Intrinsic Water Use Efficiency in Wild vs. Commercial Little Bluestem

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Introduction

- Little Bluestem (*Schizachyrium scoparium*) is a bunchgrass common in North American prairies.
- As climate change and drought increase across North America, its effect on plants and how well they can use limited water should be studied.
- In prairie restoration, the difference between commercially and wildly sourced seeds has become important in scientific discussion.[1] Commercially sourced seeds may be less expensive and easily accessible for ecological restoration, but wildly sourced seeds may have a higher survival rate.[1]
- A variable relating to the capacity for Little Bluestem to survive is its intrinsic water use efficiency (iWUE). The iWUE is the ratio between the net photosynthetic rate and stomatal conductance. It explains how efficiently a plant can use water to conduct photosynthesis.[2,4]
- Our goal in this study is to determine if commercially sourced seeds can replace wildly sourced seeds in prairie restoration in the Midwest.

Research Questions & Hypothesis

1. Do commercial seeds have a different iWUE under the control treatment conditions?
2. Which source has a higher iWUE when put through the control and drought treatment?
   - ❖ We hypothesize that the wildly sourced plants will have a higher iWUE because they are more suited to stressful environments.[1,3,4]
3. How does soil moisture impact iWUE?
   - ❖ We hypothesize as the soil moisture increases, iWUE decreases.[3]

Methods

- Our data came from 192 plants distributed across 16 bins and 12 pots per bin. The experiment took place in a greenhouse at the Chicago Botanic Garden.
- Each plant source is randomly scattered throughout each bin with six wildly and six commercially sourced plants. All seeds were sourced from various locations in the Midwest.
- In the study, 8 bins simulated a drought condition, and the other 8 simulated a well-watered control condition.
  - These bins experienced a 6-week experiment, and the drought bins' water decrease began after 1 week.
  - In the last 2 weeks, drought bins had no access to water.
- The iWUE was measured directly using LI-COR during the experiment's second, fourth, and sixth week.
- Statistical tests that were run included the T-test, ANOVA test, and linear regression.

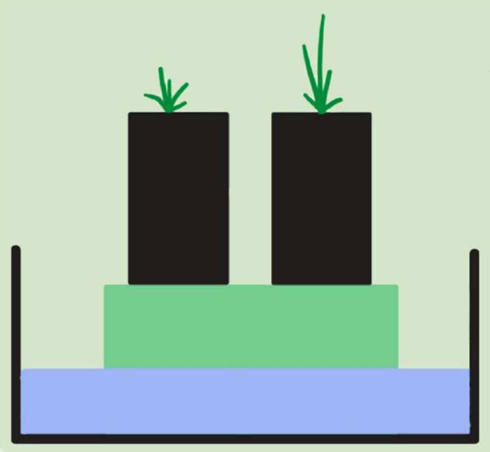

Fig 1. Visual of the floral foam drought method used in the experiment.

Fig 2. Image of bin and pot arrangement in Greenhouse 23.

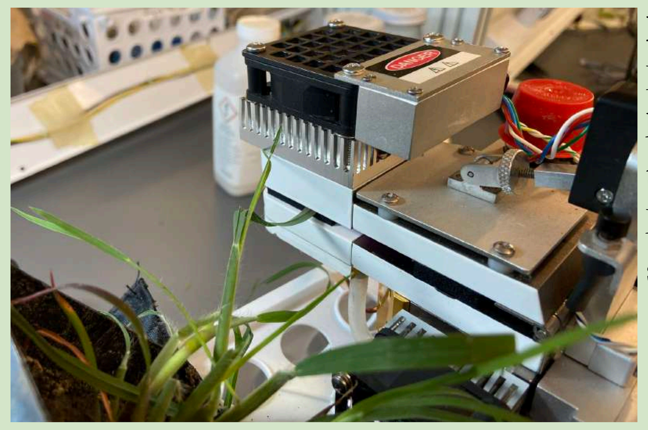

Fig 3. Image of a leaf going through a LI-COR scan.

