Effects of surfactant seed coating and water level on alkali bulrush germination and biomass

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Introduction

Alkali bulrush (*Bolboschoenus maritimus*) is an emergent plant in Great Salt Lake (GSL) wetlands and is a major food source for migratory birds (Evans and Martinson, 2008). GSL managers are interested in restoring alkali bulrush following the removal of the invasive grass *Phragmites australis*. However, low moisture availability may hinder alkali bulrush germination and establishment, especially in light of continuing water diversions from GSL tributaries and ongoing climate change.

Surfactant seed coatings have aided the germination of upland plant species in restoration projects by increasing the water available for seeds in soil (Madsen et al., 2016). However, these coatings have not been tested on wetland species. In this project, we tested the effect of a surfactant seed coating and varying levels of moisture availability on alkali bulrush in two greenhouse experiments. If this surfactant seed coating is effective for alkali bulrush, it could aid efforts to revegetate wetland areas in the Great Salt Lake and beyond and restore critical wildlife habitat.

Alkali bulrush (*Bolboschoenus maritimus*)

Phragmites australis is an invasive species in Great Salt Lake wetlands

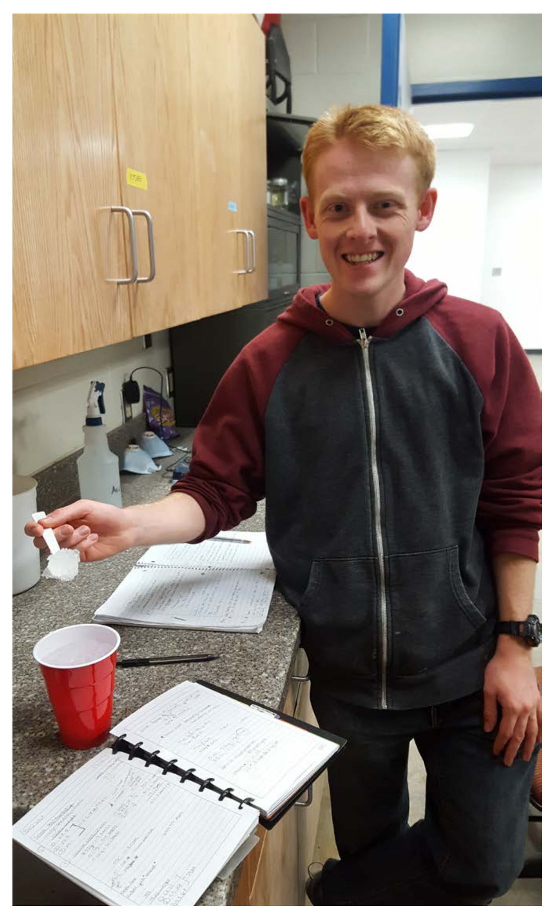
Methods

For both experiments, we compared coated and uncoated seeds. The coating consisted of diatomaceous earth, Selvol^{TM} polyvinyl alcohol binder, and Aquatrols^{TM} SET 4001 surfactant.

In Experiment 1, we evaluated the effects of seed treatment (uncoated or coated) and water level (1, 2, 3, or 4 cm in subirrigation reservoirs) on seed germination for 30 days in a greenhouse, with nighttime minimum temperatures ~19°C and daytime maximum temperature ~33°C. There were 5 pots for each coating × water level combination treatment (40 total).

