

The Nature  
Conservancy



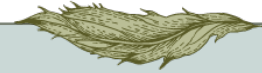
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Hannah Demler, Innovative Restoration Technician  
Christopher Donovan, Innovative Restoration Technician



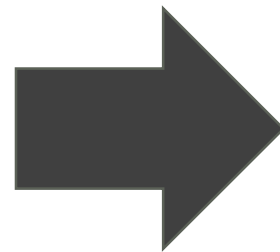
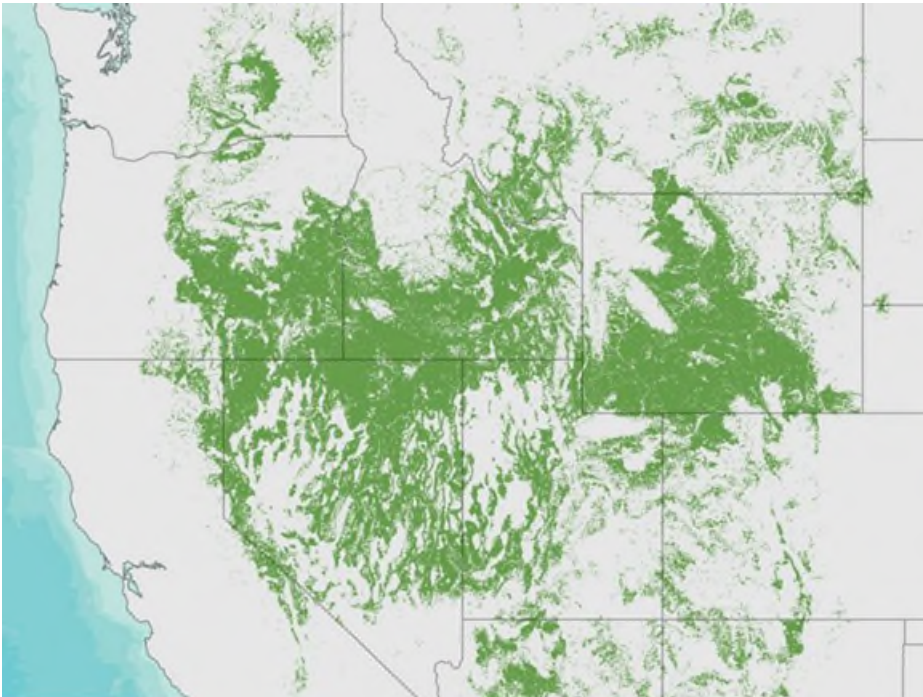
# The effects of root enhancement seed technologies and timing of seeding on Wyoming big sagebrush establishment



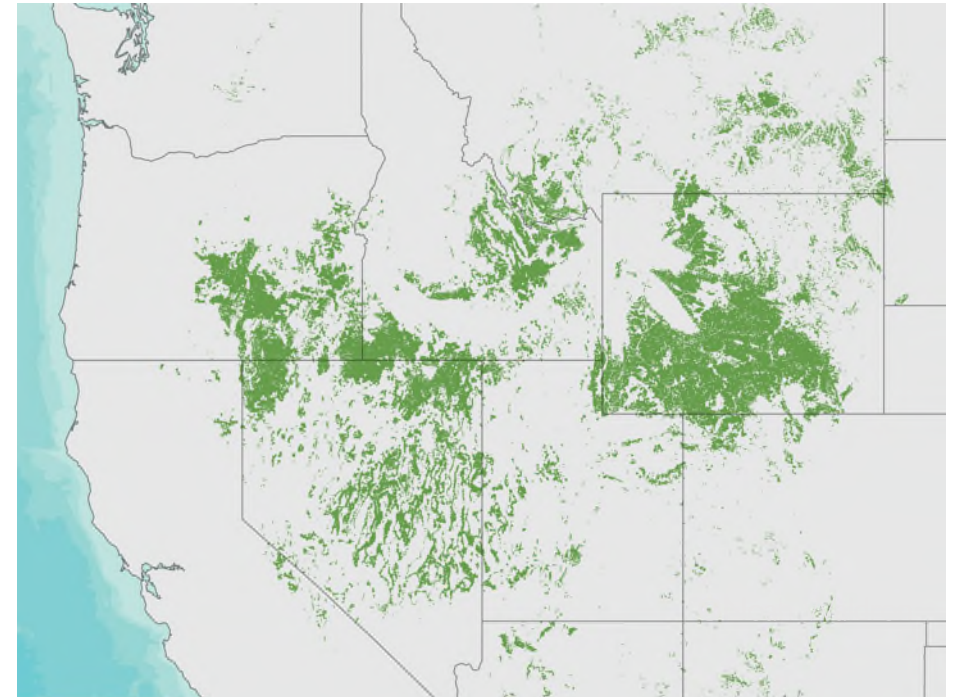
# Sagebrush Steppe



Former range



Current range





Wyoming Big Sagebrush, *Artemisia tridentata*  
*subsp. wyomingensis*



## Establishing sagebrush from seed is challenging

- Container planting is largely successful
- Container planting is expensive
- Seeding failure is common





