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Fire alters emergence of invasive plant species from soil surface-deposited seeds

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INTRODUCTION

Japanese brome (*Bromus japonicas*), Russian knapweed (*Acroptilon repens*), spotted knapweed (*Centaurea maculosa*), and leafy spurge (*Euphorbia esula*) are invasive, non-native weeds in the northern prairies of the central United States. Because they reproduce by seed, destroying the seed with fire may be one way to control these plants. Knowing the fire characteristics that will kill the seeds is important to using this method of control.

TREATMENTS

Seeds of each species were collected from southeast Montana rangelands immediately after they ripened. Pans containing 100 seeds of a single species were fitted into a fire cage so that the soil surface was even with the bottom of the cage. Dried grass at one of six fuel load levels (900, 1800, 2700, 3600, 4500, and 6200 pounds/acre) was added, and thermocouples were placed on the soil surface to record temperature at 1 second intervals. A simulated head fire burned over the pans. Seeds were germinated for 54 days. The number of germinated seedlings was counted and percent emergence calculated.

RESULTS

Fuel load was strongly correlated to how long fire temperatures remained above 122 degrees Fahrenheit and the number of seeds that sprouted.

Without fire, emergence was 97% for Japanese brome and spotted knapweed, 56% for Russian knapweed, and

46% for leafy spurge. Fire reduced germination at all fuel levels. Even at the lowest fuel level, germination was reduced at least 80% for all species. At 1800 pounds/acre, fire reduced germination at least 95% as compared to unburned seed.

Management Implications

Burning will reduce the germination of Japanese brome, spotted knapweed, Russian knapweed, and leafy spurge seed. The effectiveness of fire in reducing germination depends on species, fire history of the site, fire type (headfire or backfire), fuel and weather conditions, seed distribution, and other vegetation on the site. Repeated burning will likely be necessary to reap the full benefit of using fire to reduce weeds. Seed still on the plant will experience greater heating during a fire than seed lying on or in the ground, and will be less likely to germinate. Fire alone will not eliminate sprouting species, like leafy spurge, but can be integrated with other techniques to increase and prolong treatment effects.



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