

Evidence for Long-term Persistence of Cultivars in Ecological Restoration

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BLM

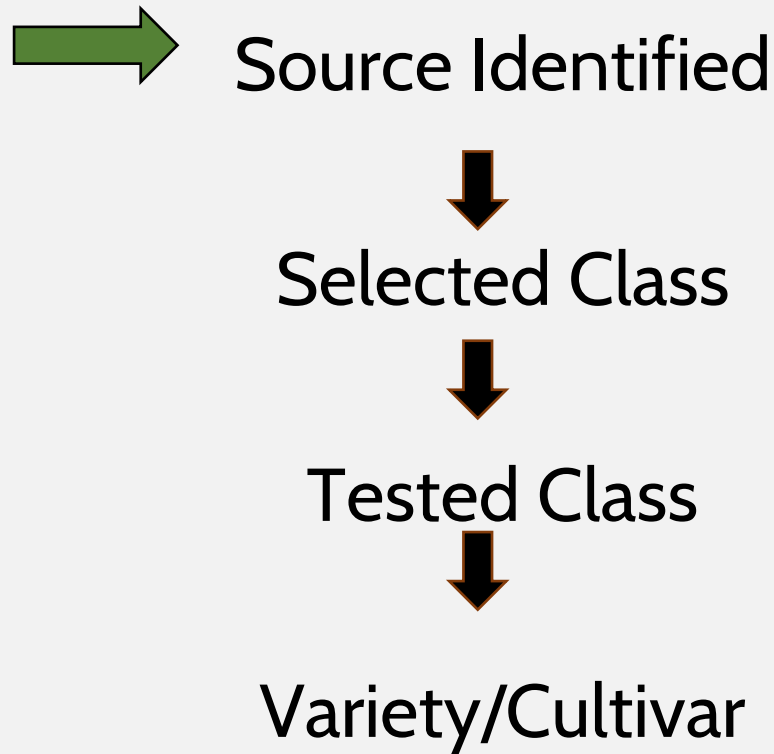
Ecological Restoration

The image shows a wide landscape under a clear blue sky. In the foreground and middle ground, there is a transition from a lush green field with yellow wildflowers on the left to a sparse, dry, and cracked soil area on the right. The background consists of rolling green hills. A semi-transparent text box is overlaid on the middle ground.

- Revegetation
- Source of plant materials?

Cultivars of native species

Plant Germplasm Development



Cultivar

“...a distinct, often intentionally bred subset of a species that will behave uniformly and predictably when grown in an environment to which it is adapted.”

Aubry C, Shoal R, Erickson V (2005) Grass cultivars: Their origins, development, and use on the national forests and grasslands in the Pacific Northwest. USDA Forest Service

“...an assemblage of cultivated plants that is clearly distinguished by any characters...and when reproduced...retains its distinguishing characters.”

USDA NRCS (2001) Glossary of Terminology Commonly Used in Mining and Reclamation Technology. TN – Plant Materials – 1-1.

Agronomic Seed Crop Traits	Native Plant Traits
No Seed Dormancy	VS. High Seed Dormancy
Rapid, Uniform Germination	VS. Staggered Germination
Fast Growing	VS. Slow Growing
Uniform Flowering	VS. Indeterminate Flowering
Uniform Seed Maturity	VS. Variable Seed Maturity
High Seed Retention	VS. Seeds Shatter Upon Ripening


Bartow, A. 2015. Seed Production Manual for the Pacific Northwest. USDA-NRCS Corvallis Plant Materials Center. Corvallis, OR. December 2015. 192p. (ID# 12767).

“Cultivar Vigor Hypothesis”

Cultivated varieties of native plants have greater biomass and an increased ability to capture resources, providing a competitive advantage relative to wild, local genotypes.

Wilsey BJ (2010) Restoration
Ecology 18: 628–637.



A wide, open grassland field with a fence line in the distance. The grass is a mix of green and yellowish-brown, suggesting a natural or semi-natural state. The sky is not visible, and the overall scene is a vast, flat expanse of land.

“Grass cultivars have been used in large quantities, often without an assessment of the consequences”

Aubry C, Shoal R, Erickson V (2005) Grass cultivars: Their origins, development, and use on the national forests and grasslands in the Pacific Northwest. USDA Forest Service

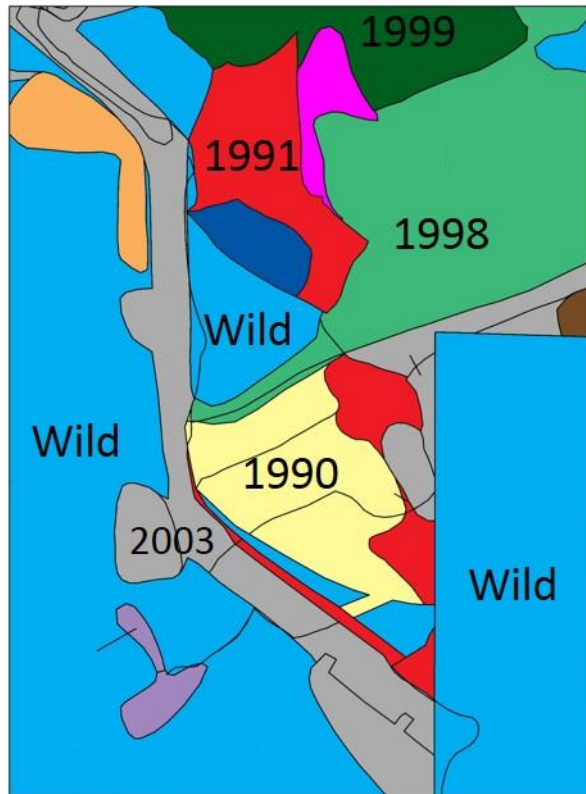
A wide-angle photograph of a grassy field. The foreground is filled with tall, green grasses. In the middle ground, there are patches of shorter, yellowish-brown grasses and small, dark shrubs. A thin, dark fence line runs horizontally across the upper third of the image. The background is a flat, green expanse that extends to the horizon under a clear sky.