Results

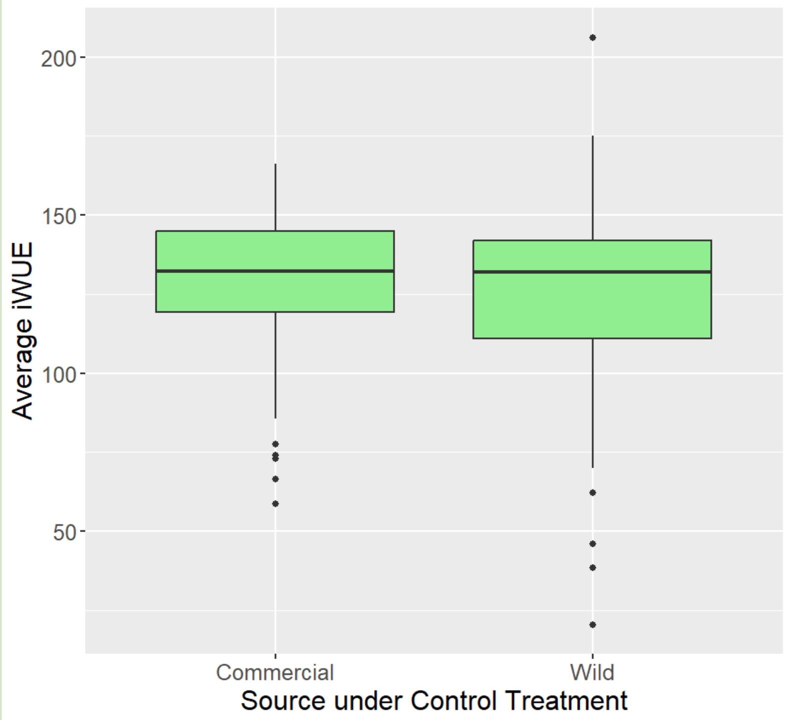

Fig 4. Both commercial and wild show the same median and similar mean, however, the wild source shows greater variability. A hypothesis test was performed to determine statistically significant results for average iWUE under control conditions between commercial and wild sources. No statistically significant value was found (P=0.4825).

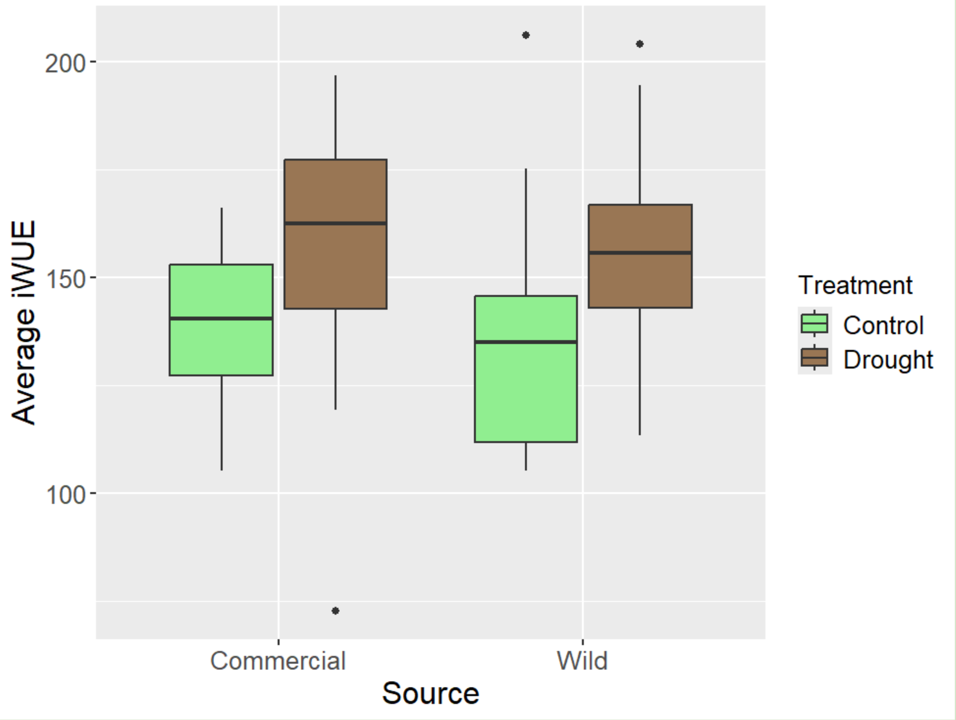

Fig 5. For 3rd LICOR sampling event, Little Bluestem plants show a higher median of average iWUE under drought treatment regardless of source. An ANOVA test was done to compare source and treatment. Statistically significant results were found for a difference in average iWUE drought and control treatments (P=0.0028). No other significant difference was found.

