Weed Suppressive Soils in Eastern Nebraska.

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Rationale

Weed-suppressive soils consist of naturally occurring microorganisms that suppress weeds by inducing disease symptoms and inhibiting growth and development. Modifying current management practices to enhance weed suppressiveness of soils can contribute to a reduction in herbicide application within agroecosystems and promote sustainable agroecosystems.

Soils were found to be suppressive to velvetleaf after 8 years of continuous corn-velvetleaf research within a 4 ha field at the Agricultural Research and Development Center (ARDC) in Eastern Nebraska.

Objectives

Experiments were established to determine if soil from this field (referred to herein as *soilA*) was indeed biologically suppressive to velvetleaf. Four hypotheses were tested:

1.Velvetleaf growth will be reduced in *soilA* compared to similar soil types

2.Sterilization of *soilA* causes soil A to be conducive to velvetleaf

3. Mixing *soilA* with conducive soil will transfer suppressiveness to the conducive soil.

4. Soil suppressiveness is correlated to the population levels (colony forming units) of soil pathogenic fungi.

Materials and Methods

Experiment 1: Five soils obtained from ARDC, potted, seeded with velvetleaf and grown for 8 weeks

Experiment 2: Pots of sterilized or unsterilized *soilA* and *G* (greenhouse soil) seeded with velvetleaf and grown for 8 weeks

Experiment 3: Different amounts of *soilA* (0, 3, 6, 9, 12, 15, 20%) were mixed with *soilG*, seeded with velvetleaf and grown for 5 weeks.

Correlating suppressiveness with *Fusarium* spps. Colony Forming Units (CFU's): CFU's in soil from pots used in experiment 1 were determined by adding 4 grams of air-dried soil into 100 ml water and spreading 20 µl of the solution evenly over a petri-dish of Nash-Synder agar media amended with Ridomil. Number of circular white and pinkish puffy colony forming units that developed on the agar media were counted after incubation for 2 days.

Table 1: A comparison of mortality, leaf area and dry biomass of velvetleaf grown in 5 soils from ARDC. Values within a column followed by the same letter do not differ.

Soil Type	Mortality	Leaf Area (cm^2 plt^{-1})	Biomass (g plt^{-1})
SoilA	0.84a	37c	0.30c
SoilB	0.55bc	130b	1.05b
SoilC	0.42c	219a	1.89a
SoilD	0.65b	91bc	0.71bc
SoilE	0.79ab	36c	0.28c

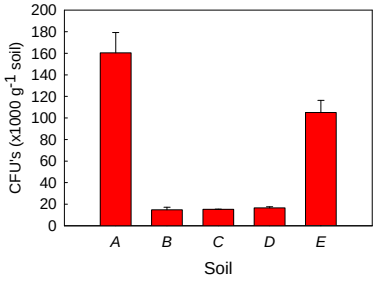

Figure 1. *Fusarium* spps. Colony Forming Units (CFU's) per gram of soil, obtained by dilution plating on Nash Synder agar media.

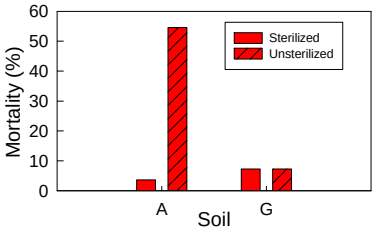

Figure 2. Comparison of velvetleaf mortality in sterilized versus non-sterilized *soilA* and *soilG*.

Photo 1. Velvetleaf growth in unsterilized (left) and sterilized (right) *soilA*.

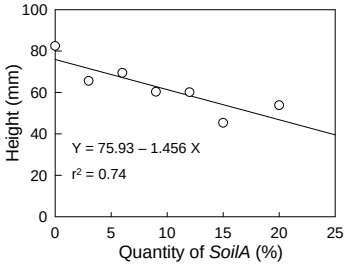

Figure 3. Mixing *soilA* (0, 3, 6, 9, 12, 15 and 20% v/v) with conducive soil transfers suppressiveness by reducing plant height (mm).

Conclusions

Results indicate that soils vary in their velvetleaf suppressive ability and this variation in suppressiveness is biological. Velvetleaf suppressiveness appears to be attributed to soilborne pathogenic fungi in the *Fusarium* genus. Further research is needed to 1) isolate and identify the pathogenic *Fusarium* species, and 2) verify the pathogenic effects of the isolate on velvetleaf, other weeds, and associated crop species. Knowledge of which pathogenic fungi contribute to weed suppressiveness will aid in developing best management practices to enhance the weed suppressiveness of soils, thereby promoting sustainable agroecosystems.