**Do cultivars differ from wild
populations in competitive
ability?**

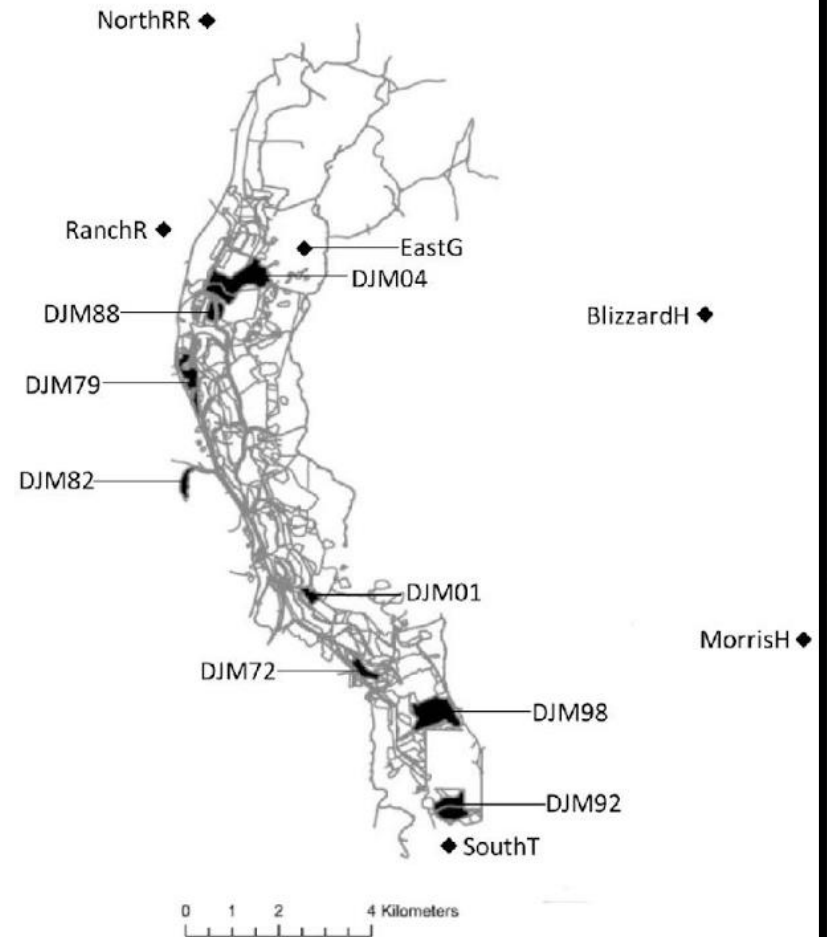
A wide-angle photograph of a grassy field. The foreground is filled with tall, green grasses. In the middle ground, there are patches of shorter, greener grass interspersed with small, dark shrubs. A thin, dark fence line runs horizontally across the upper third of the image. The background is a flat, open expanse of land under a clear sky.

Do cultivars persist in the environment?

Chronosequence



Dave Johnston Mine (DJM)



Pascopyrum smithii (Rydb.) A. Love Western Wheatgrass

- Cool season, C3
perennial, rhizomatous
grass



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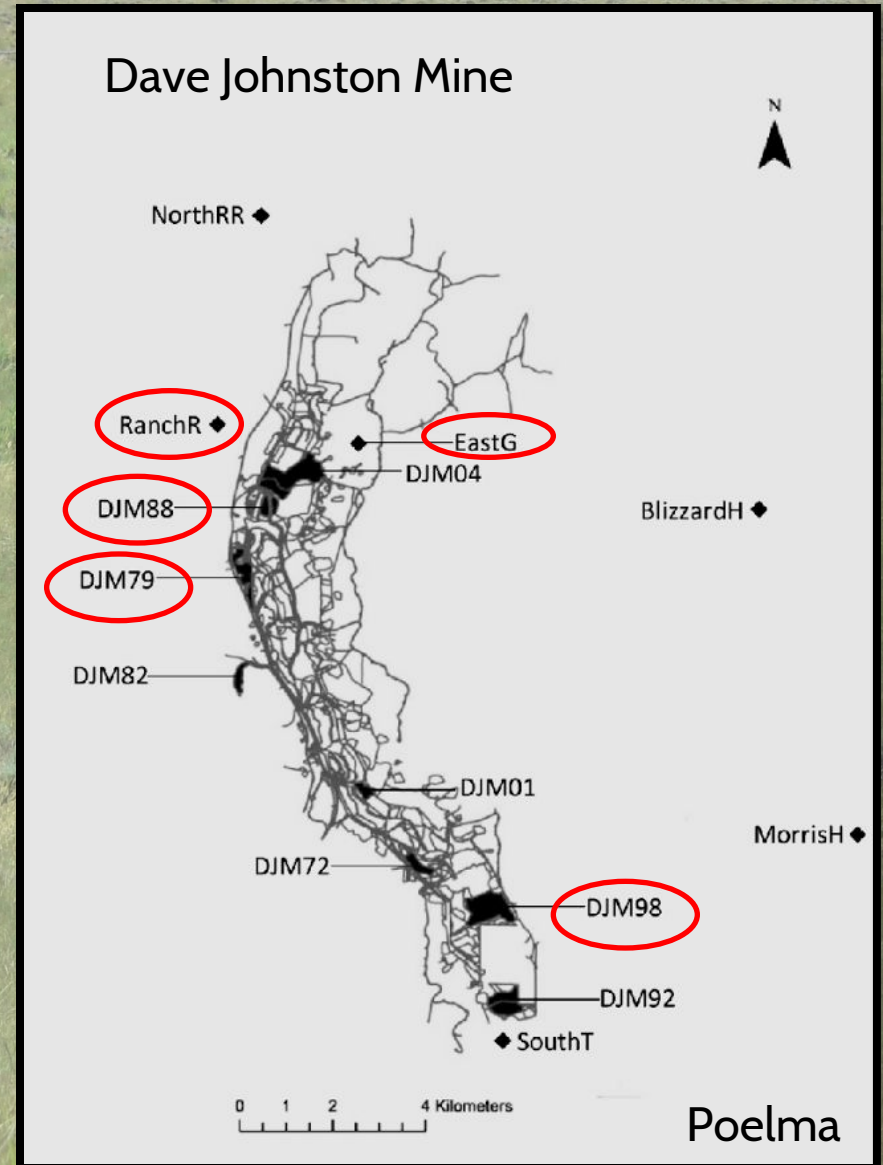
Line Drawing courtesy of USDA-NRCS
PLANTS Database / Britton, N.L., and A.
Brown. 1913. *Illustrated flora of the northern
states and Canada*, Bol.
1:256 <http://plants.usda.gov/>

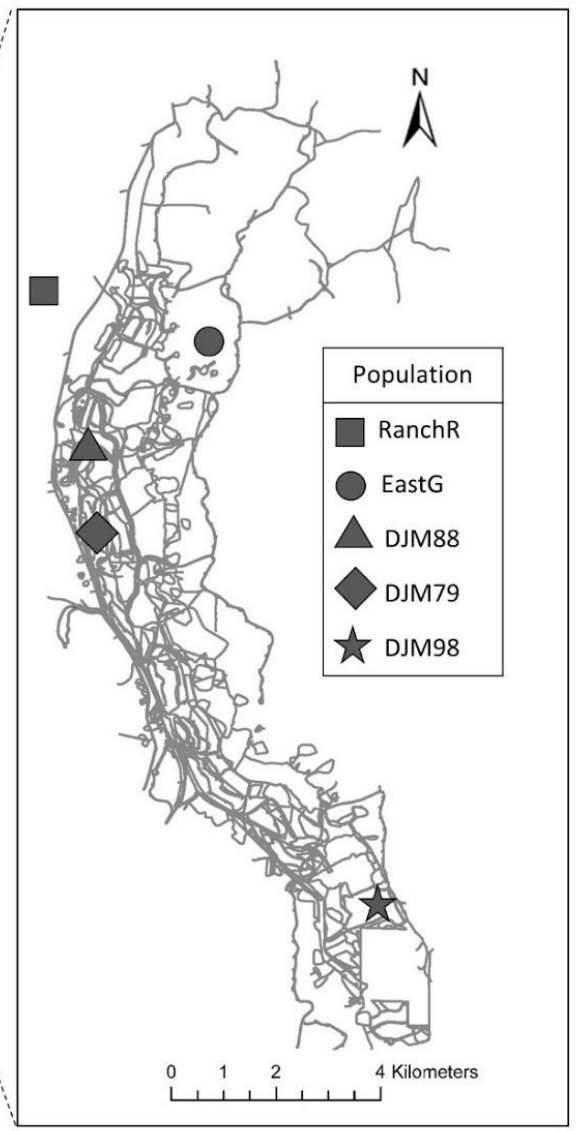
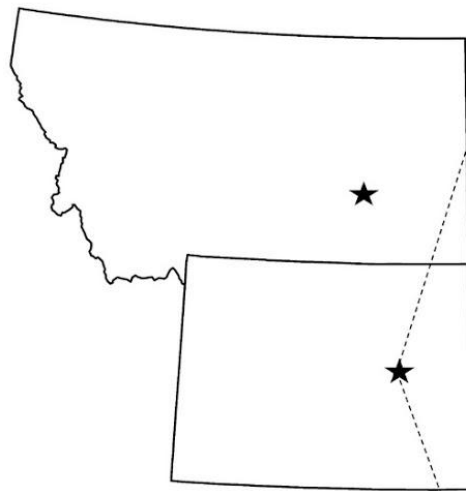




