

Novel Techniques for Enhancing Native Forb Germination and Establishment in the Great Basin

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Benefits of Forbs

- Food sources for pollinators and wildlife
- Biodiversity
- Habitat diversity
- Resistance towards invasive species



Walker and Shaw 2005; Rawlins et al. 2009.

Barriers to Forb Establishment

Abiotic factors:

- Soil moisture
- Soil temperature
- Variable precipitation

Biotic factors:

- Seed dormancy
- Soil fungal pathogens

James et al. 2011; Madsen et al. 2016.



Research Objectives

- Improve native forb establishment in the Great Basin
- Understand where bottlenecks occur



Alter abiotic and biotic conditions to overcome bottlenecks & improve establishment

Novel Techniques to Assist in Establishing Forbs

- Snow fences
- N-Sulate fabric
- Seed coating technology



Snow Fences

- Capture windblown snow
- Increase soil moisture retention
- Stabilize soil temperature

David 2008, 2013.





N-Sulate Fabric



- Protect seedlings from frost
- Minimize evaporative loss
- Prolong germination period

Geyer 2001; Tilley et al. 2009.



N-Sulate Fabric



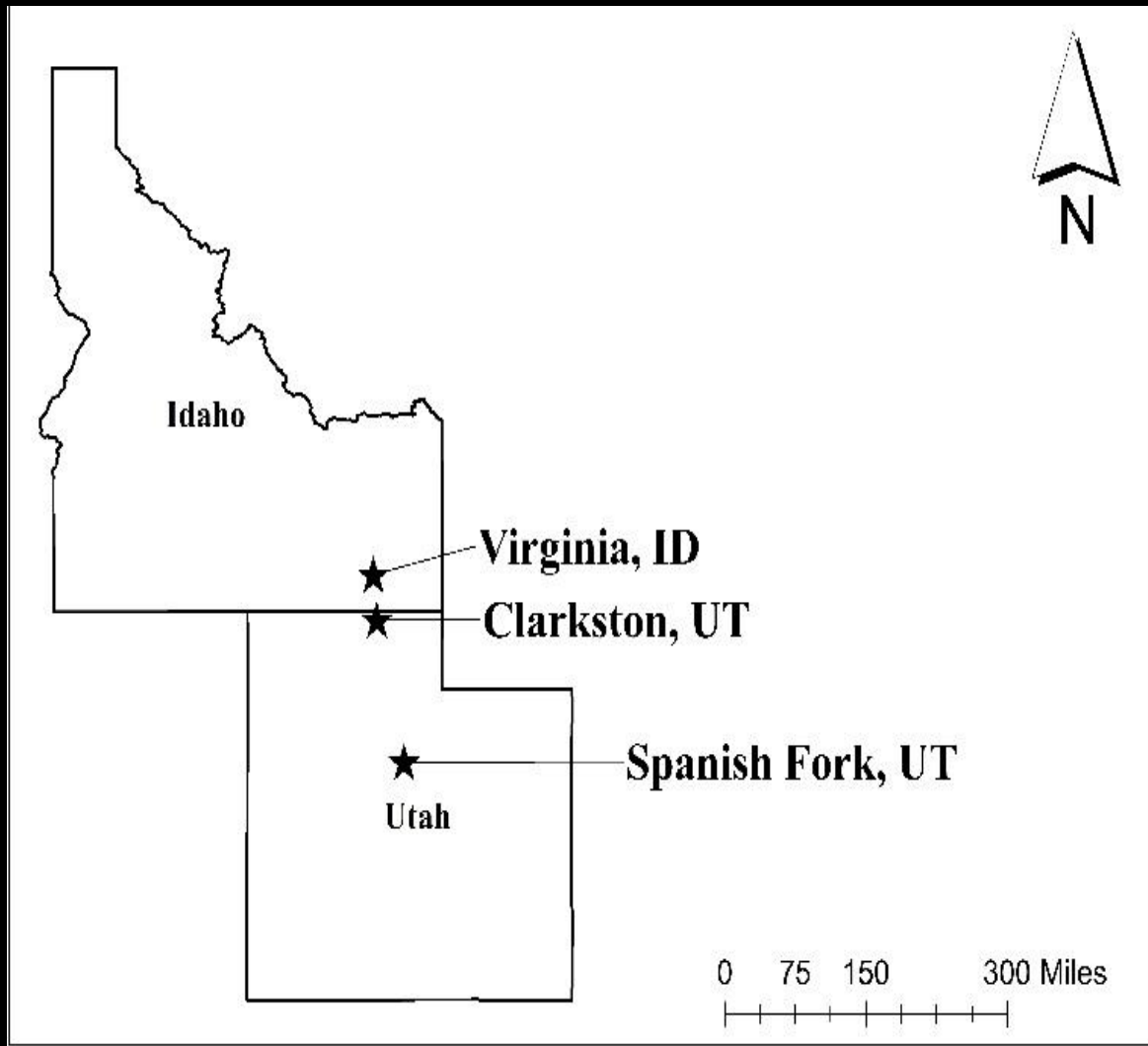
Control

Seed Coating Technology

- Ameliorate seed dormancy
- Protect against soil fungal pathogens
- Delay timing of seed germination

Madsen et al. 2012, 2013, 2016.





- Virginia, ID

- 8.2°C MAST, 40.4 cm MAP

- Clarkston, UT

- 8.8°C MAST, 45.1 cm MAP

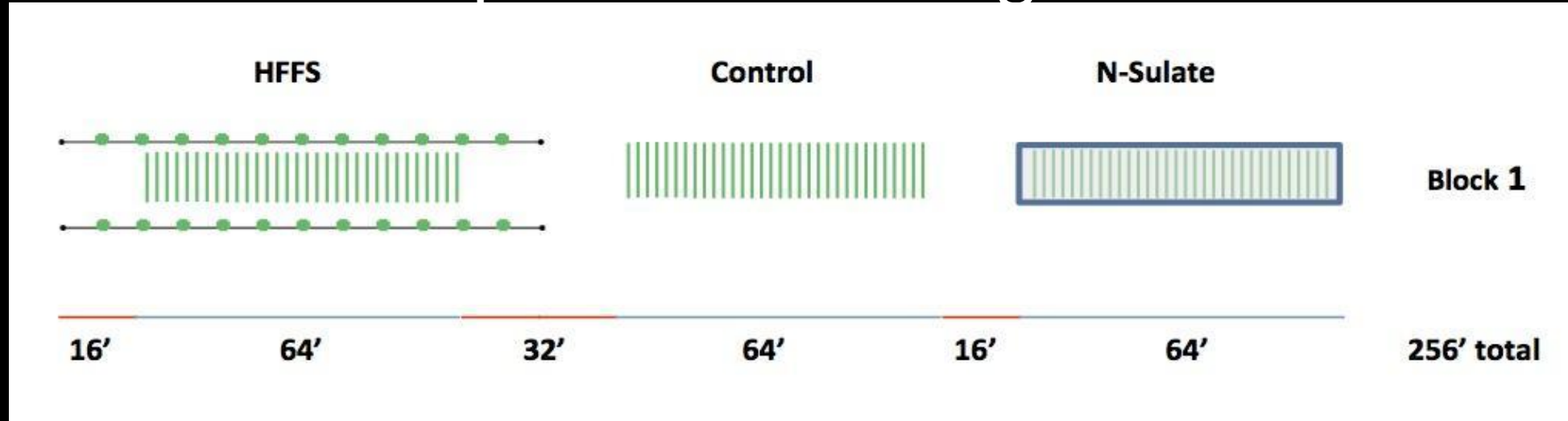
- Spanish Fork, UT

- 12.2°C MAST, 55.8 cm MAP

UT Climate Center.