# Ecological Challenges



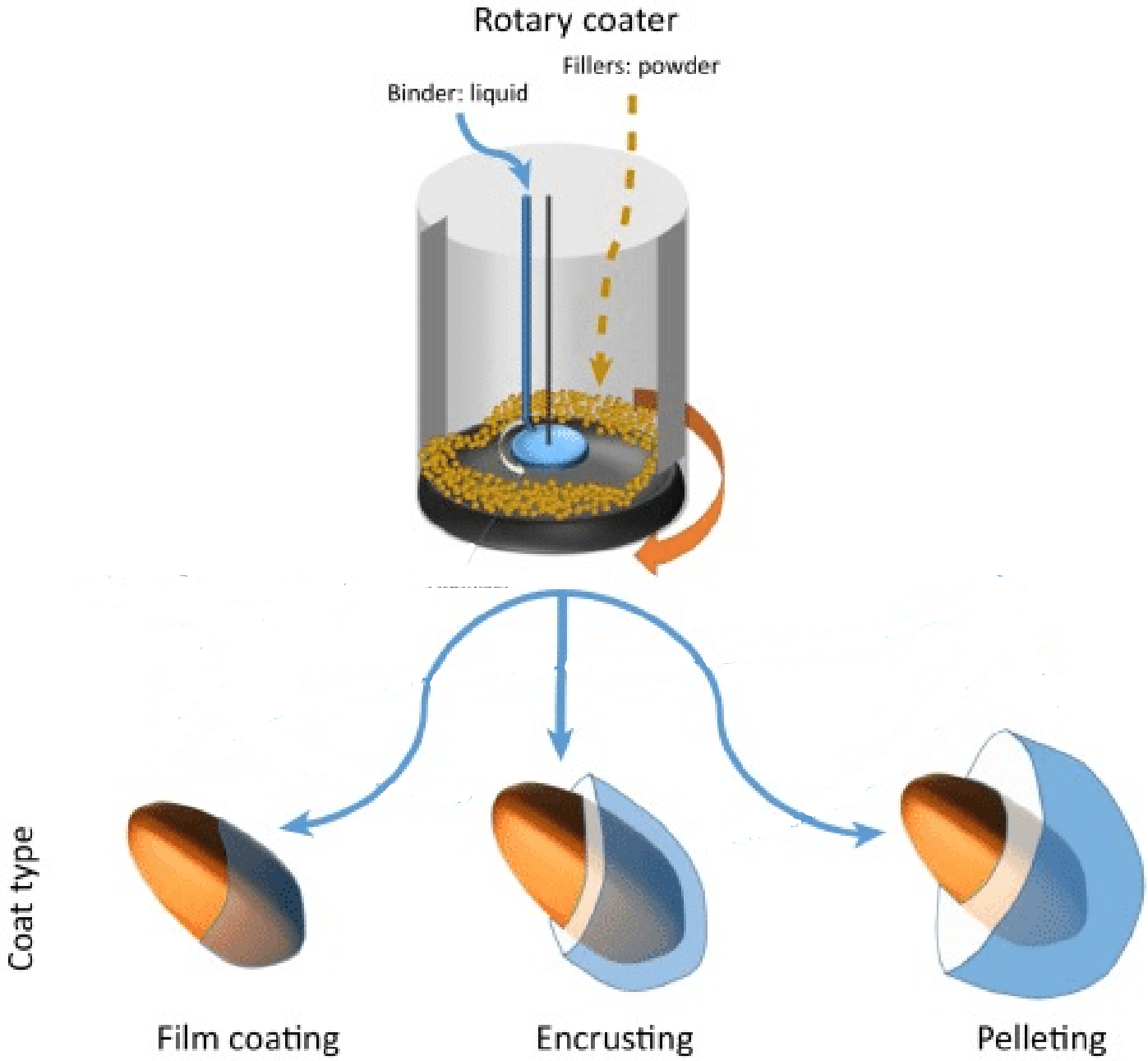
- Episodic establishment
- Climate change
- Water/nutrient availability
- Competition



# Reclamation Challenges

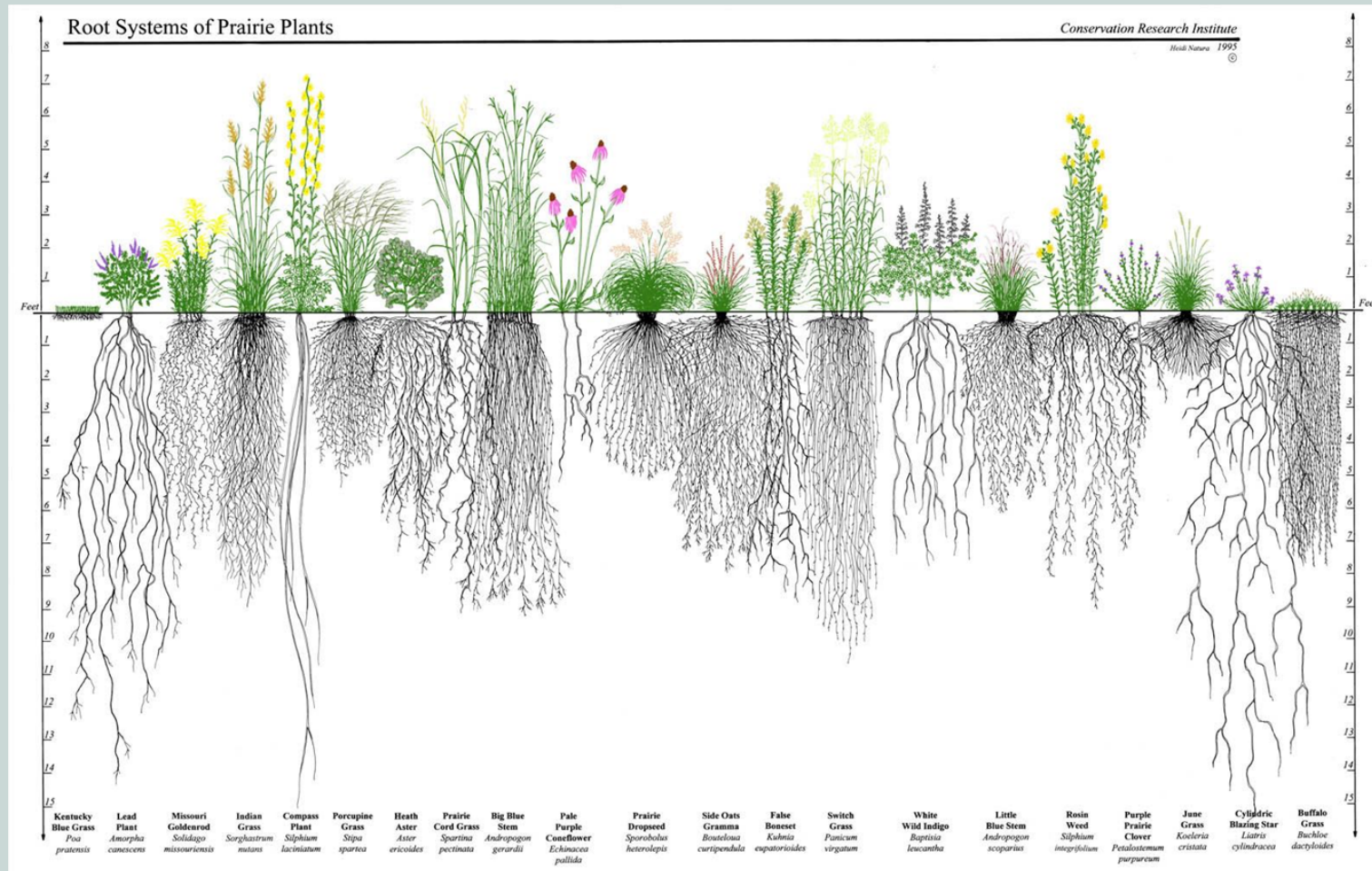
- Soil stability/erosion
- Germination requirements
- Nutrient availability
- Nurse plants
- Water availability
- Seed viability

