Does Seed Source Matter in the Post-Fire Revegetation of *Elymus multisetus* in the Great Basin?

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INTRODUCTION

Very few local adaptation experiments have been conducted for plant populations in the Great Basin. Even fewer are performed in field common gardens. Most revegetation seeding projects use non-local seed. The effect of seed source on revegetation success has not been examined in the Great Basin.

Do *Elymus multisetus* (squirreltail) seedlings from a local-wild source outperform regional-farmed sources in a post-fire revegetation establishment trial in the Great Basin?

Seeds attached to toothpicks & ready for sowing

METHODS

On 20 November 2008, 250 seeds from four seed sources (1000 seeds total) were directly sown in the field. Seed sources include the following:

- **Local**—G_0 collected within 0.25 mile of the study area
- **California**—G_0 collected from Tehama County, CA and G_1 farm-grown in Yolo County, CA
- **Oregon**—G_0 collected from Jefferson County, OR and farm-grown in Franklin County, WA (generation status unknown)
- **Idaho**—G_0 collected from Gem County, ID and G_1, G_2, and G_3 farm-grown in Utah County, UT

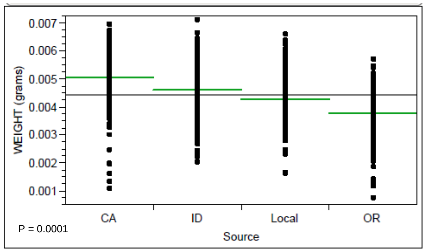
Prior to planting, there was no pregermination treatment (i.e. priming). Each seed was weighed and then glued to a toothpick for sowing and tracking. Seeds were planted in a complete randomized design and spaced 1m apart. During sowing, some seeds were physically touching an extant plant. To facilitate subsequent analysis of competition effects, competition status was noted for each affected seed.

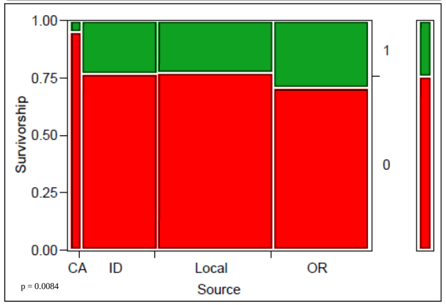
Phenology, growth, and survivorship measurements were taken from November 2008 through September 2009. Seedling emergence was tracked weekly from November 2008 through April 2009. Survivorship was monitored monthly from April-September 2009. Measurements of leaf length and quantity were taken monthly during the active growing season—May-September 2009. Since leaf length is strongly correlated to aboveground biomass, it served as a proxy for biomass. Due to the large number of germinating individuals, a random subsampling of leaf measurement was conducted in May and June. By July, the number of surviving plants was severely reduced and a census was conducted.

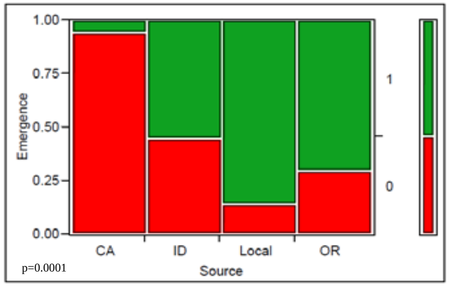
All analysis was performed in JMP 7.0.2 (SAS Institute, 2007). Outliers with values exceeding three standard deviations from the mean were excluded from analysis. Emergence and survivorship data were analyzed with both univariate and multivariate $\chi 2$ tests. Means of seed weight, emergence date and monthly leaf length measurements (May, June, & July) by seed source were compared using student's t test. For each of these five measurements, ANOVA was also conducted, with seed source as a fixed factor. For emergence date, seed weight (random) and competition status (fixed) were added to the ANOVA model. For leaf length, days to emergence (random) was also included.