Experimental Design

- Randomized Complete Block Design with four blocks



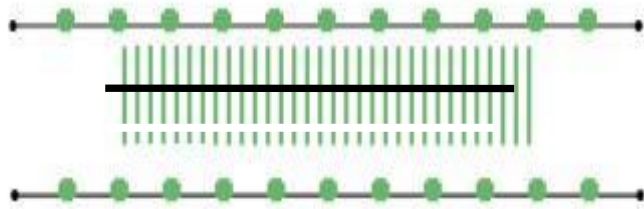
- Evaluate germination, seedling emergence, establishment, & survival of 12 native forb species
- Monitor soil moisture & temperature using gypsum blocks

Seeding of Plots



Example of Seed Row Layout

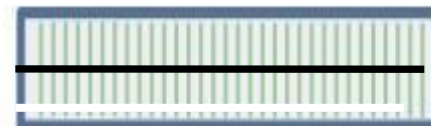
HFSS



Control



N-Sulate



Block 1

Seed Treatments – Native Legume Species

Astragalus filipes and *Dalea ornata*

1. Non-scarified (NS)	9. S + Fungicide 1 + Hydrophobic 1
2. Scarified (S)	10. S + Fungicide 2 + Hydrophobic 1
3. S + coat	11. S + Fungicide 3 + Hydrophobic 1
4. S + Fungicide 1	12. S + Fungicide 1 + Hydrophobic 2
5. S + Fungicide 2	13. S + Fungicide 2 + Hydrophobic 2
6. S + Fungicide 3	14. S + Fungicide 3 + Hydrophobic 2
7. S + Hydrophobic 1	15. S + Fungicide 1 + Hydrophobic 1 + <i>Lomatium nudicaule</i>
8. S + Hydrophobic 2	16. S + Fungicide 1 + Hydrophobic 1 + <i>Triticale</i>

Germination Study

Seed germination bags:

- 25 seeds + sieved field soil
- 4 replications
- 3 retrieval dates



Methods

Seed Germination Bags

- Count the number of germinated seeds & dormant seeds inside each bag



Seedling Emergence & Establishment

- Seedling census 2x/month from March – July 2016



Preliminary Results

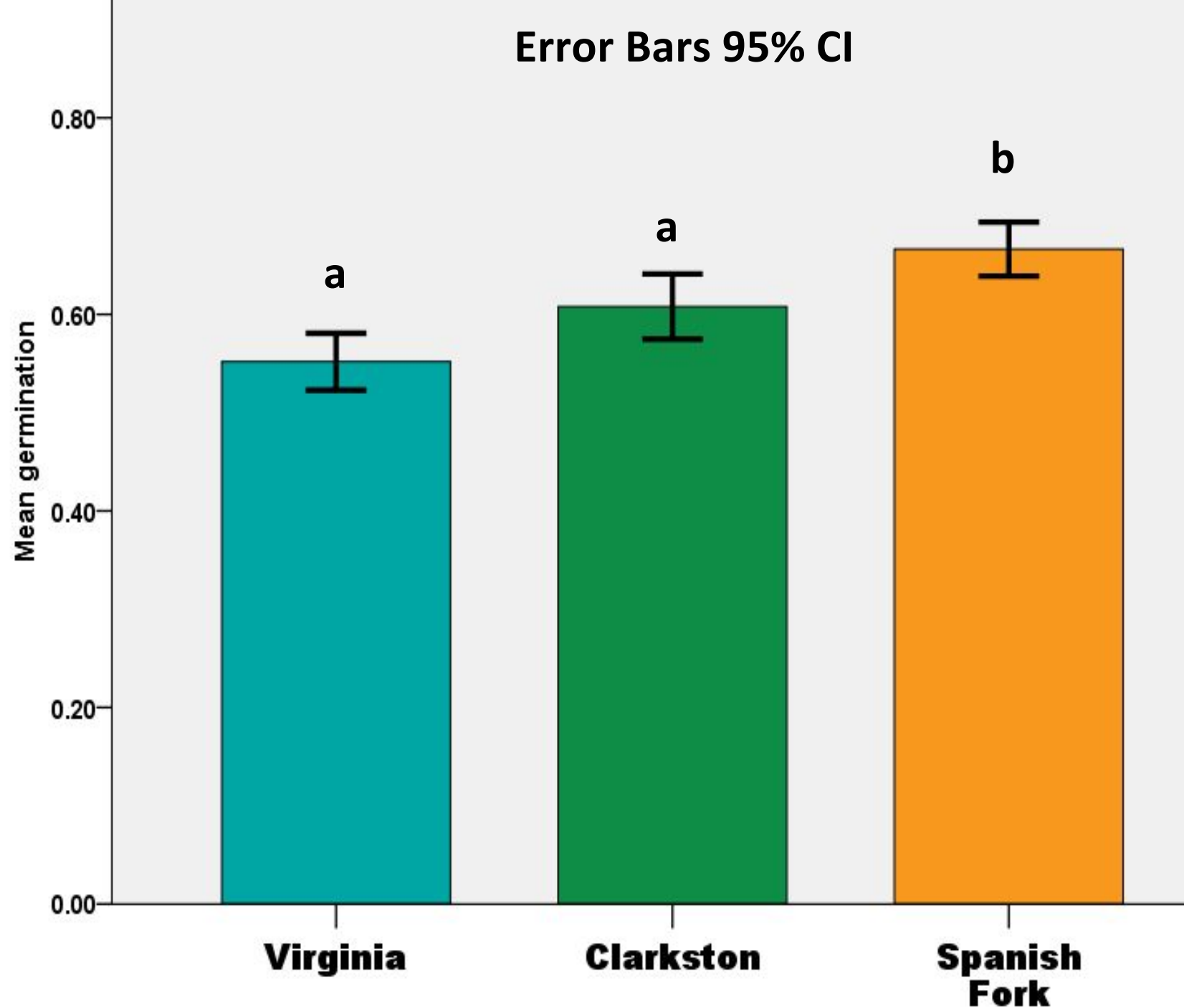
From 2016 data:

- Effects of site & treatments on germination & seedling emergence of *Astragalus filipes* (Basalt milkvetch)
- Role of seed coatings on germination & emergence

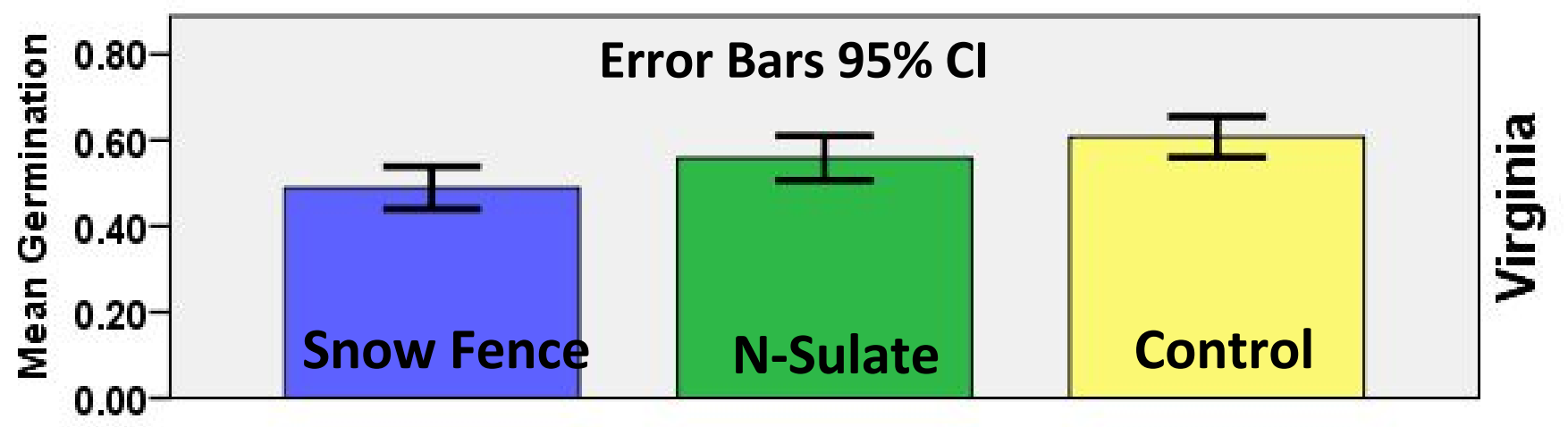


Site Effects on Germination

- Large differences between Spanish Fork & Virginia ($p = <0.001$)
- Large differences between Spanish Fork & Clarkston ($p = 0.001$)