# What is a Seed Technology?

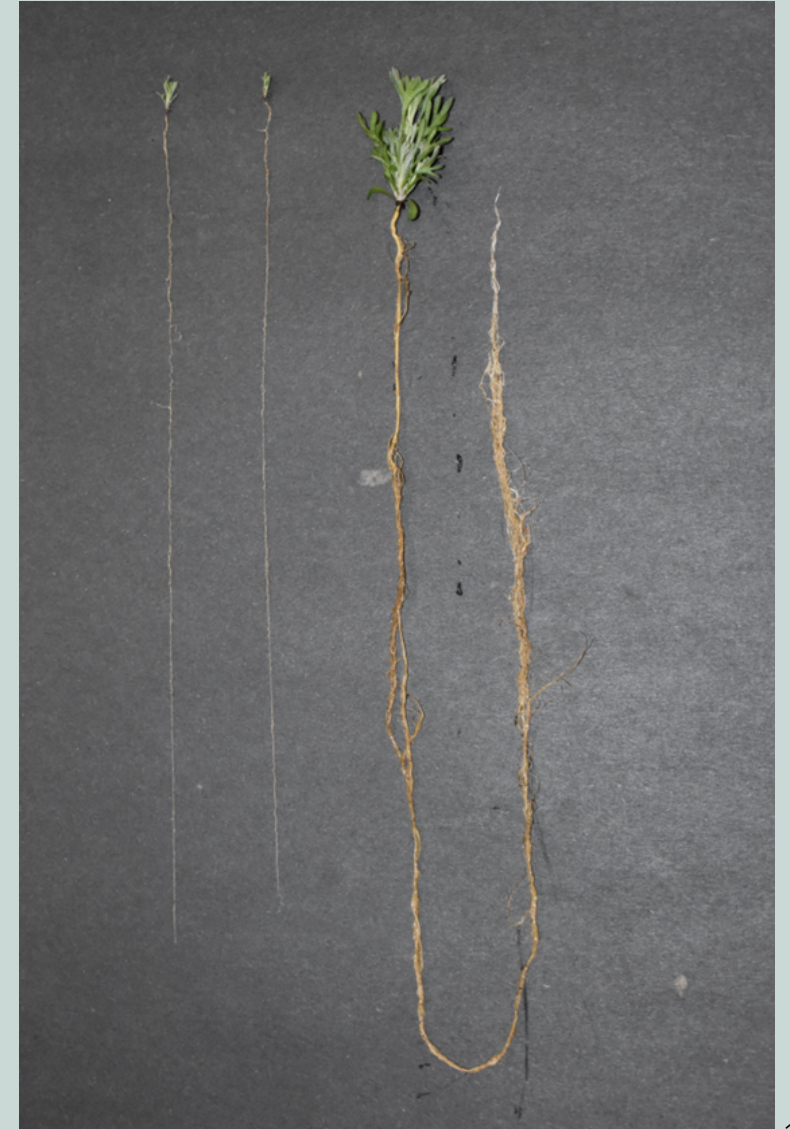




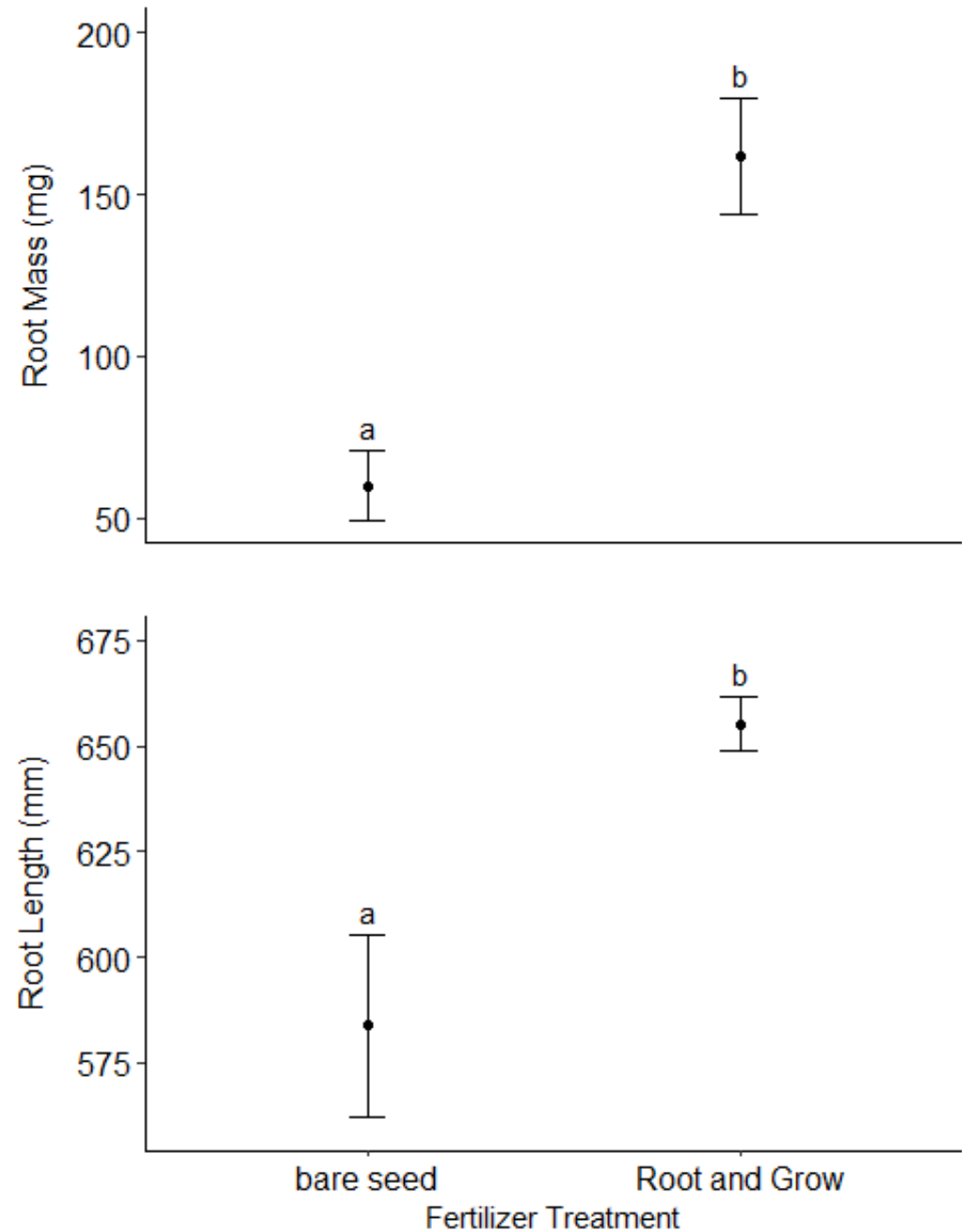
# Root Enhancement Technologies



# First, we tested readily available fertilizers



# One