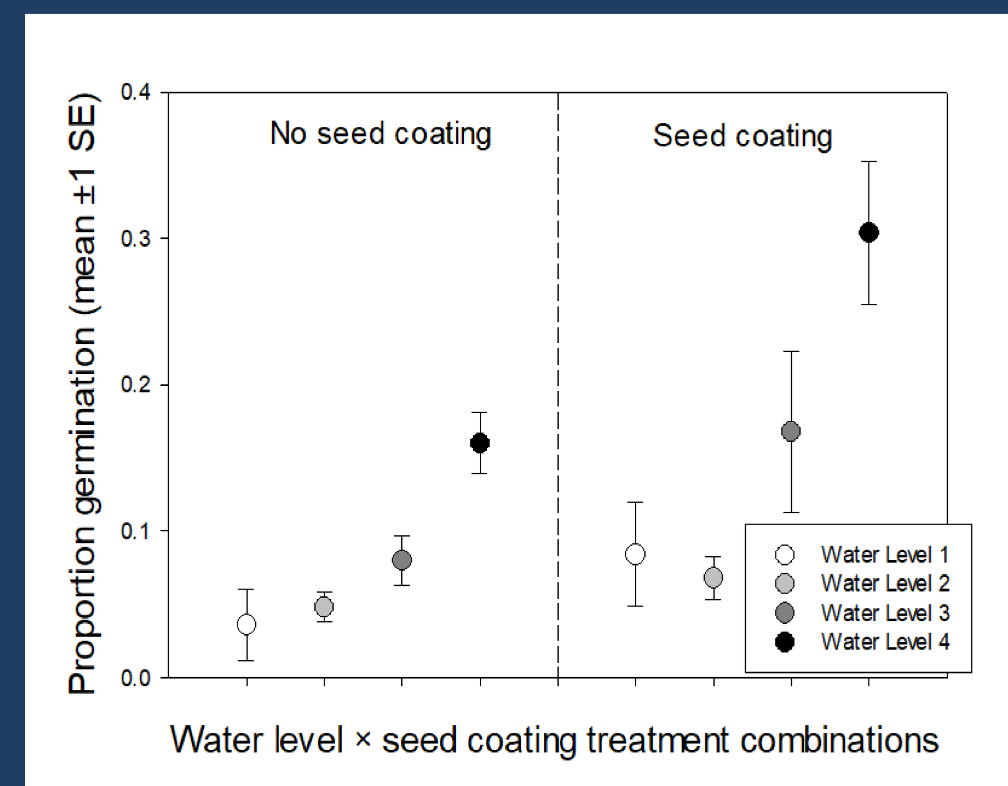
For Experiment 2, we tested the effects of the surfactant (low and high dose) and water level (control, or desiccation to 1 cm of water in subirrigation reservoirs at 0, 2, or 4 weeks after thinning) on germination and seedling biomass in a greenhouse with nighttime minimum temperatures ~18-23°C and daytime maximum temperature ~33°C. We allowed seeds to germinate for 3 weeks, after which we thinned seedlings to no more than 5 per pot. There were 5 pots in each coating × water level treatment (60 total). We collected and dried belowground, flower, and non-flower aboveground biomass in an industrial oven for approximately 72 hours.

We used a two-way ANOVA to analyze the results of both experiments.



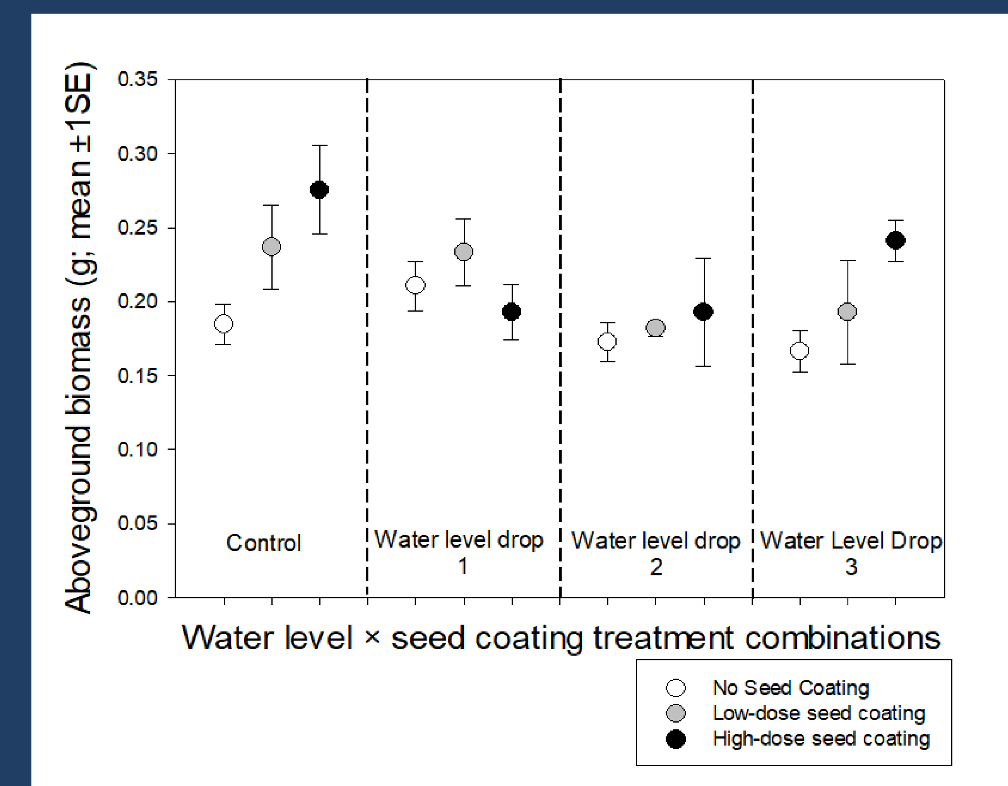
Above: Anders counting alkali bulrush seedlings
Right: Mixing polyvinyl alcohol binder for the surfactant seed coating

