Early growth of introduced and native grasses on lupine-enriched soil

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Introduction

Ecological studies have shown that increased levels of soil nitrogen favor fast-growing introduced plant species, such as annual grasses. One source of elevated nitrogen is N-fixing plants, which have been shown to promote introduced species (Maron and Connors, 1996; Kolb *et al.*, 2002).

The Bodega Marine Reserve (BMR) is home to a large population of native *Lupinus arboreus* (yellow bush lupine). These lupines host nitrogen-fixing bacteria in nodules on their roots. As a result, the soil underneath bush lupines is rich in nitrogen from leaf litter and excess nitrogen secreted at these nodules. After lupines die, the nitrogen-enriched soil coupled with the sudden availability of bare ground creates patches of terrain which are prime candidates for invasion.

The focus of this study is to compare early rates of growth, germination, and final biomass between grasses grown on lupine and non-lupine soil.

Hypotheses:

1. ***Native and introduced grasses will have higher rates of germination on lupine soil than on non-lupine soil.***
2. ***Introduced annual grasses grown on lupine soil will have increased initial growth rates and biomass accumulation.***

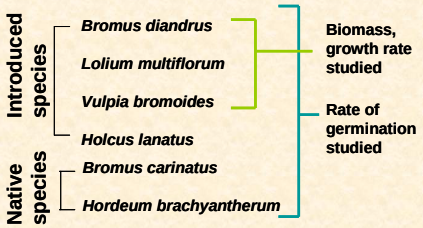
Methods

Two soil types used:

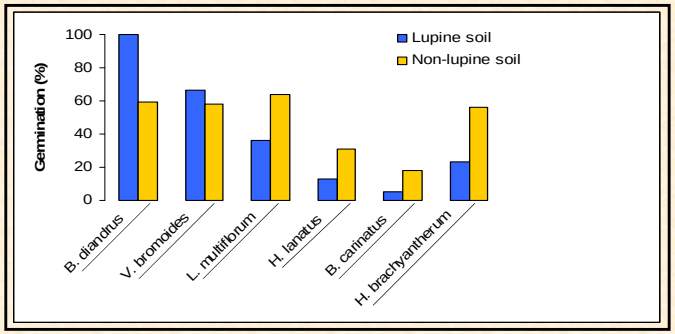
Soil from under lupine (LUP)

Soil from under grassland, away from lupine (NL)

Six grass species grown:

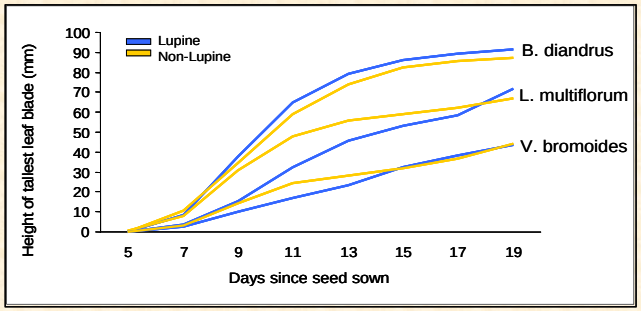


Germination

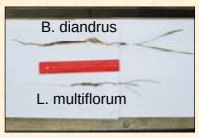


B. diandrus had a much higher rate of germination on the lupine soil than the on the non-lupine soil. However, this result was not seen in the other species. In contrast, *L. multiflorum, B. carinatus, H. brachyantherum,* and *H. lanatus* had higher percent germination on the non-lupine soil.

Growth rate



Soil type did not significantly affect growth rate of any of the species, as evident in the cumulative growth trends shown above.

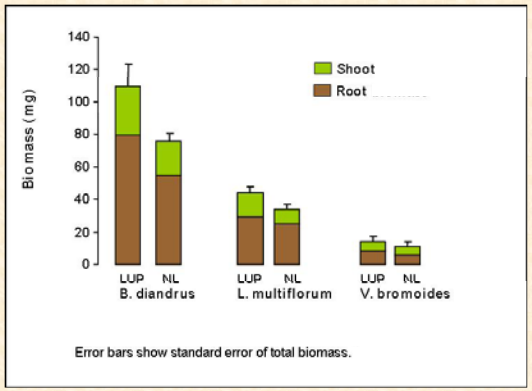


Measuring root length

Checking pots for seedlings

Germination study seed cup

Biomass



Introduced annual grass species grown on lupine soil had greater final biomass than those grown on non-lupine soil. Whether biomass increased mainly in the root or mainly in the shoot varied by species.

Discussion

Germination

- Rate of germination was affected by soil type
- Some species germinated more successfully on lupine soil, some on non-lupine soil
- Not linked to origin of species (native vs. introduced)
- Unknown factor behind difference in germination
- More research needed to identify mechanism behind difference in rates of germination
- Germination may play an important role in the ecology of invasion

Examples of seeds used shown below

Growth and biomass

- Growth rates not significantly different between soil type
- Biomass accumulation was higher on lupine soil
- Allocation varied by species

Further Research Questions:

1. **Are soil biota different between lupine and non-lupine soils?**
2. **Do these biota affect grass seed germination?**
3. **Are growth rates and biomass accumulation affected by soil type in native grass species?**

References

Kolb, A., P. Alpert, D. Enters, and C. Holzapfel. 2002. Patterns of invasion within a grassland community. Journal of Ecology 90:871-881.

Maron , J. L., and P. G. Connors. 1996. A native nitrogen-fixing shrub facilitates weed invasion . Oecologia 105:302–312.

Acknowledgments

This work was supported by grant #DBI-0453251 from the National Science Foundation to S.L. Williams. Thanks to Dan Gruner and the Strong Lab, Cynthia Hays, Rachel Fontana, and Martha Y. Diaz.