OSMRE National Technology Transfer Team (NTTT), **Applied Science Final Report***
U.S. Department of the Interior, OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

A Test of Competition Reduction and Seed Enhancement Technologies to Improve Sagebrush Establishment in Grass-Dominated Reclamation Sites

Authors: Corinna Riginos, Magdalena Eshleman, Michaela Owens, and Hannah Demler
Affiliations: The Nature Conservancy, Lander, Wyoming

Project Background and Objectives:

Many sites in Wyoming have been successfully reclaimed with perennial grasses but lack other plant diversity including sagebrush, a critical part of the ecosystem. If sagebrush fails to establish during initial reclamation, re-seeding it may also fail because of competition from established perennial grasses. Further interventions, including grass and seed treatments, may be needed to reduce competition or otherwise enhance establishment of sagebrush. Seed Enhancement Technologies (SETs) provide one potential pathway to boosting sagebrush establishment. The goal of the prototype seed technologies tested here was to enhance seeding survival and vigor by stimulating root growth, which could provide a greater likelihood of overcoming competition. Reducing competition from perennial grasses could also benefit sagebrush establishment.

The objective of our study was to test whether some combination of reducing grass competition and enhancing seedling growth through a seed enhancement technology or targeted fertilizer application could enhance establishment of Wyoming big sagebrush.

Applicability to Mining and Reclamation:

The results of this study will inform whether and what type of SET and/or grass competition management could improve sagebrush establishment on mine reclamations. This knowledge could aid practitioners in meeting bond release requirements around shrub density, particularly when the initial establishment of sagebrush was unsuccessful.

Methodology:

We tested the effect of several prototype SETs and grass competition treatments (clipping, herbicide, untreated) at Bullrush and Dave Johnston Mines, reclaimed uranium and coal mine sites, respectively, with high grass cover. We monitored all sagebrush seedlings throughout the growing season to track emergence, survival and seedling height.

Figure 1: Clipping vegetation at Bullrush mine to simulate grazing.

Highlights:

The most significant results from this study are:

1. The reduction of competition from existing vegetation can improve sagebrush seedling survival and increase seedling height. In one experiment seedling survival was 2x higher in the herbicide treatment than in the other grass treatments.

2. Herbicide was more effective than clipping in enhancing seedling growth. Clipping for 1-2 years may not have reduced below-ground competition.

3. The impacts of SETs were inconsistent or absent and film coating had little to no effect on sagebrush seedlings. Externally applied fertilizers sometimes resulted in larger seedlings, especially in the herbicide grass treatments.

Figure 2: Herbicide treatment (with dye) to reduce competition from perennial vegetation.

Conclusions:

Seed enhancement technologies do not appear to be a good solution for sagebrush. Seeds are very small, making it difficult to apply enough fertilizer without coating them; but coating them inhibits emergence.

These experiments indicate that reducing grass competition can have a substantial benefit to sagebrush establishment success. The herbicide treatment, which was the most effective, is not applicable at broad scales, but locally applied patches of herbicide with seeding could be utilized to establish sagebrush islands on a reclaimed site. Longer-term repeated grazing could also reduce grass competition more effectively than clipping.

These results also underscore the importance of seeding grasses at a moderate rate and including other weaker competitor species (sagebrush and forbs) in initial reclamation seeding practices.

Figure 3: High grass cover at the Dave Johnston mine, now the Rolling Hills wind farm.

Fact Sheet Contact Information

PRINCIPAL INVESTIGATOR (PI):
Corinna Riginos, corinna.riginos@tnc.org
307-335-2131
The Nature Conservancy

PROJECT TECHNICAL REPRESENTATIVE (PTR):
Jacob Mulinix, jmulinix@osmre.gov
303-236-4700
Office of Surface Mining Reclamation and Enforcement

Applied Science Information

NATIONAL TECHNOLOGY TRANSFER TEAM (NTTI) CONTACT:
Daniel Sammarco, dsammarco@osmre.gov
412-937-2150
Office of Surface Mining Reclamation and Enforcement