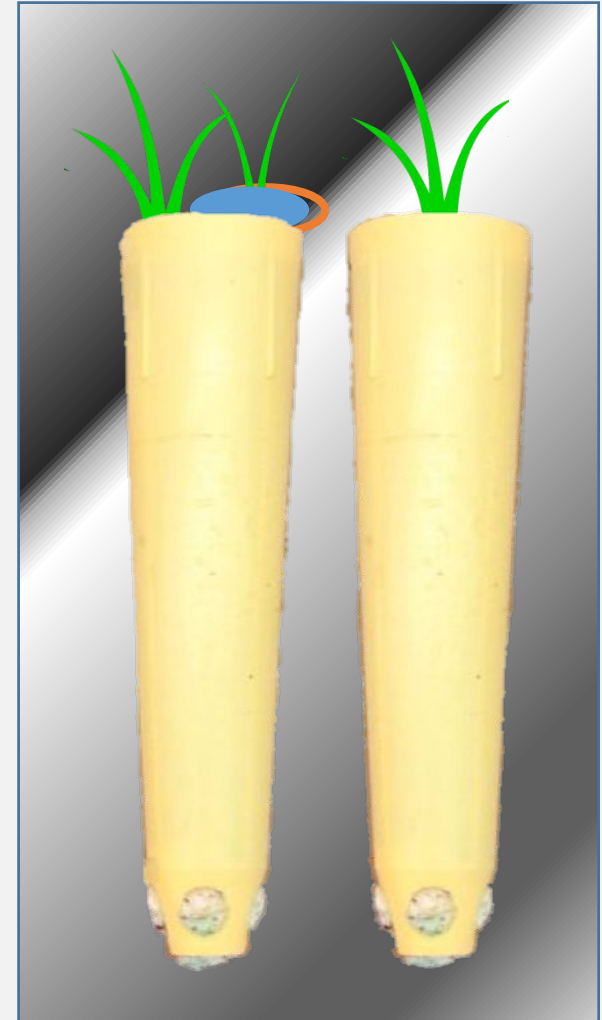
Source Populations

- 'Rosana' cultivar
Origin: Forsyth, MT
- Chronosequence
 - DJM79
 - DJM88
 - DJM98
- Wild populations
 - EastG
 - RanchR