RESULTS

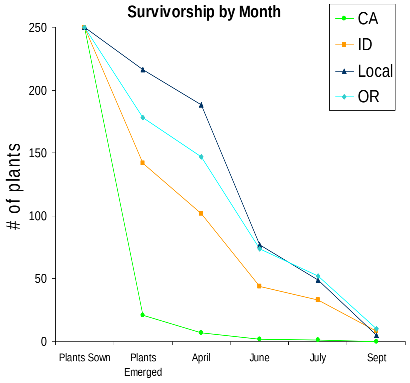
- Seed weight varies by seed source (p = 0.0001)
- Higher emergence percentage with:
  - Local seed source (p <.0001)
  - No direct competition (p=0.0646)
  - Higher seed weight (p=.0006)
- Earlier emergence with:
  - Local seed source (p <.0001)
  - No direct competition (p=0.0015)
  - Higher seed weight (p=0.0689)
- Higher survivorship through July with:
  - Oregon seed source (p =0.0084)
  - Lower seed weight (p=0.0466)
  - No correlation to competition status
- No significance correlations to September survivorship
- Leaf length:
  - Strong correlate to above-ground biomass
  - July mean leaf length varies by seed source (p = 0.0411)
  - Oregon seed source produce greatest total leaf length



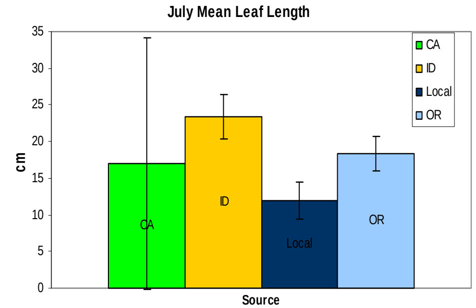


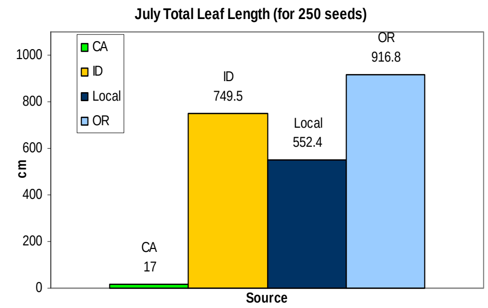


RESULTS—Continued



Source	CA	ID	Local	OR
Plants Sown	250	250	250	250
Plants Emerged	21	142	216	178
% Emergence	8.40%	56.80%	86.40%	71.20%
April # of Plants	7	102	188	147
April % Survivorship	33.33%	71.83%	87.04%	82.58%
June # of Plants	2	44	77	74
June % Survivorship	9.52%	30.99%	35.65%	41.57%
July # of Plants	1	33	49	52
July % Survivorship	4.76%	23.24%	22.69%	29.21%
Sept # of Plants	0	8	5	10
Sep % Survivorship	0.00%	5.63%	2.31%	5.62%





CONCLUSIONS

This experiment provides only mixed support for the possibility of local adaptation in *Elymus multisetus* in the Great Basin. Nonetheless, it can still be inferred that seed source is an important factor in seedling establishment and performance of *Elymus multisetus*. Seedling survivorship is an important component of fitness, though long-term survival may data may provide different results. The differential seedling establishment success exhibited across seed sources can be taken as indirect evidence for overall fitness differences between populations. Certain populations may possess adaptive traits that allow for enhanced performance under post-fire revegetation conditions.

More testing of the scale of local adaptation in perennial bunchgrasses in the cold desert is warranted. Furthermore, the decision to introduce regional, farm-grown seed in Great Basin restoration sites should be accompanied by either review or field evaluation of the performance of each seed source under similar conditions to proposed revegetation site. The introduction of farm-grown seed may significantly impact local population genetics.

SUBSEQUENT POSSIBLE RESEARCH

- Investigate possible differences in seed quality by source
- Conduct reciprocal transplant establishment experiments with wild seed at differing Great Basin sites and elevations
- Isolate the effects of commercial production and seed source
- Test seedling establishment across a resource gradient
- Test smallness as an adaptive trait for revegetation
- Conduct local adaptation experiments for other important Great Basin revegetation species

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