Management Techniques for the Control of Sahara Mustard (Brassica Tournefortii) in the Mojave Desert

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In the southwestern United States, Brassica tournefortii (Sahara mustard) is a highly invasive plant that colonizes roadways, beaches, sand dunes, and open desert threatening native annuals. Manpower limitations and insufficient funding limit the ability of managers to effectively control Sahara mustard. We tested seed germinability in Sahara mustard after fruiting plants were treated with either 2%, 5%, or 12% triclopyr. Sahara mustard seed pods were labeled and left intact in the ground. Pods were collected when brown and dry, which varied depending on the treatment. We conducted an ANOVA with arcsin square root transformed proportion data was performed using the StatSoft software Statistica v13 (StatSoft, Inc., Tulsa, OK). Sahara mustard seed pods intact in the ground, Pods were collected when brown and dry, which varied depending on the treatment. The treatments included spraying marked plants with 3 different concentrations of triclopyr (2, 5, and 12%). We also tested seed germinability in Sahara mustard after fruiting plants were separated from their resources and allowed to dry in the field. Seed pods were labeled by developmental stage before treatment. The three treatments consisted of: 1) pulling the plant with roots intact, 2) pulling the plant and breaking the roots and leaf rosette from the inflorescence, and 3) pulling off individual fruits. All treatments resulted in a decrease in germination from control seeds.

Hypotheses:
• Experiment 1: We hypothesized that triclopyr in killing the fruiting plant would have a negative effect on seed development, therefore, reducing the amount of viable seed added to the seed bank.
• Experiment 2: We hypothesized that interrupting the flow of water and nutrients to the developing seed would negatively affect viability, thus reducing the amount of viable seed added to the seed bank.

Results and Discussion
The herbicide triclopyr has been effective in killing B. tournefortii plants in the rosette stage (Elizabeth Powell, unpublished data), but until the current study, herbicides have not been tested on B. tournefortii fruiting plants to measure their effects on seed viability. The results show a decline in germinability from controls across all stages and herbicide treatments with 0% germination across Stage 1, 1-9% (±4%) germination across Stage 2, and 18-41% (±5%) germination across Stage 3 (Figure 1). Resources stored in the roots of plants play a vital role in their survival. The interruption of sugar transportation to a maturing seed may prevent complete development of the embryo and endosperm. Loss of water and nutrients during seed maturation can cause a cessation of development and the developing seed would have to rely on the materials already stored within the plant to continue to develop. The results show a decline in germinability from controls across all stages and treatments with 0% germination across Stage 1, 0-3% (±3%) germination across Stage 2, and 23-85% (±5%) germination across Stage 3 (Figure 2).

Mucilaginous seed coats aid in dispersal or can physically act as an oxygen and water barrier, thus delaying germination until conditions are suitable. The ability of B. tournefortii seeds to form a mucilaginous seed coat when imbibed has likely contributed to its spread throughout shoreline areas of Lake Mead National Recreation Area in the Mojave Desert (Bangle et al. 2008). The results on formation of gel coats show a wider range in Stage 1 across concentrations of herbicide. Means with the same letter do not differ (p>0.05) (Figure 3).

Under optimal conditions Brassica tournefortii germinates to 95% (±1%). However, the occurrence of Sahara mustard skeleton dispersing via water and the formation of mucilaginous seed coats when imbibed has likely contributed to its spread throughout shoreline areas of Lake Mead National Recreation Area in the Mojave Desert (Bangle et al. 2008). The results on formation of gel coats show a wider range in Stage 1 across concentrations of herbicide. Means with the same letter do not differ (p>0.05) (Figure 4). Seeds remain viable after extended submergence and germination study. I also recorded how many seeds/plate developed gel coats. The hypothesis that seeds would have a negative effect on seed development, therefore, reducing the amount of viable seed added to the seed bank was only partially supported. In general, the developing seed may prevent complete development of the embryo and endosperm, which is a reason for the differences in germinability from controls across all stages and herbicide treatments with 0% germination across Stage 1, 0-9% (±4%) germination across Stage 2, and 18-41% (±5%) germination across Stage 3 (Figure 1).

What we know about Brassica tournefortii in the Mojave Desert
• germinates at a wide range of temperatures from (19ºC to 30ºC)
• undergoes light seed dormancy (up to 24 days)
• requires light for establishment
• seeds remain viable after extended submergence combined with our experiment that 50% of germinated pods that sat across large bodies of water for a year retained seed viability
• plants can produce 10-80 seeds per plant
• occurs in densities of 5 to 625 plants m-2
• seeds remain viable after extended submergence combined with our experiment that 50% of germinated pods that sat across large bodies of water for a year retained seed viability
• germinates at a wide range of temperatures from (16ºC to 32ºC)
• germinates in a wide range of soil moisture

What we don’t know
• developed a mucilaginous gel coat.
• form a mucilaginous seed coat when imbibed has likely contributed to its spread throughout shoreline areas of Lake Mead National Recreation Area in the Mojave Desert (Bangle et al. 2008).

• Mucilaginous seed coat
• Germination study
• I also recorded how many seeds/plate developed gel coats.

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