fertilizer showed promise



# Turning liquid fertilizer into a seed enhancement technology

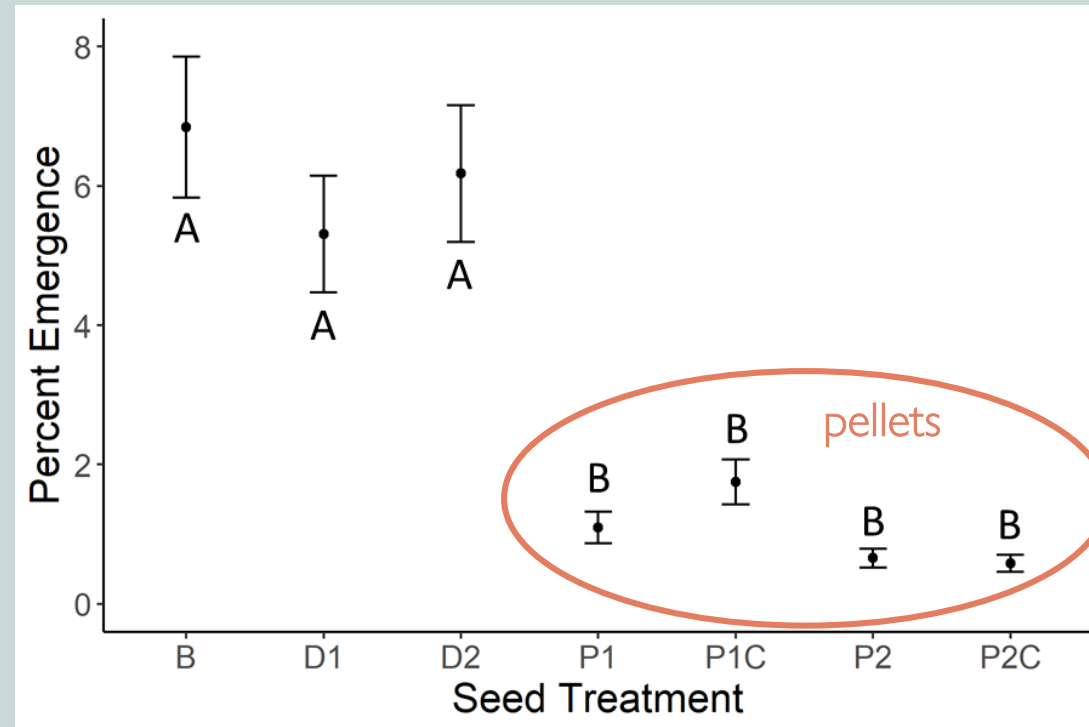


Pasta maker

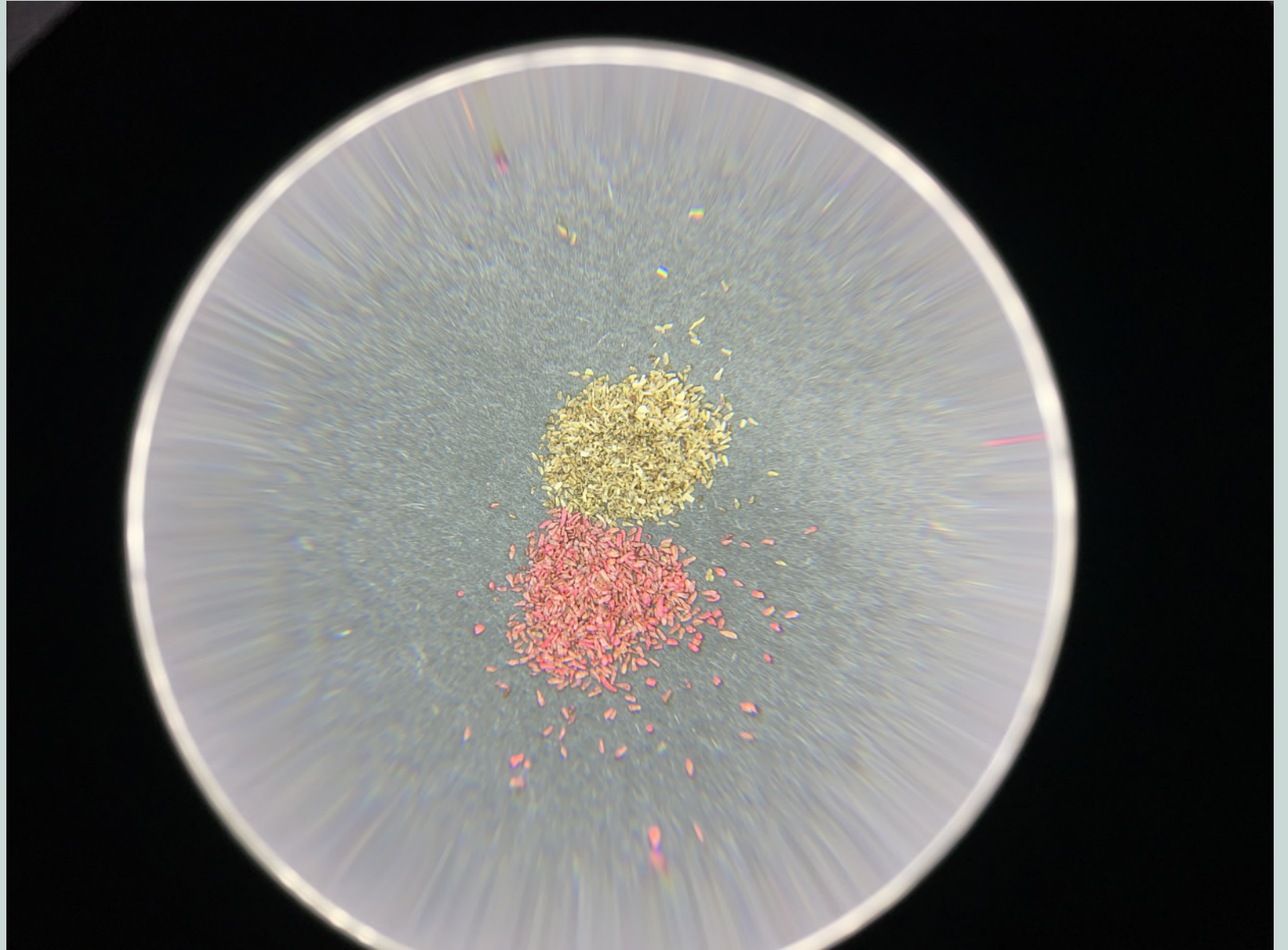


Seed pellets