Figure 1 – Experiment 1 Results



Germination proportion increased with water level and the presence of the seed coating.

Figure 2 – Experiment 2 Results

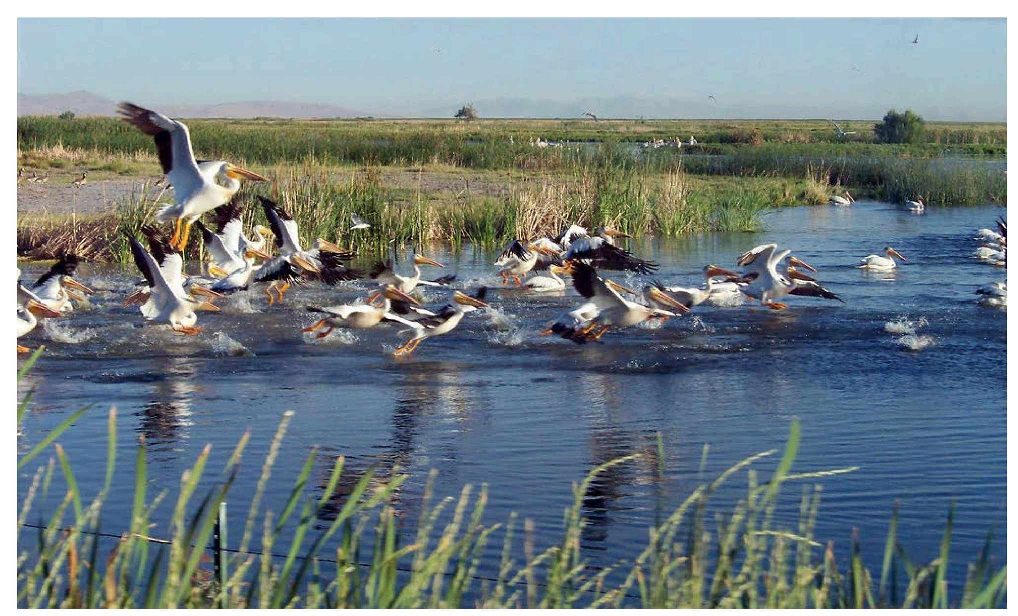


No clear relationship between water, seed coating, and aboveground biomass. We found similar results for belowground, flower biomass.

Results

In Experiment 1, higher water level and seed coating were significantly associated with higher germination proportion (seed coating: $p=0.013$; water level: $p<0.0001$).

In Experiment 2, we found no clear relationship between seed coating, water level, and aboveground biomass (the only significant difference was between the control water level and desiccation at 2 weeks). However, uncoated seeds had a higher germination proportion than low- or high-dose coated seeds ($p<0.0001$), in contrast to the results from Experiment 1.



Alkali bulrush supports water bird populations in Great Salt Lake wetlands

Conclusions

Our results indicate that:

- This surfactant seed coating may promote alkali bulrush germination.
- However, contradictory results in Experiment 2 highlight the need for further studies that better minimize extraneous variables like spatial and temporal fluctuations in greenhouse conditions and differences in surfactant coating application among seed batches.

References

Evans, K. E., & Martinson, W. (2008). Utah's featured birds and viewing sites: a conservation platform for IBAs and BHCAs. Sun Litho.

Madsen, M. D., Davies, K. W., Boyd, C. S., Kerby, J. D., & Svejcar, T. J. (2016). Emerging seed enhancement technologies for overcoming barriers to restoration. *Restoration Ecology, 24*. doi:10.1111/rec.12332

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