3-2015

The Possible Effects of Deleterious Rhizobacterial Combinations on the Growth of the Weed Velvetleaf

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Abstract

The use of biological agents in the control of the invasive weed velvetleaf *Abutilon theophrasti* is attractive due to this weeds development of herbicide resistance. One option is the utilization of deleterious rhizobacteria with amendments to optimize their effectiveness. Indole acetic acid (IAA)-producing *Rhizobium rubi* AT3-4RS/6 (RS) and cyanogenic *Pseudomonas putida* ATH2-1RI/9 (RI) were used to inoculate soil with and without amino acid amendments. RS & tryptophan (a precursor of IAA synthesis) caused the least velvetleaf shoot growth. All roots were colonized by rhizobacteria, on average, 1.40E+10 CFU/gram of dry root.

Introduction

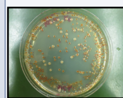
The weed velvetleaf *Abutilon theophrasti* has an allelopathic effect and competitive nature that has greatly reduced crop production (Viktor et al, 2011). Herbicide resistance of velvetleaf has brought further concern on how to control this weed (Yuan et al, 2007). Deleterious rhizobacteria has been found to colonize the roots of weed seedlings and decrease weed growth (Kremer & Kennedy, 1996). Such impacts can lead to using rhizobacteria as a biological control agent for weeds such as velvetleaf (Li & Kremer, 2006).

Tryptophan with deleterious rhizobacteria increases phytotoxic activity on weed seedlings (Sarwar & Kremer, 1994), which suggests that applying amendments to deleterious bacteria can increase weed control efficiency.

The purpose of this study was to determine which combination of deleterious bacteria, indole acetic acid (IAA)-producing *Rhizobium rubi* AT3-4RS/6 (RS) & cyanogenic *Pseudomonas putida* ATH2-1RI/9 (RI), and amino acid amendments, tryptophan and glycine, had the greatest impact on velvetleaf.

The null hypothesis was that different combinations of deleterious rhizobacteria and amendments will not effect velvetleaf growth.

METHODS



Bacterial Formulations

- Culture RS & RI
- Combine bacteria with celite
- Determine colony-forming unit/gram of celite using 0.1% peptone & spread plates

Planting

- Autoclave soil
- Germinate seeds
- Mix bacteria & amendments (tryptophan & glycine) with soil
- Use 6 plants/treatment to give us a total of 54 plants

Harvesting

- Grow weeds 3 weeks
- From bacterially inoculated roots, obtain colony-forming unit/gram using 0.1% peptone & spread plates
- Weigh dried roots and shoots

RESULTS

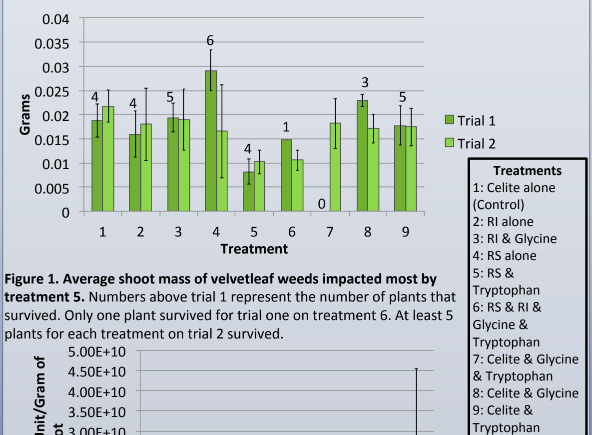


Figure 1. Average shoot mass of velvetleaf weeds impacted most by treatment 5. Numbers above trial 1 represent the number of plants that survived. Only one plant survived for trial one on treatment 6. At least 5 plants for each treatment on trial 2 survived.

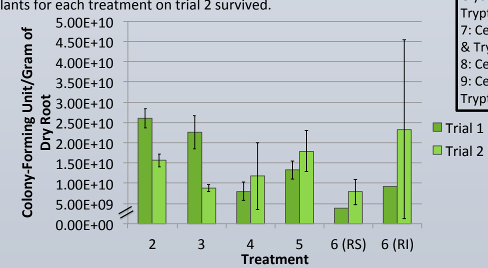


Figure 2. Average Colony-Forming Unit/Gram of bacterially inoculated roots of all treatments. Only one plant survived for trial 1 on treatment 6.

CONCLUSIONS

Deleterious bacteria were able to successfully colonize the velvetleaf roots with an average of 1.40E+10 CFU/gram of dry root. Both trials indicate that RS with tryptophan had the greatest impact on reducing velvetleaf shoot growth. These preliminary results suggest that we will reject the null hypothesis.

Future works can be applied to understand if the amount of colonization does matter. Questions that can be addressed are would an increase in colonization decrease velvetleaf growth more? Is there a specific amount of colonization that has the greatest impact on velvetleaf growth? Future works can also include another treatment of RS and RI without any amendments. This would investigate a question such as does velvetleaf growth decrease more by having deleterious bacteria RS & RI together without any amendments?

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ACKNOWLEDGEMENTS

This research was supported by the Undergraduate Research Scholar Award.