Plasticity of *Pleuraphis jamesii* across a monsoon gradient: A field trial at the Canyonlands Research Center

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Pleuraphis jamesii (Galleta grass)

- C₄ photosynthesis (warm season grass)
- Rhizomatous
- Desirable forage for livestock and native herbivores
- Restoration: ground cover and erosion control
Seasonal Ecohydrology of the Southwest

Spring Dominated

Monsoon Dominated

Modified from Schwinning et al. (2008)
Seasonal Ecohydrology of the Southwest

Modified from Schwinning et al. (2008)
**P. jamesii in Moab, UT**

**Main Research Question:**
How do populations of *P. jamesii* across the SW monsoon gradient respond to different precipitation regimes?

- **Distribution of *Pleuraphis jamesii***

- **Graph:**
  - Y-axis: Greenness
  - X-axis: Month (2014)
  - Data points for daily precipitation (mm)

- **Note:**
  - It acts like a cool season grass.
  - But it can green up again in the summer like a warm season grass.
Selecting *P. jamesii* populations for the common garden study

**Locations from herbarium records**

- **Monsoon intensity** = \( \frac{\text{Monsoon precipitation (JAS)}}{\text{Annual precipitation}} \)

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**Viva' James' galleta**

- *Pleuraphis jamesii* Torr.

- **Description**
  - "Viva' James' galleta" was released in 1989 as a new release between New Mexico State University's Las Lomas Agronomic Sciences Center and the USDA/ARS Los Lunas Plant Materials Center.

- **Uses**
  - It is well adapted to severe conditions, well adapted to mild winters, and well adapted to non-severe conditions, well adapted to low winter temperatures, well adapted to high winter temperatures, well adapted to high winter temperatures, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures.

- **Adaptation and Use**
  - It is well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures, well adapted to non-severe conditions, well adapted to mild temperatures.

- **Ecological Conditions**
  - "Viva' James' galleta" is well adapted to mild conditions.
Selecting *P. jamesii* populations for the common garden study

**Locations from herbarium records**

All sites have same mean annual precipitation (~227 mm yr\(^{-1}\)), but differ in pattern.
Research Questions and timeline

Questions
1. Population responses: Local adaptation vs. phenotypic plasticity?
2. Intraannual precipitation pattern: Which monsoon intensity is most favorable for plant performance?
3. Population x precipitation: Is there an interaction between population and intraannual pattern?

Timeline
• Fall 2014 – site construction, collect and transplant individuals
• Spring/Summer 2015 – establish individuals, collect pretreatment data
• Spring/Summer 2016 – begin treatments, measure responses: soil moisture, ecophysiology, phenology, morphology, biomass
Common garden at the Canyonlands Research Center

www.canyonlandsresearchcenter.org
Experimental Design

- **Site Level**: 4 greenhouse blocks
- **Shelter Level**: 3 treatments/block, 2 reps/treatment
- **Plot Level**: 4 populations/plot, 3 reps/population
Cleared and leveled site
Trenched to hydrologically isolate plots
Collected *P. jamesii* individuals for the common garden study.

Collected **72** individuals from each population (288 total).
Transplanted to Common Garden
Fall 2014
Evaluating clonal propagation in 2015

94% survived transplanting
68% successfully established

Establishment (% green)

Month

Apr  May  Jun  Jul  Aug  Sep

Delta  Moab  Chaco  Sevilleta
Population differences during pretreatment year?

Phenological Stages:
0 = senesced, 1 = green leaves, 2 = boot, 3 = flowering
(only includes established individuals)
Population differences during pretreatment year?
# Treatments 2016

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Spring ppt (mm)</th>
<th>Monsoon ppt (mm)</th>
<th>Total ppt (mm)</th>
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</thead>
<tbody>
<tr>
<td>Spring Dominated</td>
<td>120</td>
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<tr>
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<td>Monsoon Dominated</td>
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<td>120</td>
<td>160</td>
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Questions?
Comments?