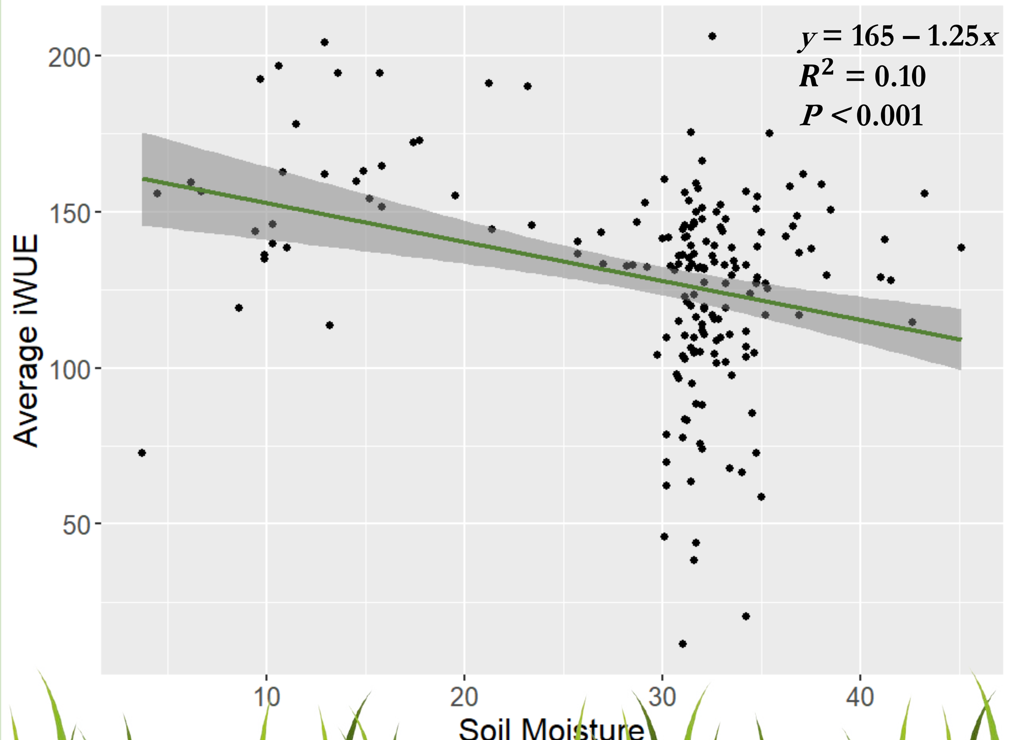

Fig 6. A weak correlation between iWUE and soil moisture is indicated by the R^2 coefficient in the linear regression. This indicates that iWUE is dependent on more variables than soil moisture.

Discussion

- There were no statistically significant differences in the average iWUE for commercially sourced and wildly sourced Little Bluestem under control conditions (**Fig 4.** and **5**). Therefore, commercially sourced seeds may have a similar survival rate to wildly sourced seeds and are amenable to ecological restoration.
- In drought conditions, there is evidence of Little Bluestem having higher average iWUE values, indicating a similar adaptive response for both sources (**Fig. 5**). Further supporting the possibility of using commercially sourced seeds over wildly sourced seeds for restoration.
- Based on other results, a stronger correlation may be found when considering variables like humidity, vapor pressure deficit, and other factors that may have a role in predicting iWUE (**Fig. 6**).
- Further research to confirm the substitution of wild seeds for commercial seeds includes conducting experiments in the field to simulate real-life environmental stressors.

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