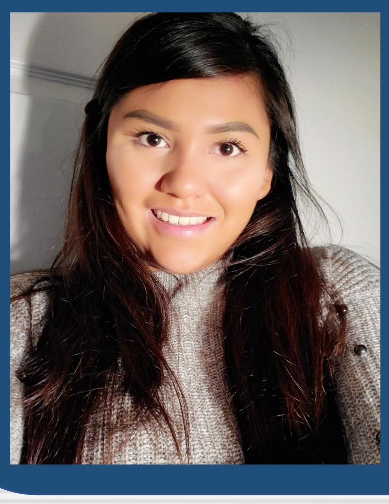
The Quest for Sprouting Common Desert Dropseed Species (*Sporobolus* R. Rb., Poaceae) from the Chihuahuan Desert



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INTRODUCTION

Sporobolus, or dropseed grass, is a large cosmopolitan genus in the Poaceae with 160 species (Peterson et al., 2014). Two species are targets in this study, *Sporobolus contractus* (spike dropseed) and *Sporobolus flexuosus* (mesa dropseed) because they do well for erosion control, soil building and provide palatable forage for livestock or wildlife (Peterson et al., 2014). These dropseed grasses are native to the southwestern United States and commonly found in the Chihuahuan Desert in rangelands prairies, woodlands, sandy, and open areas. Even though *Sporobolus* species are very productive seed distributors, drought-tolerant, and adapted to various soils, a common problem for conservation and restoration research efforts they are difficult to germinate (Hatch et al. 2019). For these reasons, conservationists and desert ecologists are interested in identifying and understanding the main factors affecting *Sporobolus* germination. Like most grasses, *Sporobolus* shows physiological seed dormancy (PD) with deep, intermediate, or non-deep levels (Baskin & Baskin 2004). PD can be broken up to promote germination with the addition of growth hormones, careful scarification, and the alteration of various temperatures (0-10°C or ≥ 15°C). This study aims to further our understanding and clarification of the germination techniques for these specific grasses.

Figure. 1 Vegetative and reproductive structures of two species of *Sporobolus*. A. *Sporobolus contractus* and B. *Sporobolus flexuosus*. In the upper left corner of the photo's inflorescence and in the lower right corner fruits commonly referred as seeds.

Natural species distribution of *Sporobolus contractus* and *Sporobolus flexuosus* in SW New Mexico