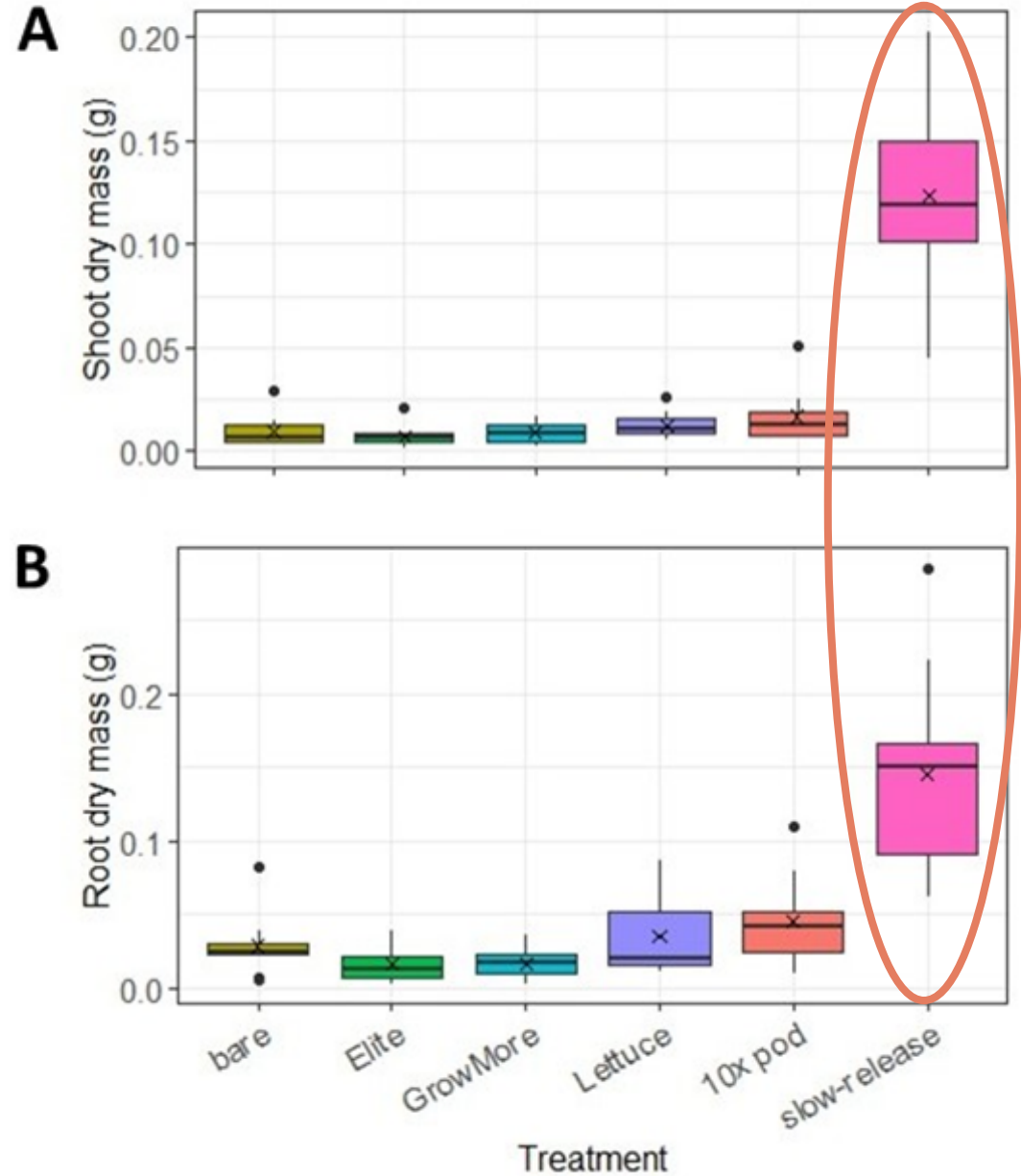
# Poor emergence from pellets



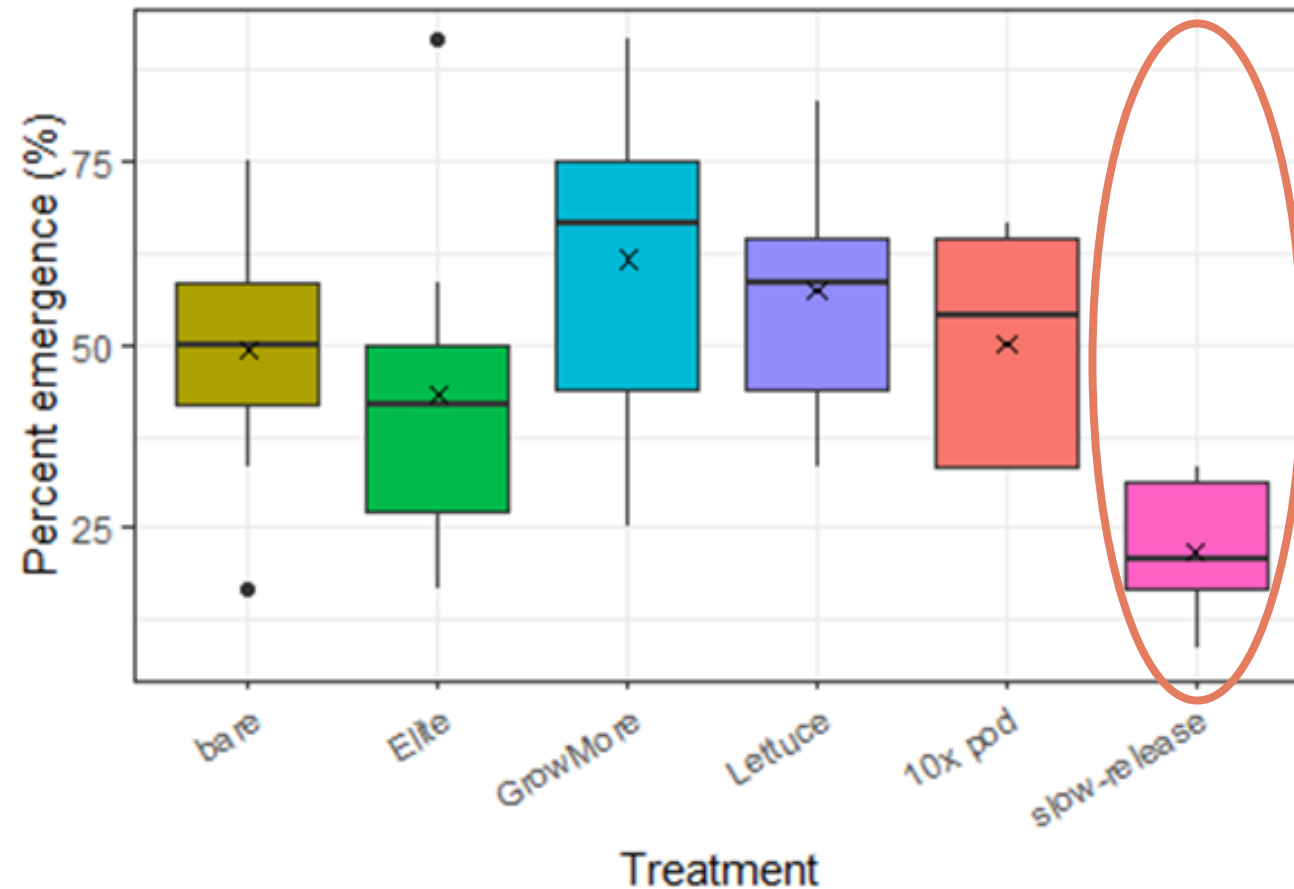
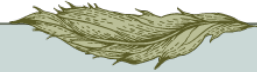
# Beyond pellets



Some  
technologies  
enhance  
root  
growth...