Treatment Effects on Germination



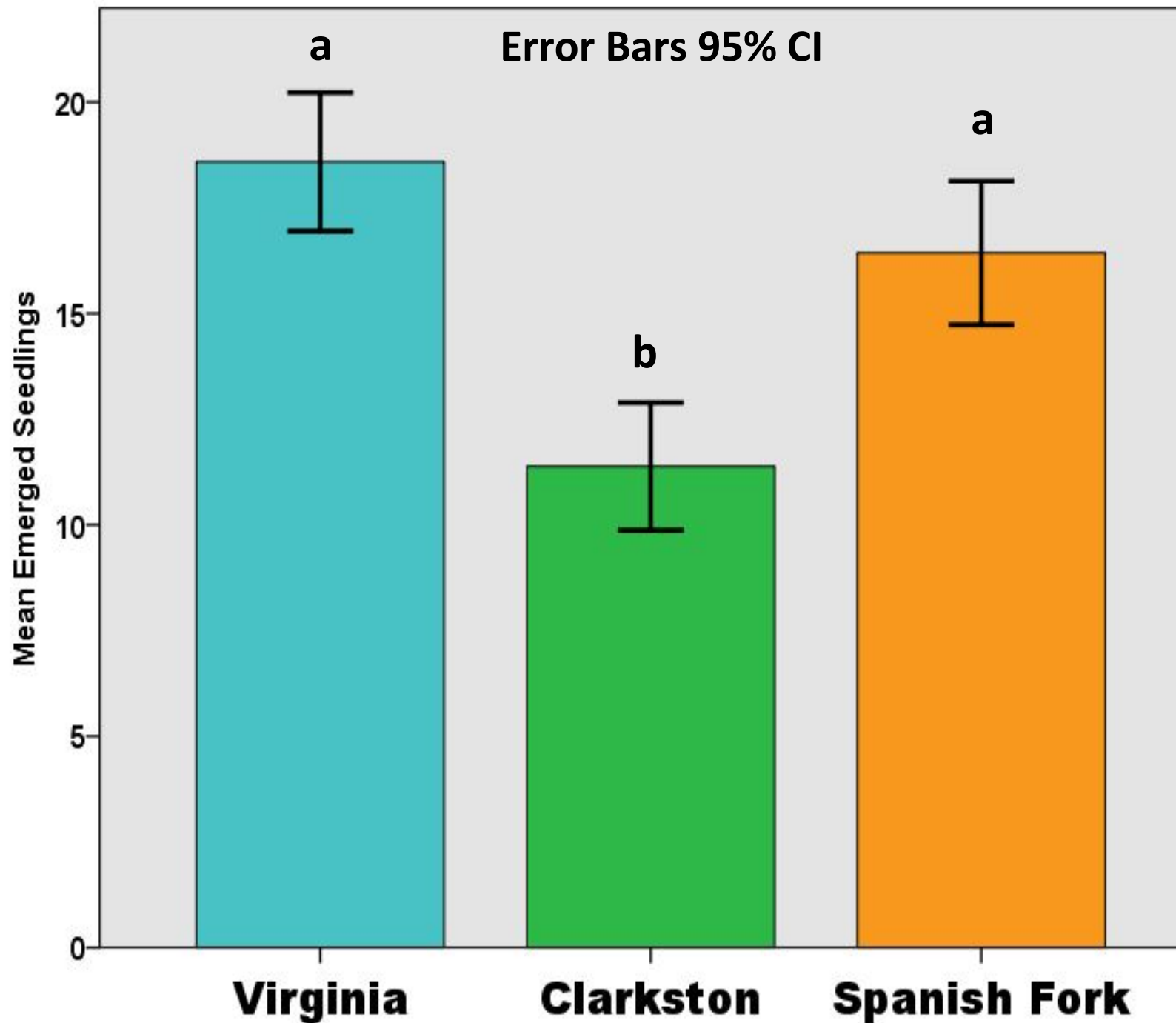
- Virginia – N-Sulate & Control are best ($p = 0.004$)
- Clarkston – no difference
- Spanish Fork – no difference

Seedling Emergence



Site Effects on Emergence

- Large difference between Virginia & Clarkston ($p = 0.042$)
- Large difference between Spanish Fork & Clarkston ($p = 0.001$)