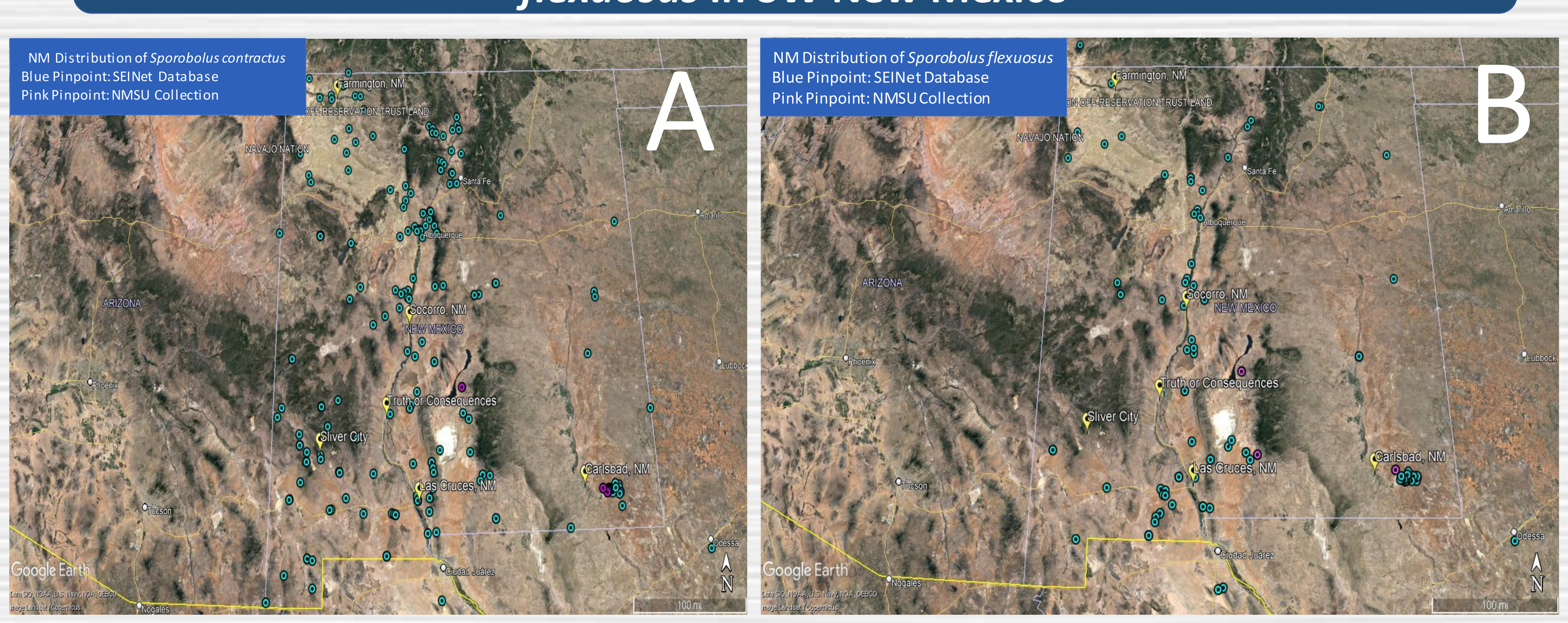


Figure 2. Map of distribution of the species targeted in this study based on herbarium occurrence data and BLM collections. A. *Sporobolus contractus*. B. *Sporobolus flexuosus*. Red marks represent BLM collections.

HYPOTHESIS AND OBJECTIVES

Hypothesis: We hypothesize that seed emergence will be triggered by the addition of potassium nitrate (KNO3), responses to various temperature regimes (15˚C, 35˚C, 55 ˚C and 75˚C), and pre-germination mechanical treatment (bract removal).

Objective:

- To produce maximum germination results in *Sporobolus flexuosus* (Thurb. ex Vasey) and *Sporobolus contractus* (A.S. Hitchc.) through successful protocols.