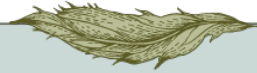


# But negatively impact emergence





# Testing these technologies in the real world

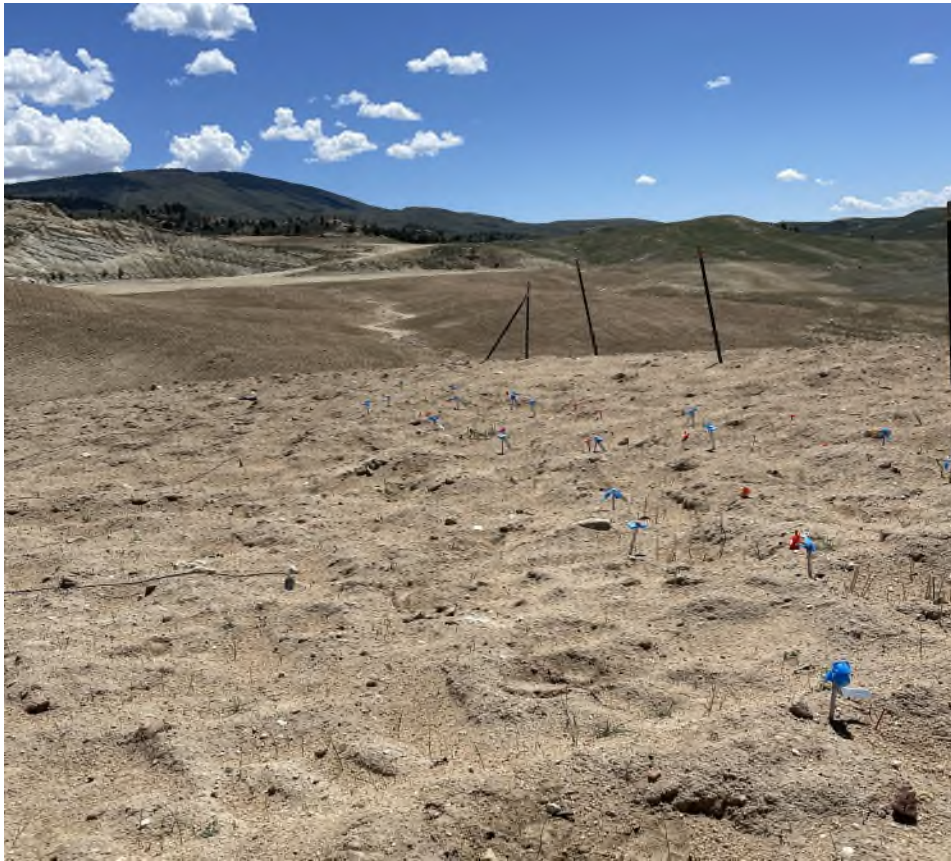


## McIntosh Pit

- Uranium mine
- Opened in 1950s
- Closed in 1982
- Actively being reclaimed
- Geomorphic reclamation
- No topsoil piles



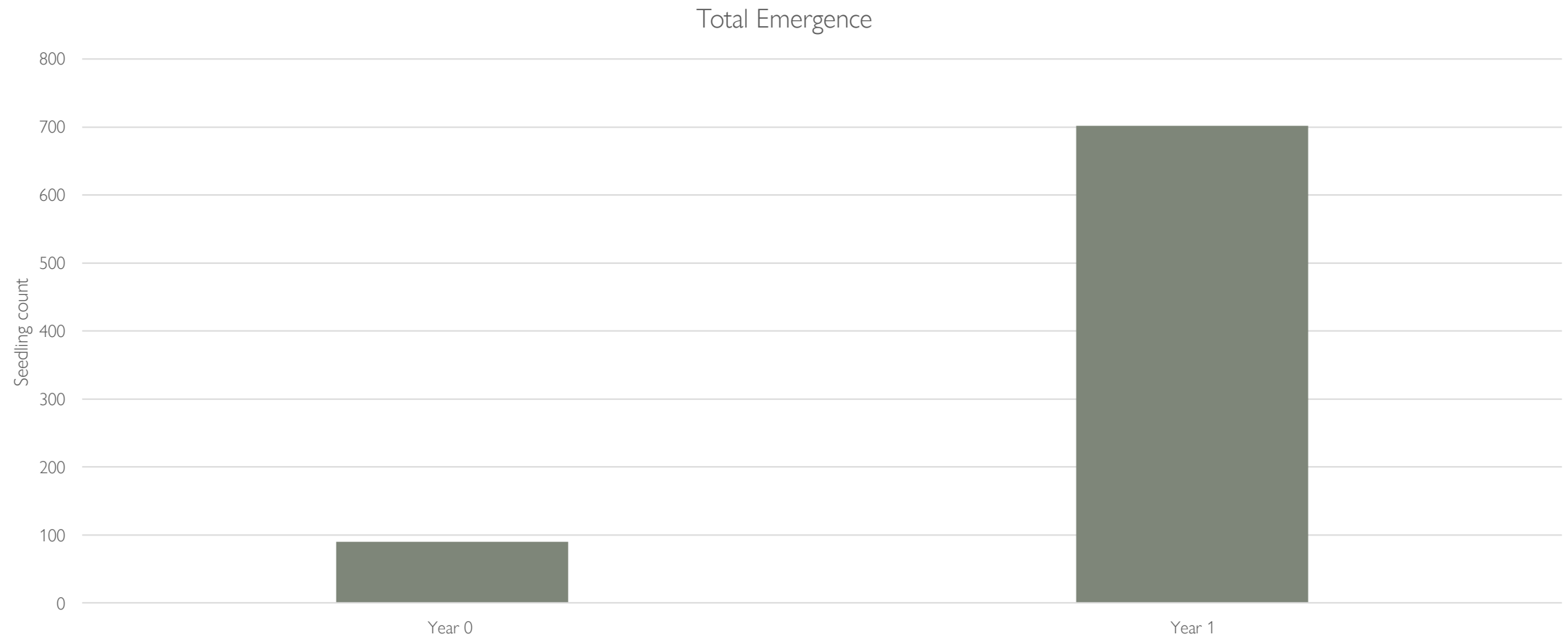
# Year 0 site



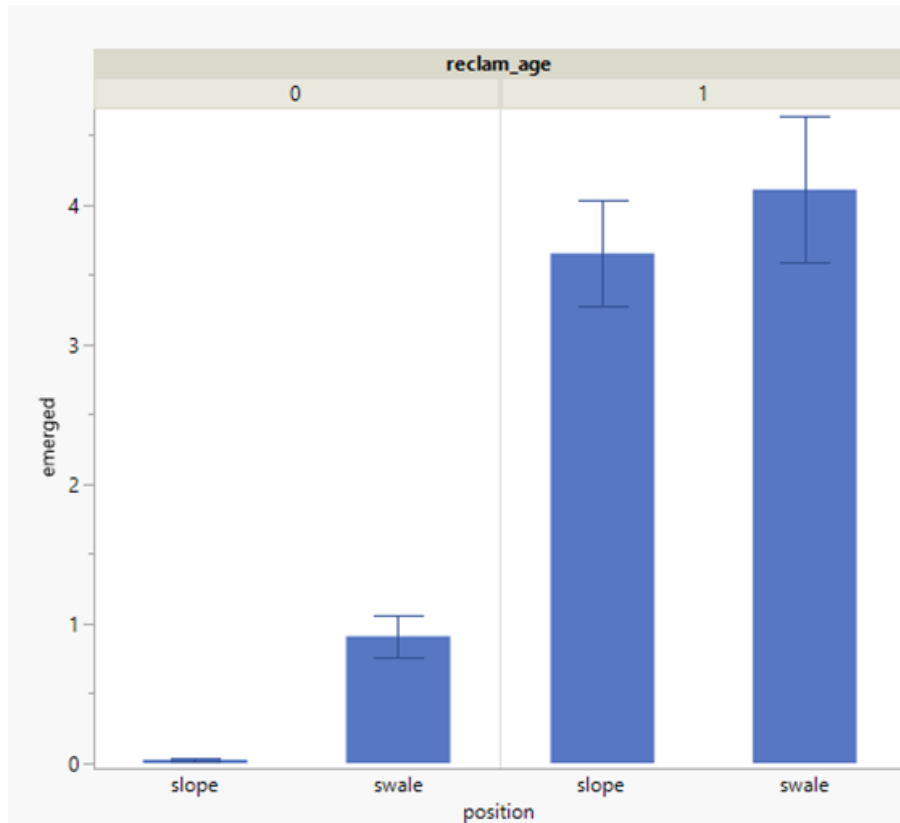
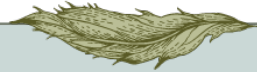
# Year 1 site