Single vs. Competition Pots



Photos: M. Poelman

Methods



Photos: M. Poelman

Traits Measured

- Plant Growth (non-destructive)
- Final Biomass
- Seed Weight

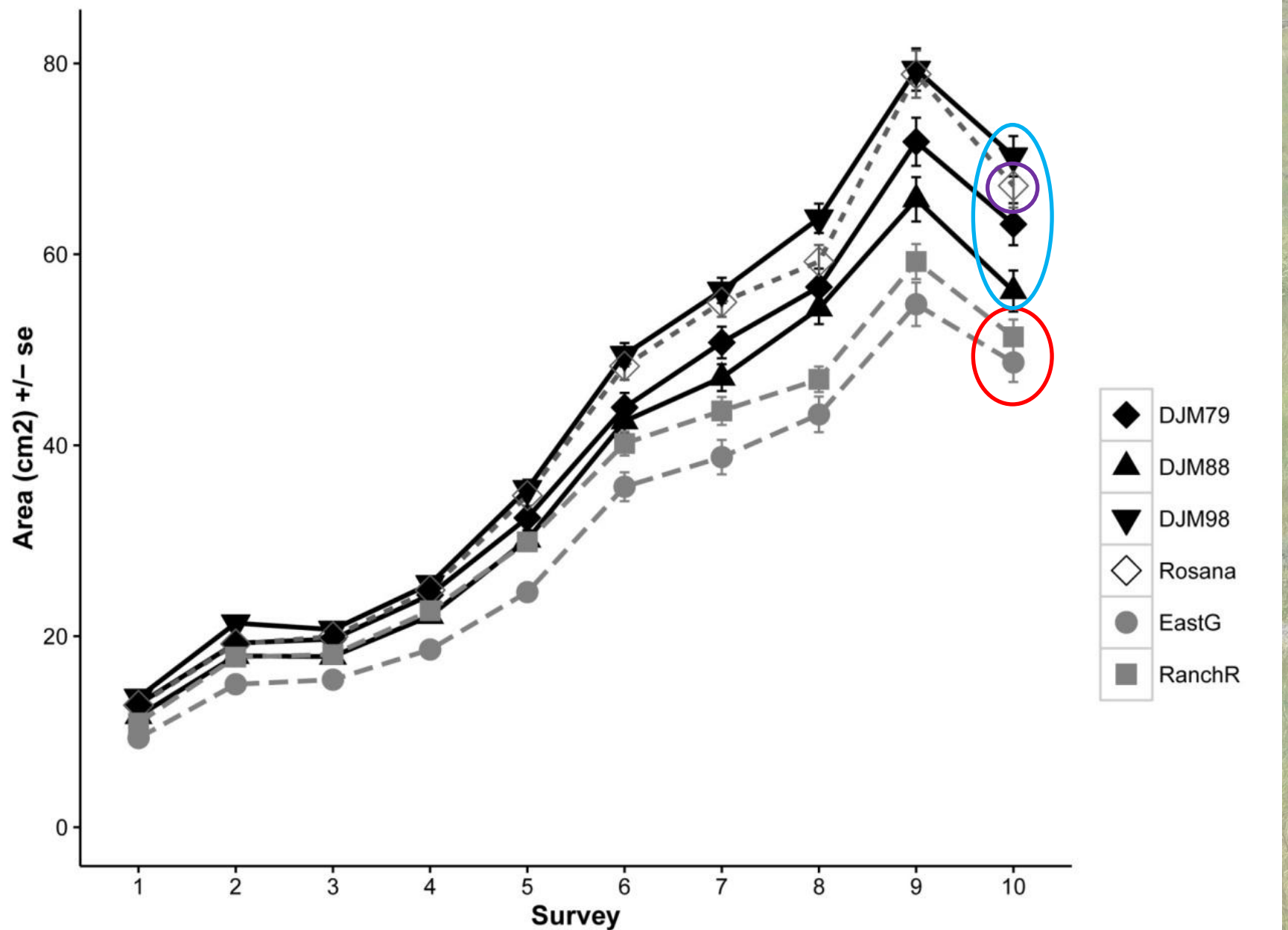


Results

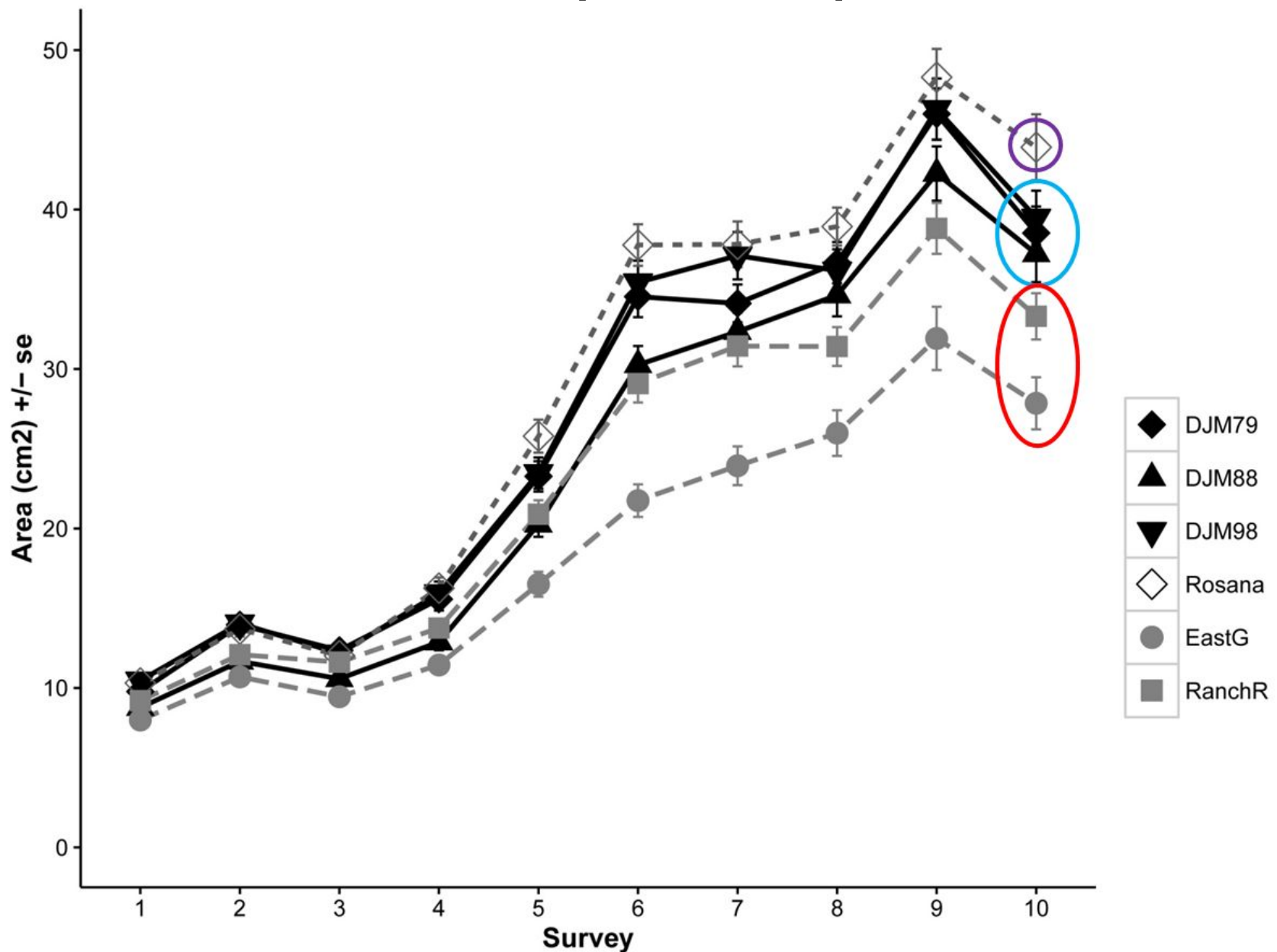


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Plant Growth : Single pots