MATERIALS AND METHODS

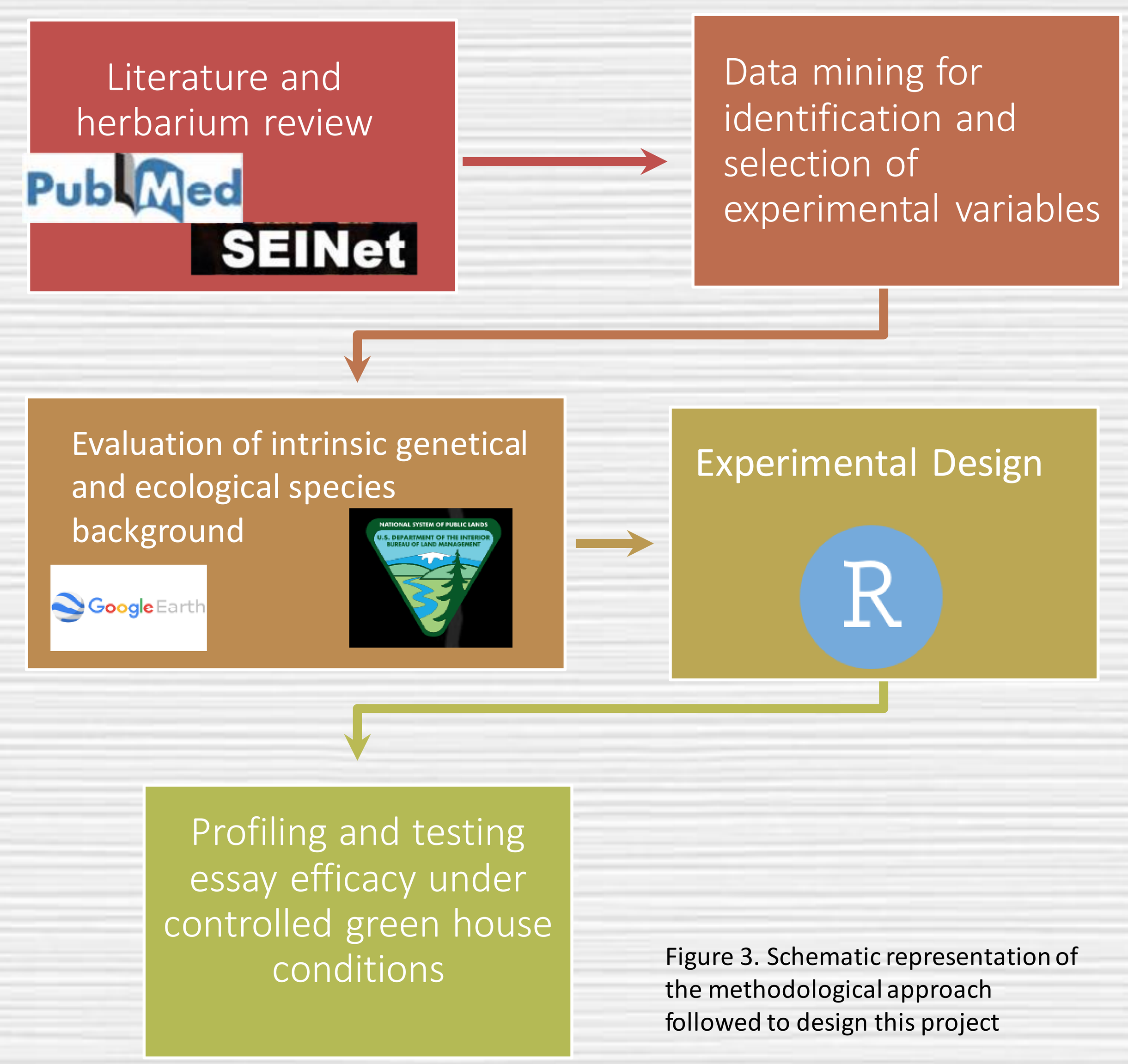


Figure 3. Schematic representation of the methodological approach followed to design this project

PRELIMINARY RESULTS

Species name:
Sporobolus ioclados Hook. f.

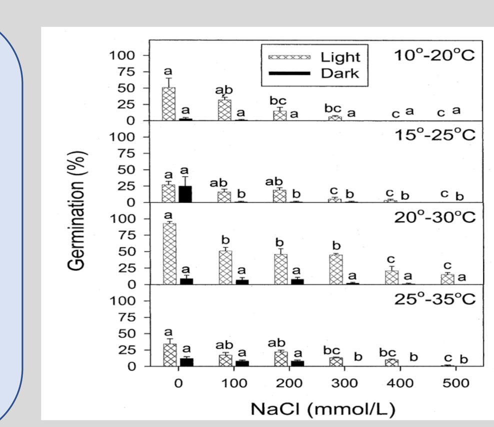
Fruit/seed geographic source: Pakistani Coast

Variables Tested

- Light vs Dark
- Temperature
- Salinity

Results

- Germination decreased with an increase in salinity.



Khan, 2003 *Light, Salinity, and Temperature Effects on the Seed Germination of Perennial Grasses.* American Journal of Botany.

Factors	Levels
Chemical Scarification	0.2% Potassium Nitrate (Y/N)
Air heat	25, 35, 55, 75, 100 °C
Bract Removal	Bracts/No Bracts

Table 1: Three variables or factors with a total of nine levels will be tested in *Sporobolus* spp. seedling experimental protocols.

Approach 1: Full Factorial Experimental Design

Trials	25 °C	45 °C	65 °C	85 °C	100 °C
1	Bracts + Potassium Nitrate	Bracts + Potassium Nitrate	Bracts + Potassium Nitrate	Bracts + Potassium Nitrate	Bracts + Potassium Nitrate
2	No bracts + Potassium Nitrate	No bracts + Potassium Nitrate	No bracts + Potassium Nitrate	No bracts + Potassium Nitrate	No bracts + Potassium Nitrate
3 ↓ 20	No bracts + No Potassium Nitrate	No bracts + No Potassium Nitrate	No bracts + No Potassium Nitrate	No bracts + No Potassium Nitrate	No bracts + No Potassium Nitrate

Table 2: Various factors with corresponding levels the seeds will undergo for the duration of the experiment.

Keynote: 6 populations (3 populations of each species) x 20 possible runs = 120 petri dishes with 10 replicates= 1200 trials