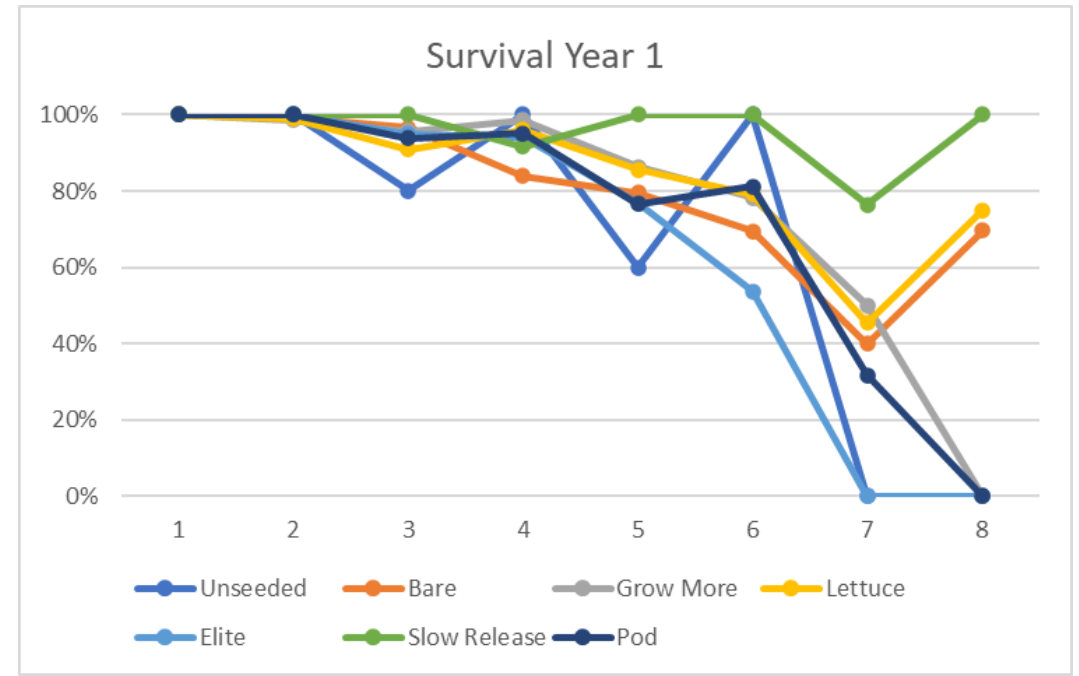
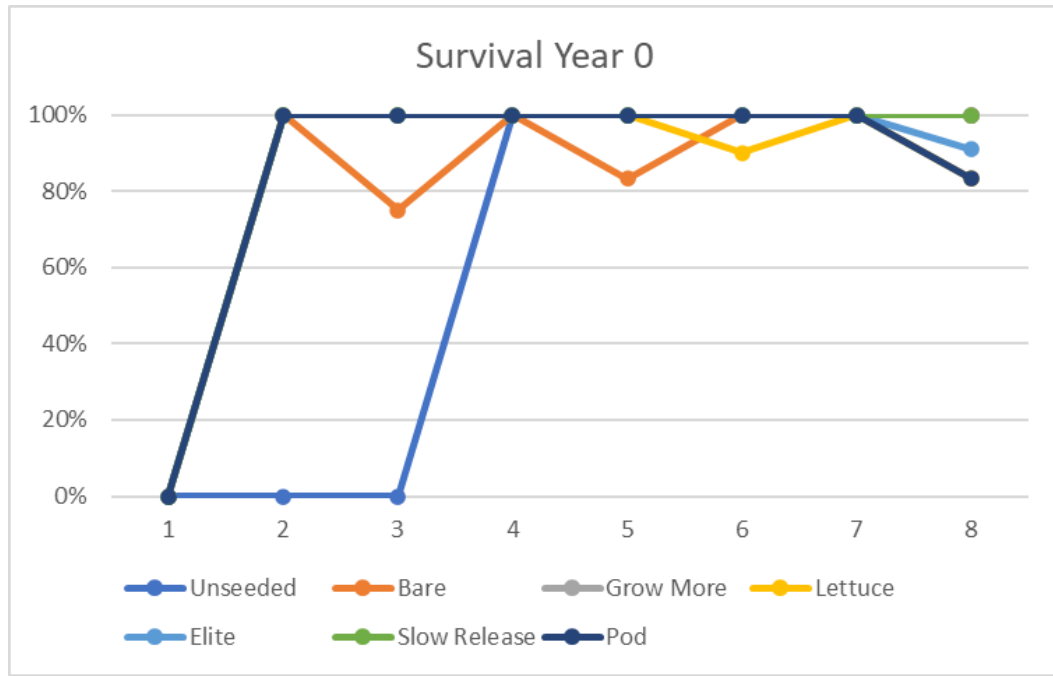
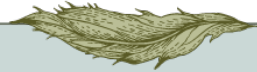
# Emergence is higher at year 1 sites



