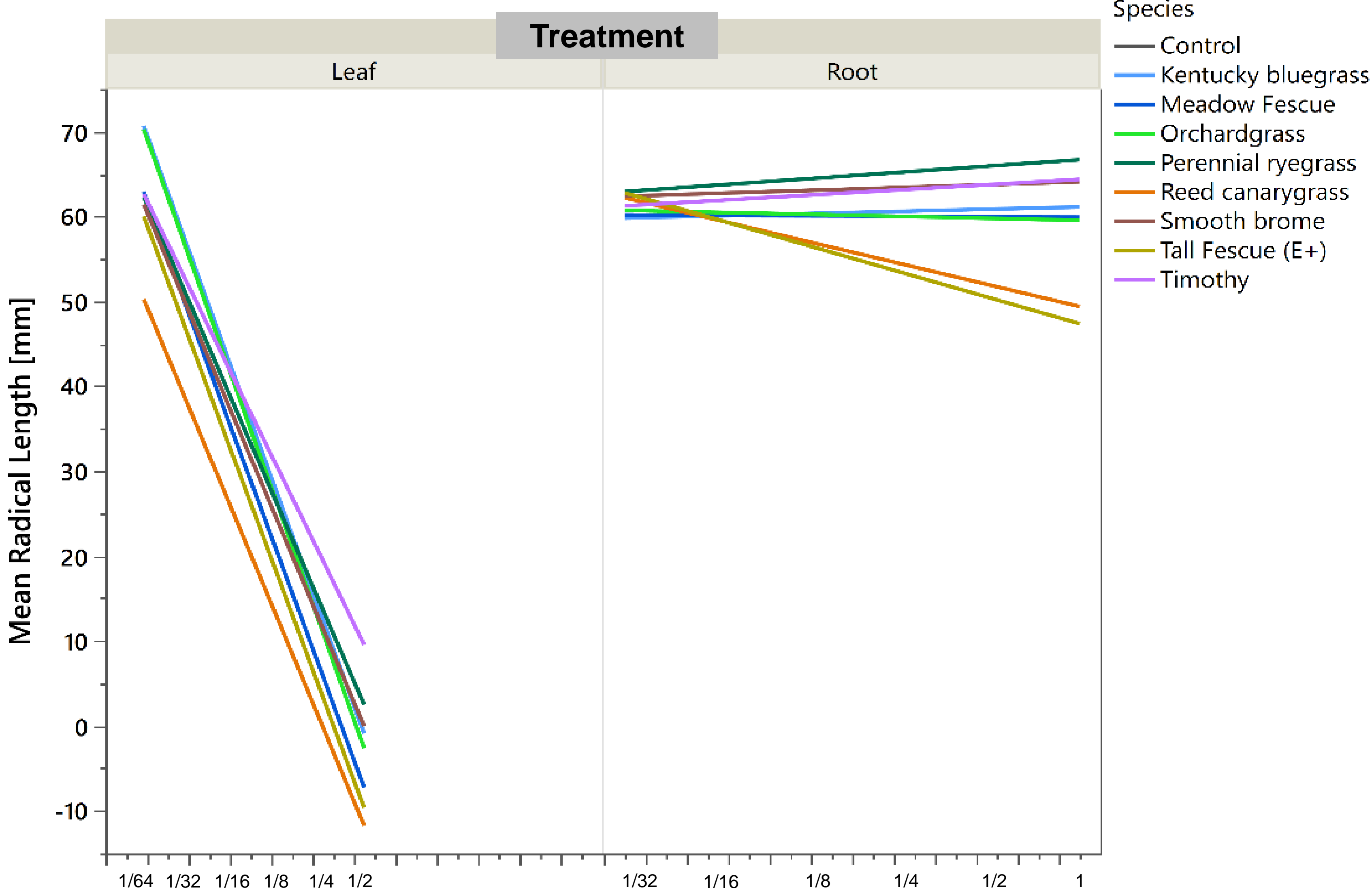
- Germination of BFT and radicle length was inhibited at high concentrations of extracts of all grasses (Fig. 3). Inhibition declined as extract concentrations declined.
- Concentration was significant ($P < 0.001$, Table 1, 2, 3, 4), indicating that the effect of grass species on BFT germination differed depending on concentration
- Reed canarygrass, tall fescue, and meadow fescue extracts were the most inhibitory
- Orchardgrass and timothy extracts were only inhibitory at the highest concentrations
- Only root leachate from reed canarygrass and tall fescue were significantly inhibitory



Species

- Control
- Kentucky bluegrass
- Meadow Fescue
- Orchardgrass
- Perennial ryegrass
- Reed canarygrass
- Smooth brome
- Tall Fescue (E+)
- Timothy

Fig 3: Effects of eight forage grass leaf extracts and root leachate on birdsfoot trefoil germination and radicle length



Source	D F	F-Value	Prob > F
Species	7	13.45	<0.0001
Concentration	48	4.49	<0.0001
Extract pH	1	0.34	0.5583
Extract Conductivity (mS)	1	1.59	0.2129

Table 1: Analysis of Variance table for birdsfoot trefoil germination in extracts of eight grass species at six concentrations

Source	D F	F-Value	Prob > F
Species	7	11.92	<0.0001
Concentration	48	5.33	<0.0001
Extract pH	1	0.54	0.4765
Extract Conductivity (mS)	1	0.67	0.4135

Table 2: Analysis of Variance table for birdsfoot trefoil germination in root leachate of eight grass species at six concentrations

Source	D F	F-Value	Prob > F
Species	7	43.05	<0.0001
Concentration	48	16.51	<0.0001
Extract pH	1	0.84	0.3626
Extract Conductivity (mS)	1	0.14	0.7184

Table 3: Analysis of Variance table for birdsfoot trefoil radicle length in extracts of eight grass species at six concentrations

Source	D F	F-Value	Prob > F
Species	7	16.83	<0.0001
Concentration	48	6.52	<0.0001
Extract pH	1	0.71	0.4012
Extract Conductivity (mS)	1	0.06	0.8021

Table 4: Analysis of Variance table for birdsfoot trefoil radicle length in root leachate of eight grass species at six concentrations

Conclusions

- Existing pasture composition can inhibit BFT establishment
- Tall fescue, meadow fescue, and reed canarygrass tissues at levels present in pasture can inhibit BFT germination and radicle growth
- BFT radicle growth is inhibited more than germination by allelochemicals in leaf tissue and root exudates
- Leaf tissue extracts are more inhibitory than root leachates

Acknowledgments

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