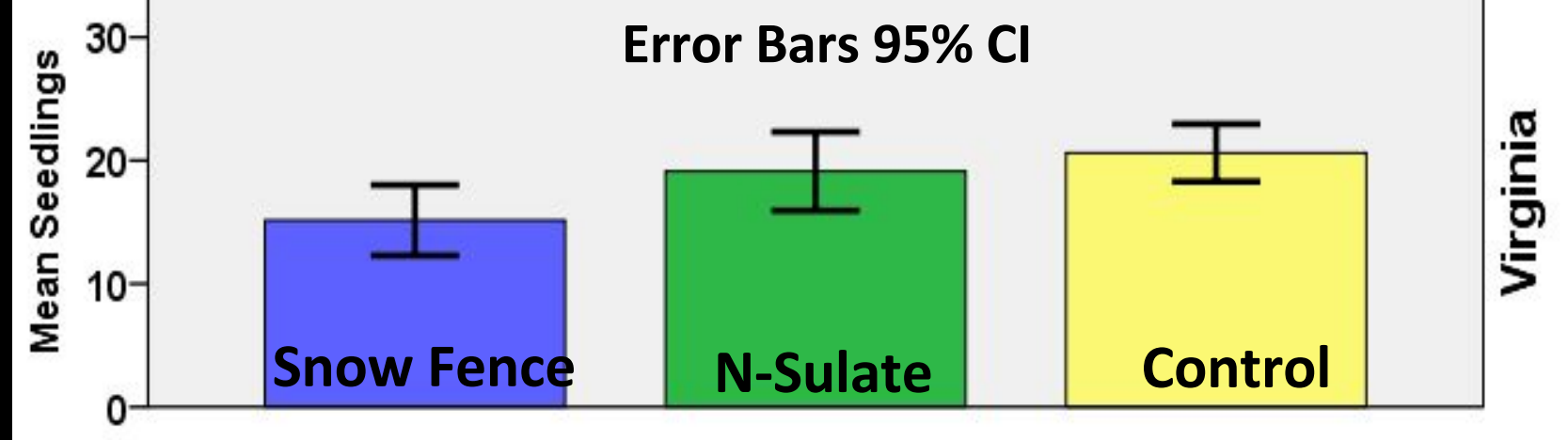


Treatment Effects on Emergence

- Virginia – no difference

- Clarkston – N-Sulate is best ($p = <0.001$)

- Spanish Fork – snow fence is best ($p = <0.001$)