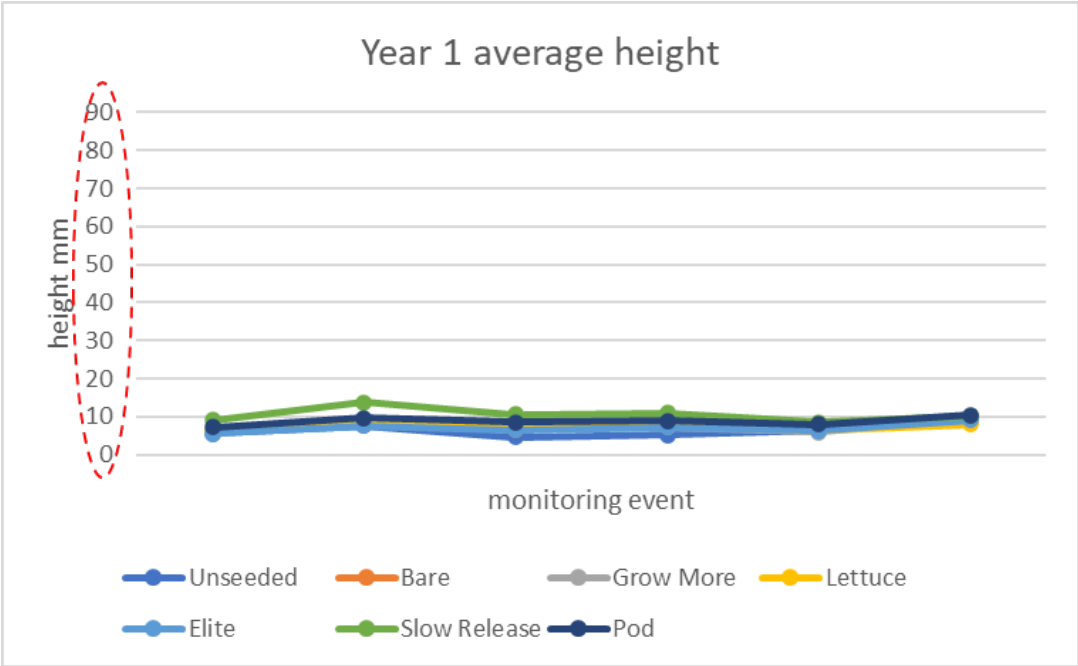
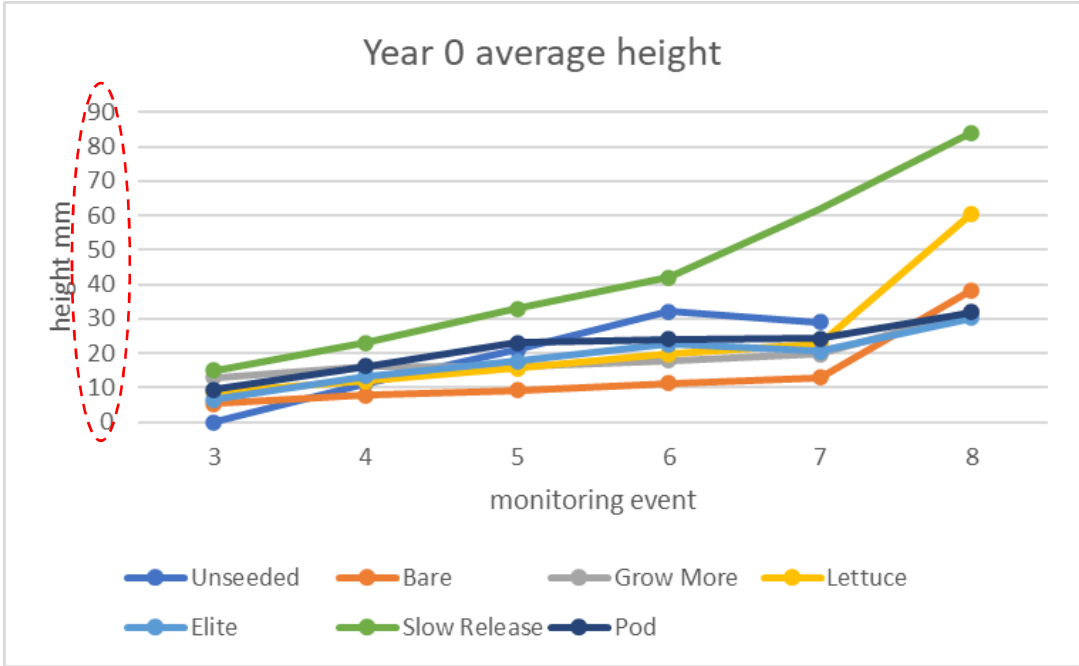
# Topography effects emergence at year 0 sites



# Survival is higher at year 0 sites



# Seedlings grow up to 10x larger at year 0 sites





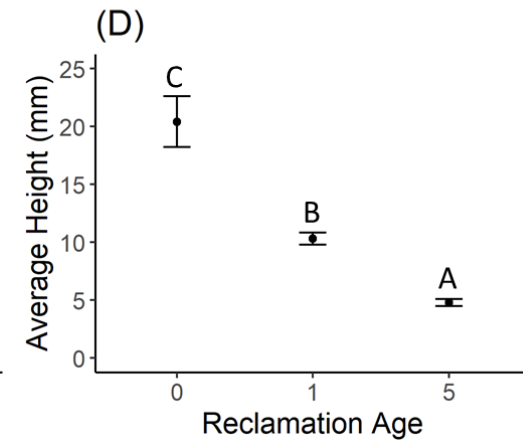
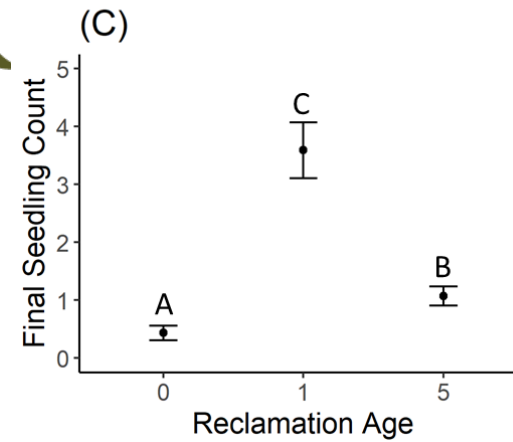
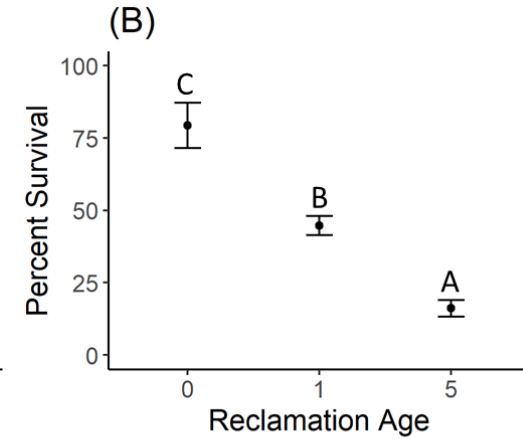
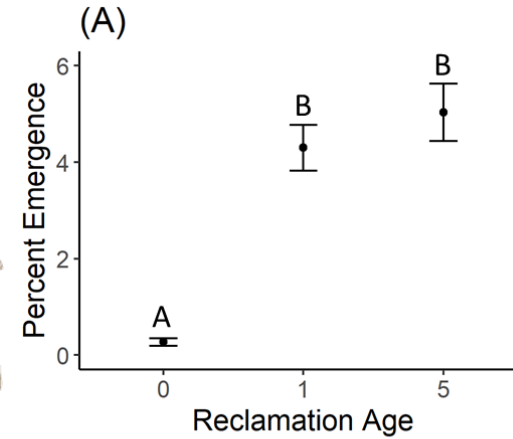
# Takeaways

- Mixed and weak effects of root enhancement technology on emergence, survival, and growth
- Some inhibited emergence but enhanced size
- Time since reclamation plays a large role in sagebrush establishment





More time since reclamation means more, smaller seedlings



# Implications for reclamation

- Approaches that increase emergence through increased soil stability and available soil moisture in Year 0 could lead to higher reclamation success
- Re-seeding one year after reclamation can be successful and is an opportunity to improve sagebrush establishment if initial seeding was unsuccessful



# Next steps



- Collect data from current field trials
- Develop new root enhancement technologies
- Lab and field trials





Thank you!

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Questions?