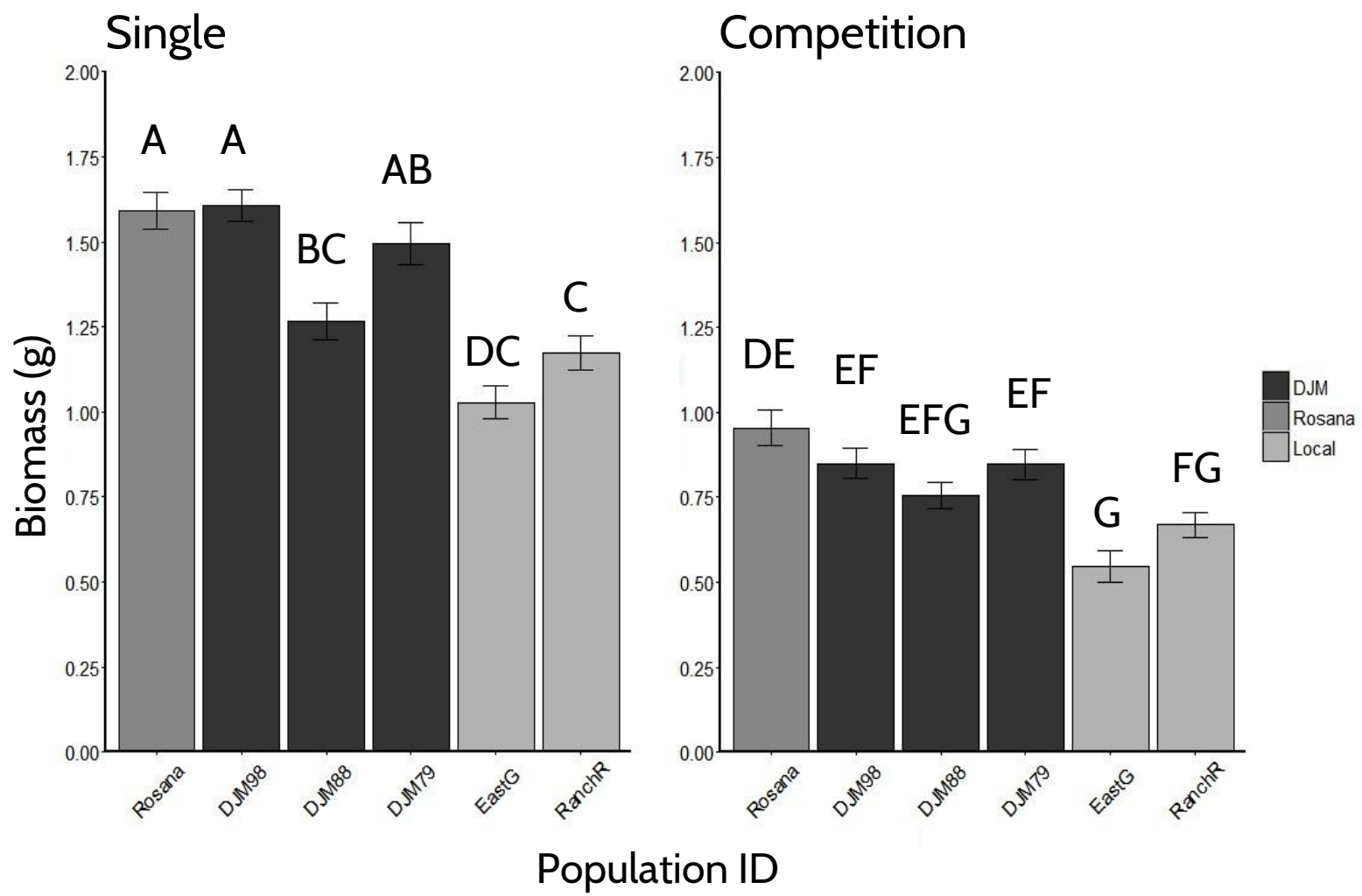


Plant Growth :Competition pots



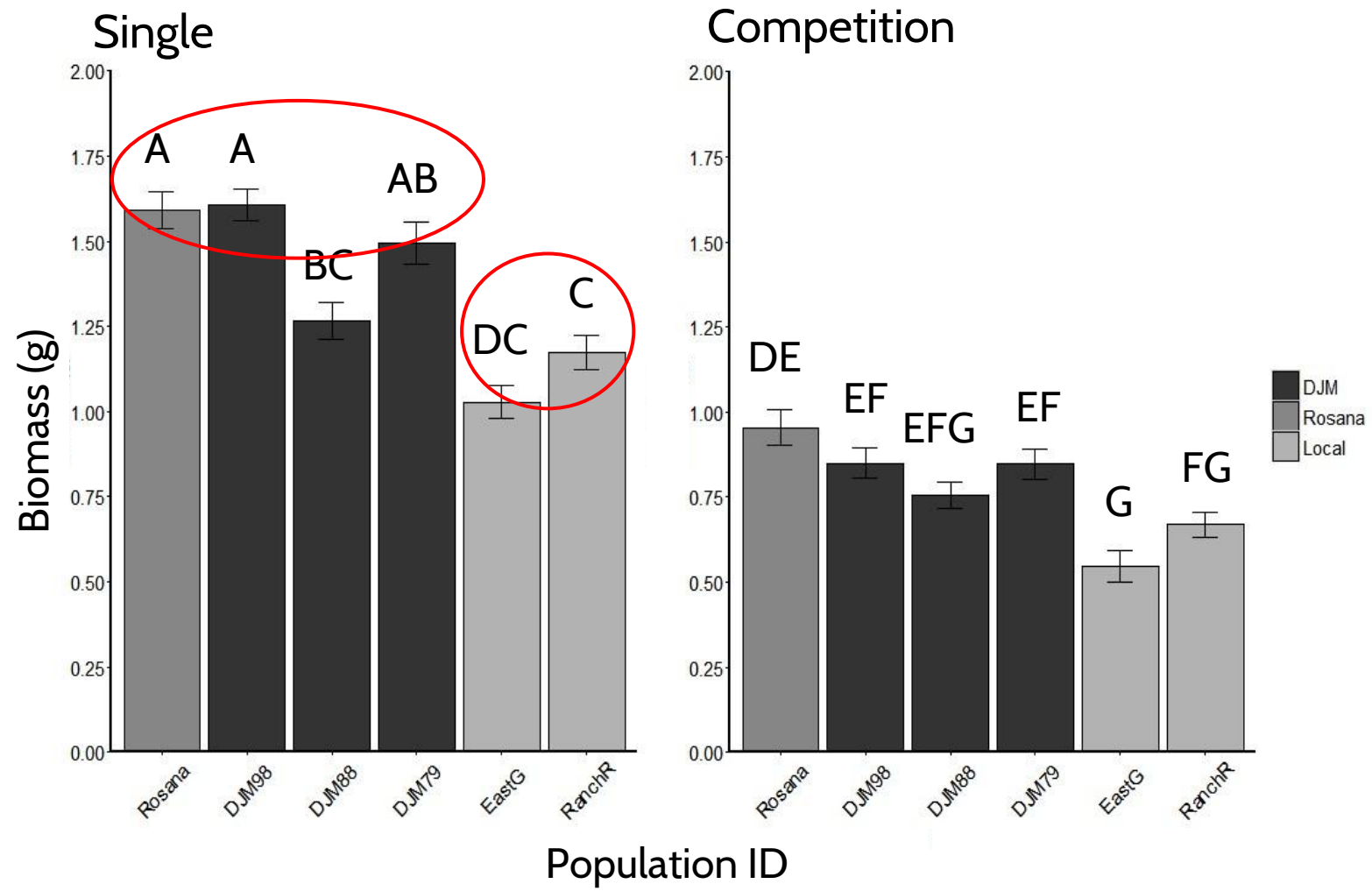
Different letters indicate significance at $\alpha=0.05$

Final Biomass



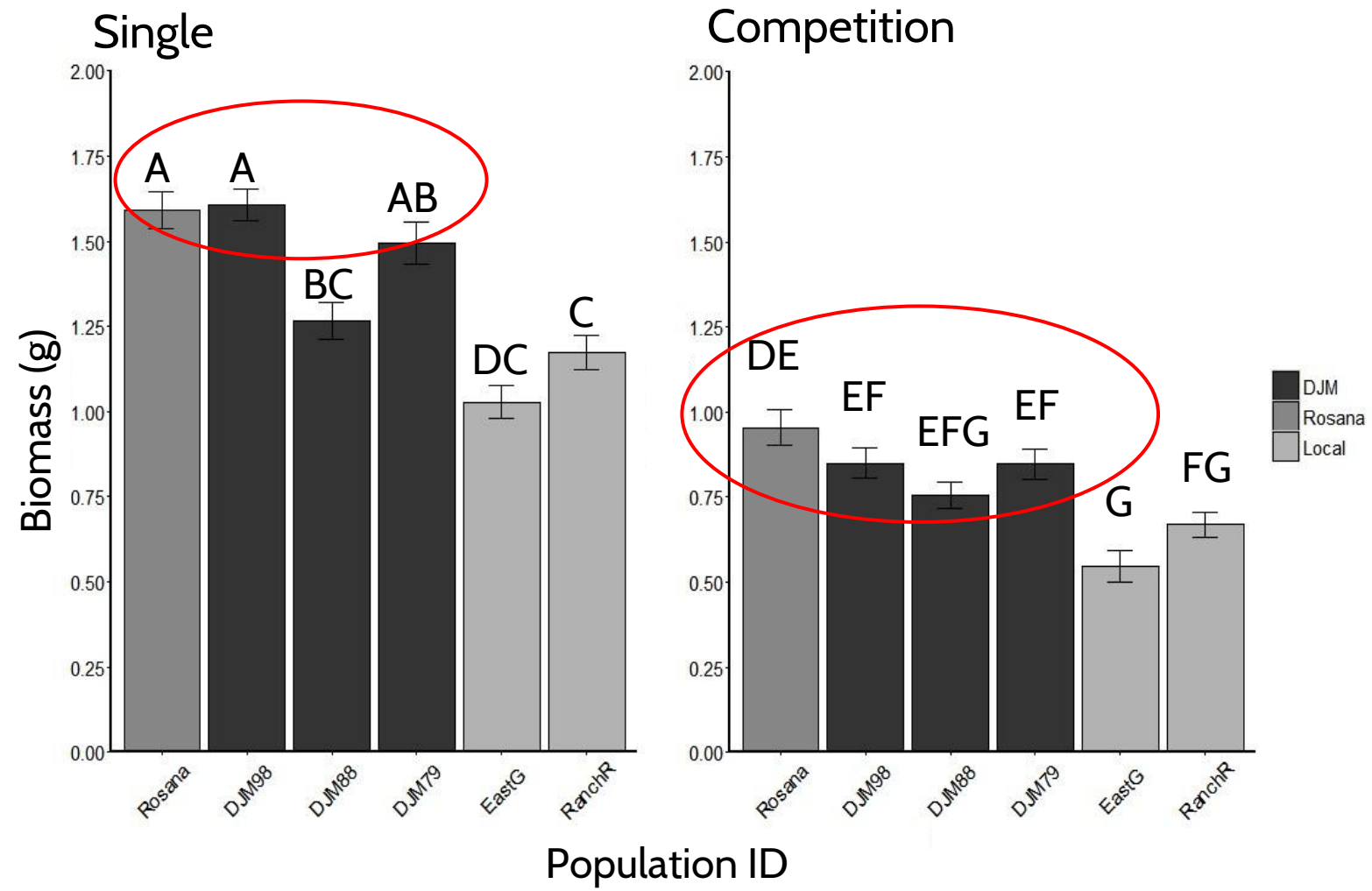
Different letters indicate significance at $\alpha=0.05$

