

Restoring Wyoming Big Sagebrush to Annual Brome-Invaded Landscapes with Seeding and Herbicides¹

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Abstract: Restoring degraded grasslands with seeding is a major challenge. Often, seeded species do not establish and areas become/remain dominated by unwanted plants. We combined herbicides and reseeded in former coal mining fields³ dominated by exotic winter annual grasses [downy brome (*Bromus tectorum* L.) and Japanese brome (*Bromus arvensis* L.), hereafter “annual bromes”]. The main interest was restoring Wyoming big sagebrush [*Artemisia tridentata* spp. *wyomingensis* [Beetle & A. Young] S.L. Welsh, hereafter “big sage”], among the most difficult species to restore to North American grasslands. We tested the non-selective herbicide glyphosate and the grass-specific herbicide quizalofop. The summer following herbicide applications and seeding, annual brome cover was 22 % (13%, 36%) for controls, compared to 11% (5%, 25%) and 16% (7%, 35%) for glyphosate and quizalofop, respectively. Two summers after herbicide applications and seeding, seeding alone and combined with quizalofop did not significantly increase big sage, but seeding combined with glyphosate provided big sage densities of 3.05 (1.42, 6.56) and 0.43 (0.13, 1.40) plants m⁻² at the two study mines. These results were consistent across experiments initiated in two different years. In addition to big sage, seed mixes contained native grasses, forbs and sub-shrubs, and while seeding consistently increased combined cover of these plant groups, effects of herbicides on these plant groups varied by mine. In the northern Great Plains, growing season conditions amenable to big sage recruitment do not appear entirely uncommon, and herbicides can increase recruitment.

Additional Key Words: downy brome, glyphosate, grass herbicide, grassland restoration, Great Plains, mining, mixed grass prairie, plant establishment.

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 3. Work reported here was conducted near Spring Creek (45°12' N, 106°91' W) and Decker (45°06' N, 106°84' W) surface coalmines.