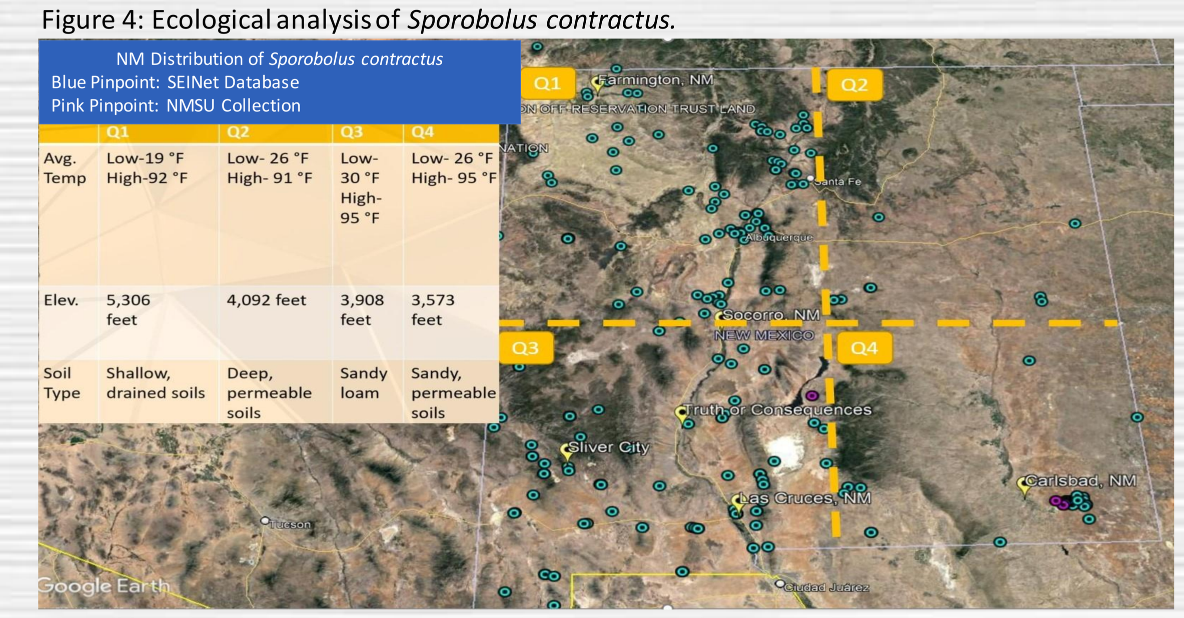
Approach 2: Fractional Experimental Design (reduce by a ¼)

Same approach, but design will be reduced **by ¼.** → **6 populations** (3 populations of each species) → Reduce **20** to **15** possible runs → Reduce **10** to **5 replicates.** Gives us 450 trials. This will reduce workload.

Approach 3: Exploratory Experimental Design

In this approach, we aim to explore the impact of each main experimental factor focusing on a subset of experiments/trials/runs that can help document the kind of adjustments we need to do once we run a full factorial approach. One of the criteria to define the experimental subset was to control for environmental and genetic variation. Genetic variation was assessed based on ploidy. For this preliminary experiment we selected the true diploid *Sporobolus contractus*, 2*n* = 36 instead of the aneuploid *Sporobolus flexuosus*, 2*n* = 36, 38 (Peterson et al. 2014).

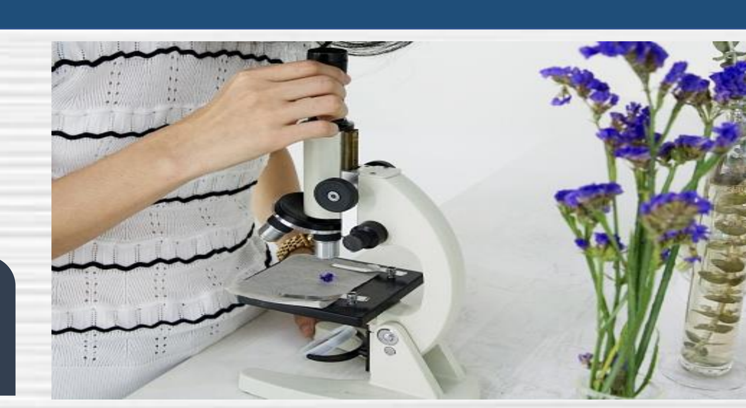
Figure 4: Ecological analysis of *Sporobolus contractus.*



	Q1	Q2	Q3	Q4
Avg. Temp	Low-19 °F High-92 °F	Low- 26 °F High- 91 °F	Low- 30 °F High- 95 °F	Low- 26 °F High- 95 °F
Elev.	5,306 feet	4,092 feet	3,908 feet	3,573 feet
Soil Type	Shallow, drained soils	Deep, permeable soils	Sandy loam	Sandy, permeable soils

Same approach, but temperatures were adjusted to prevent overheating of seeds (15, 35, 55, 75°C) → *Sporobolus contractus:* **3 populations** → 5 possible runs → Reduce **10** to **5 replicates.** Gives us 240 trials. This will reduce workload.

FUTURE DIRECTIONS



- Conduct ecological germination research on additional desert grass species
- Contribute to the knowledge on *Sporobolus* germination
- Next step: investigate effect of ecological and genetical backgrounds on germination of grass desert species

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