Final Biomass



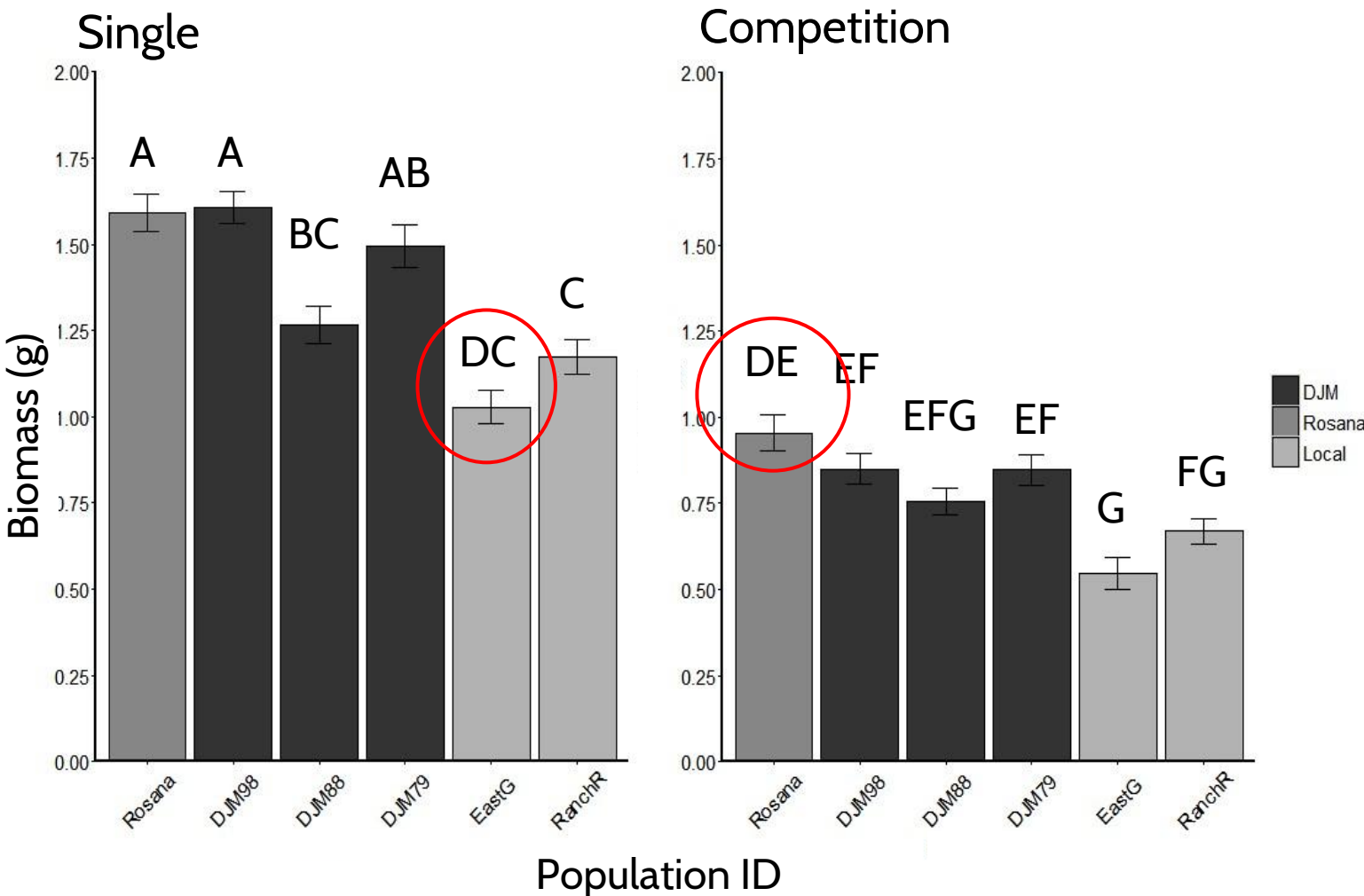
Different letters indicate significance at $\alpha=0.05$

Final Biomass



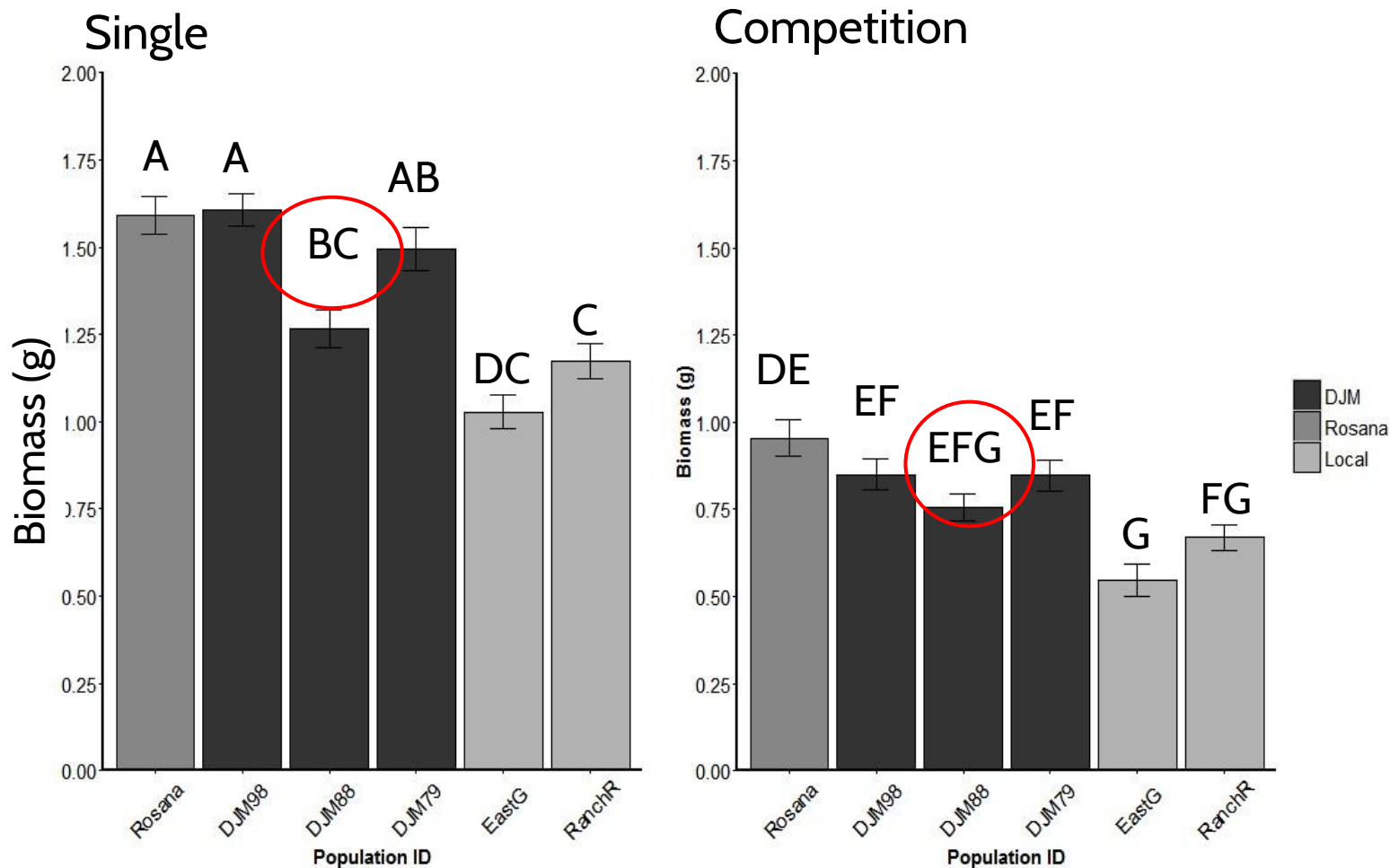
Different letters indicate significance at alpha=0.05