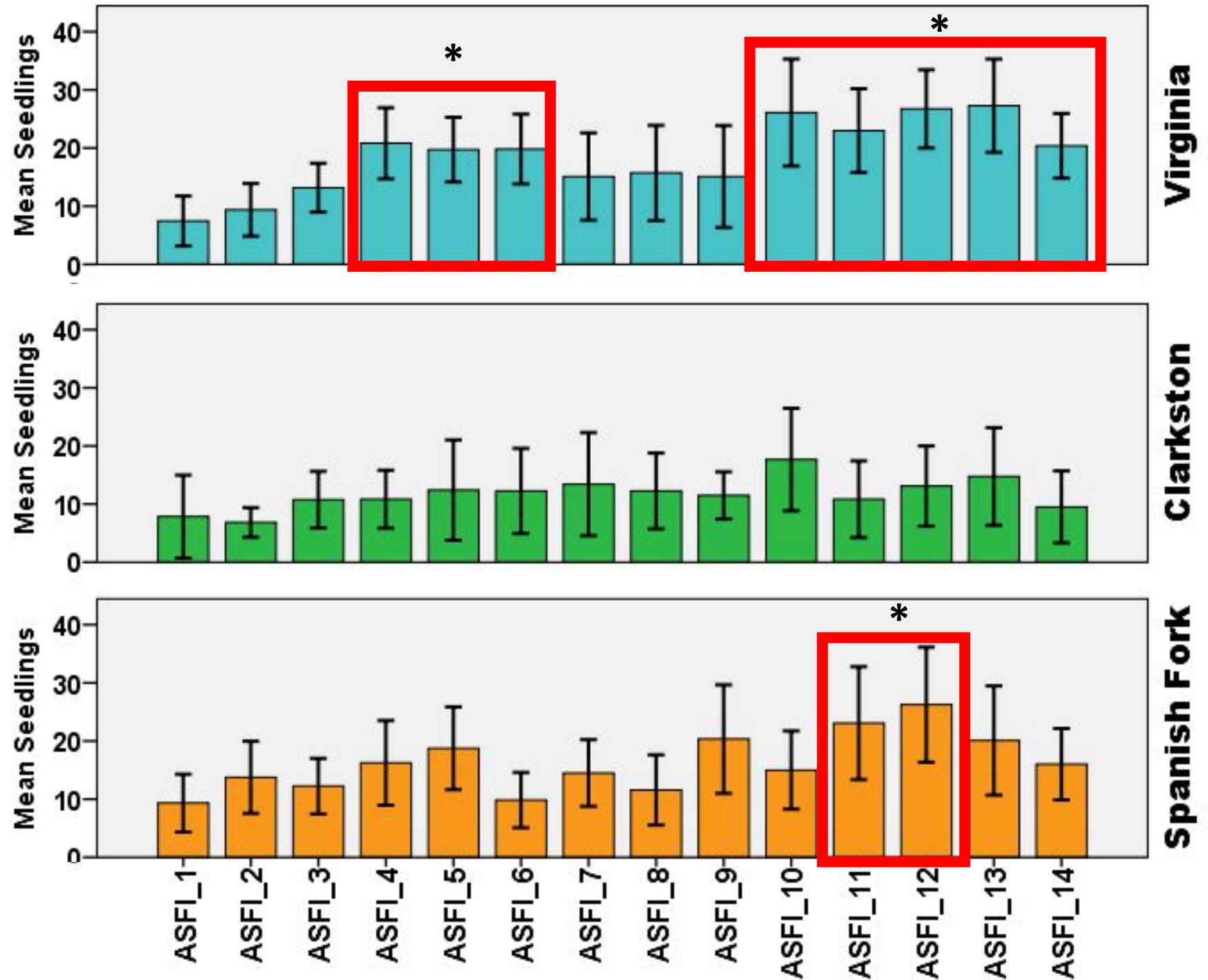


What about seed coatings?



Effects on Emergence

- Virginia & Spanish Fork – fungicide, and fungicide + hydrophobic coatings best
- Clarkston – no difference



Conclusions



- Germination is relatively high at all sites ($> 55\%$) & treatment effects vary by site

- Treatment effects on emergence span a latitudinal gradient



- Seed coatings important for emergence

Next Steps...

- Repeat entire experiment for 2016 plots
- Monitor survival from 2015 plots
- Monitor soil moisture & temperature



Thank You



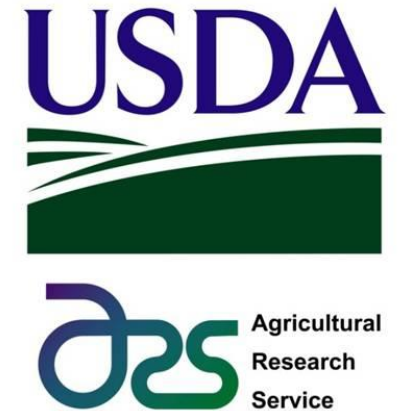
Funding:

USDA-ARS

Great Basin Native Plant Project

Utah State University

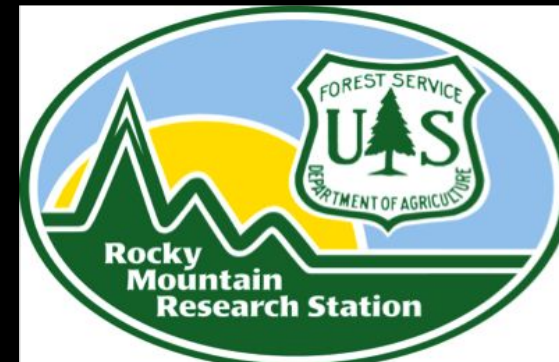
USU Ecology Center



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The preceding presentation was delivered at the

2017 National Native Seed Conference

Washington, D.C. February 13-16, 2017

This and additional presentations available at <http://nativeseed.info>