Final Biomass



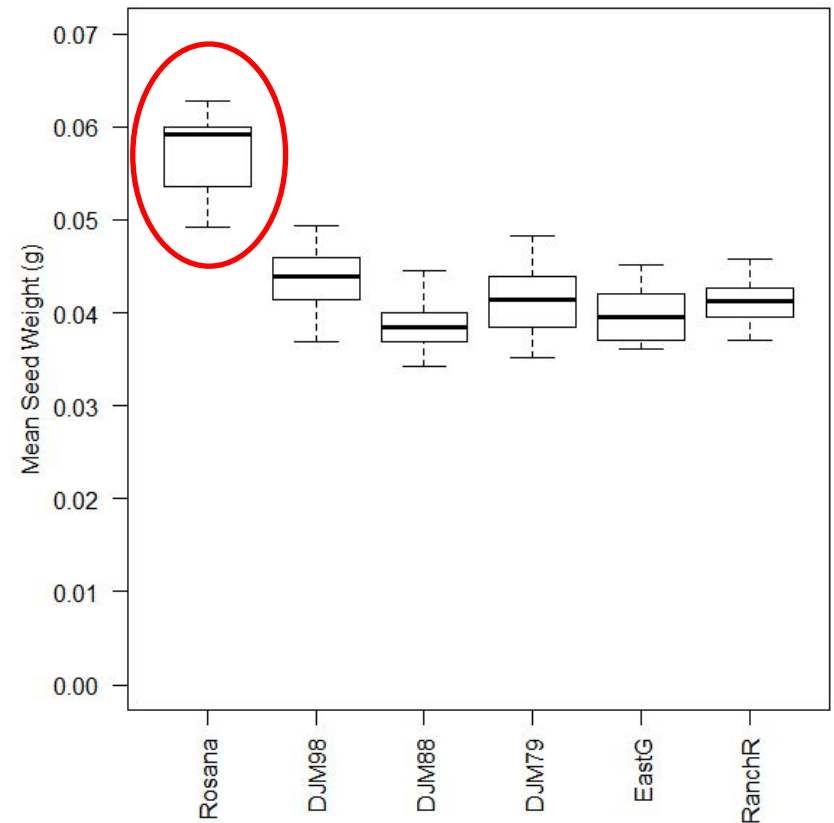
Final Biomass

Different letters indicate significance at $\alpha=0.05$



Seed Weight : Maternal Effects

- Rosana seeds were significantly larger than all other sources
- DJM plants retained vigor in other traits
- DJM sources were not different from wild seed sources



Genotyping by Sequencing

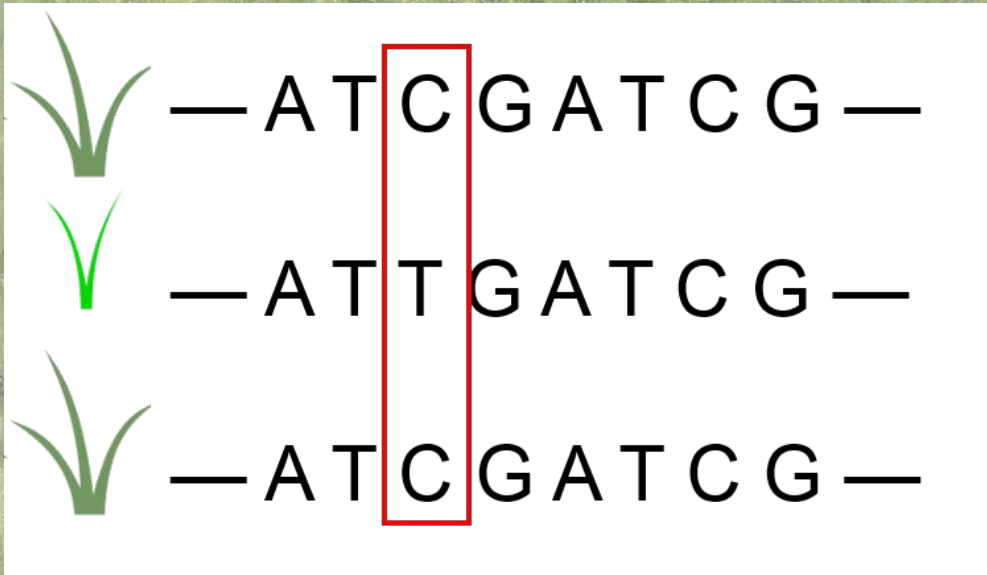
- Isolated genomic DNA
- Analyzed SNP's



North Central Regional Plant Introduction Station			
Accession: PI 433949	Lot: 98nce051	Office Use No: 1	
Order No: 262354	Item No: 1		
Investigator: Kristina Hulford – University of Wyoming – Department of Ecosystem Science and Management			
Funder: Kristina Hulford – University of Wyoming – Department of Ecosystem Science and Management			
pi LD131			
Order Wt (grams): 1.2			



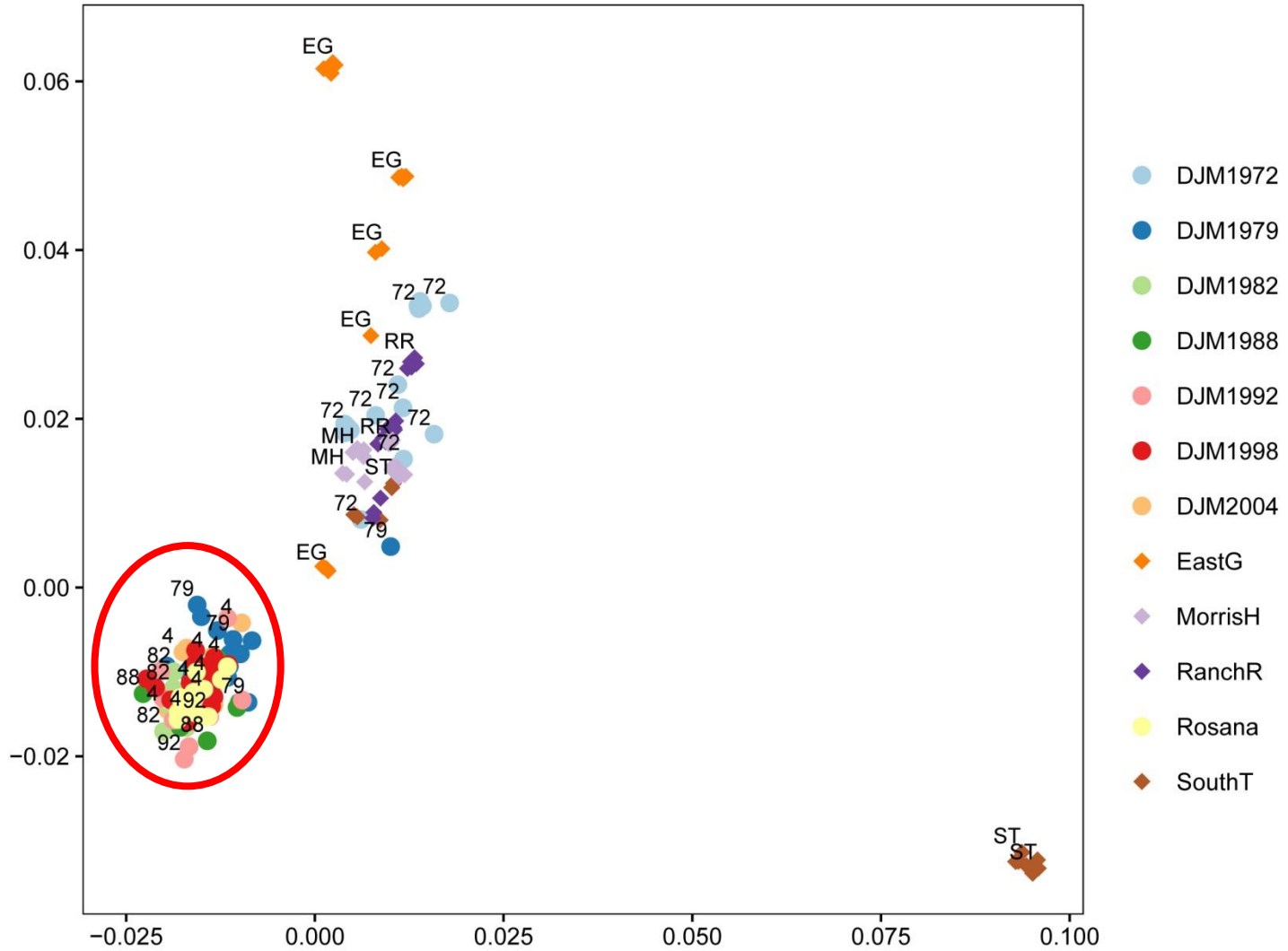
Single Nucleotide Polymorphisms



Western Wheatgrass
n=6400 SNPs

Western Wheatgrass

PCo 2 (21.6%)



Western Wheatgrass



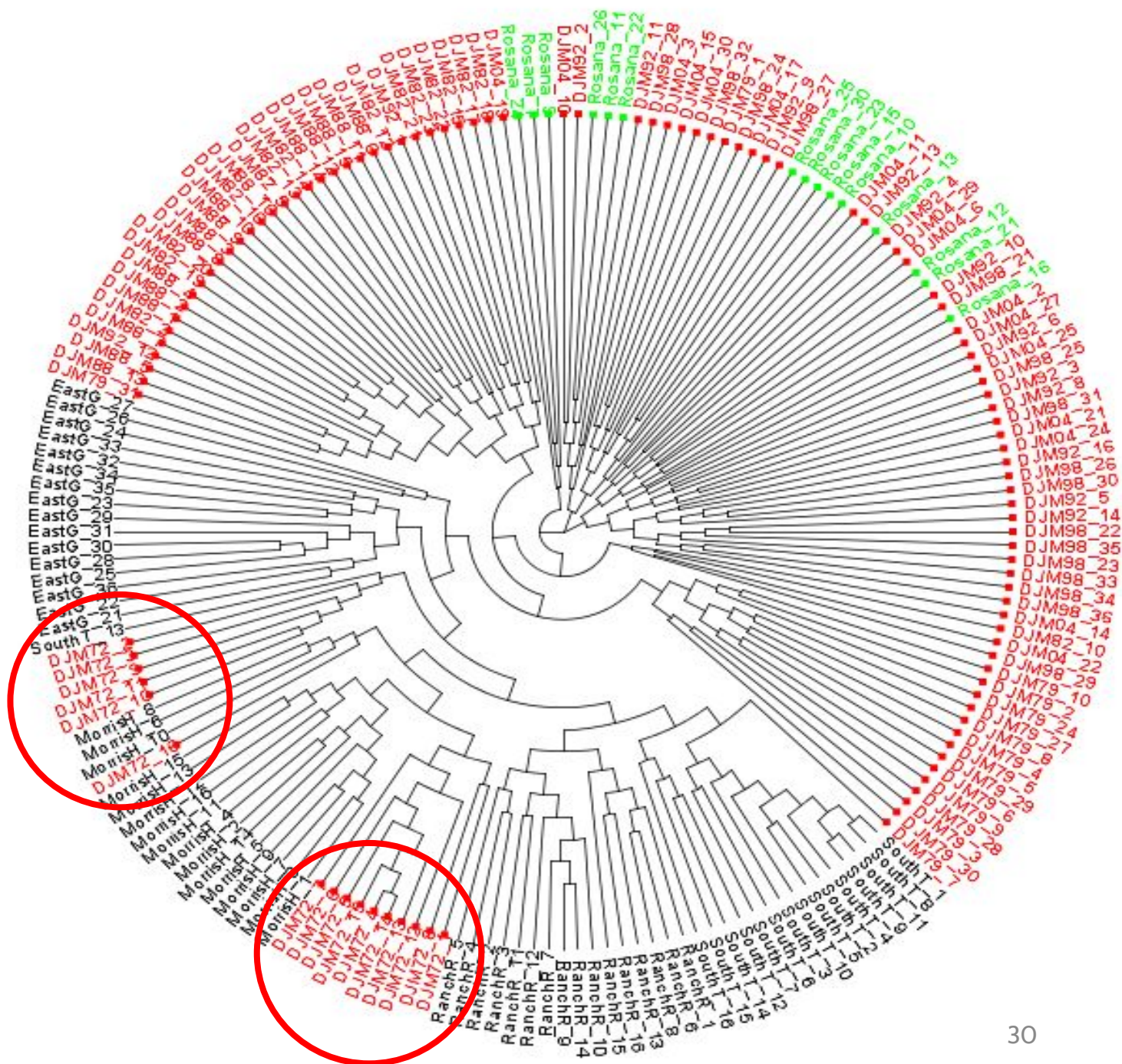
Chronosequence



Cultivar



Wild



- The cultivar Rosana has a competitive advantage over wild populations
- Cultivated traits and genotypes persist over time at planted sites

Chronosequence populations were either similar to Rosana or intermediate among cultivar and wild sources



- Evidence of cultivar vigor
- Cultivars of western wheatgrass persist on the landscape for extended periods of time (> 20 years)



- Agronomic traits are not necessarily disadvantageous at restoration sites
- “Genetically appropriate” may mean different things to different practitioners
- Research needed to understand consequences of agronomic traits in restored environments



Acknowledgements

Glenrock Coal Company

Chet Skilbred

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PacifiCorp Power

Aron Anderson

Laine Anderson





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>

