

Fire Effects on Invasive Weed Seed Germination

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Pans of weed seeds following caged fire with 100 g m⁻² fuel

Objective

Quantify fire effects on germination of surface-deposited seeds of Japanese brome (Brja), spotted knapweed (Cebi), Russian knapweed (Acre), & leafy spurge (Eues)

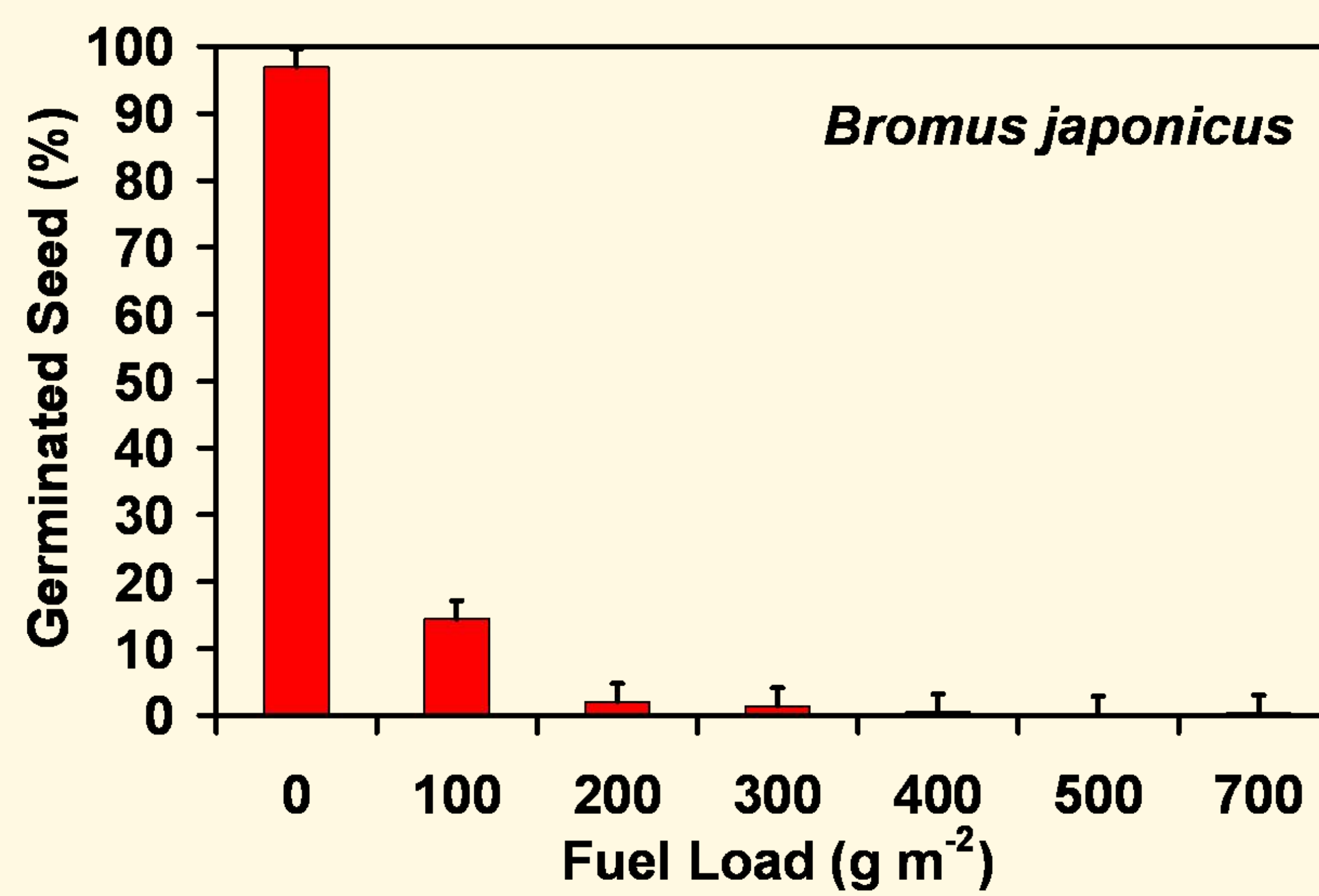
Hypotheses

- 1) Percent germination of weed seeds will decrease linearly with increasing fuel load and heat dosage
- 2) Seed germination response to fire will vary by species

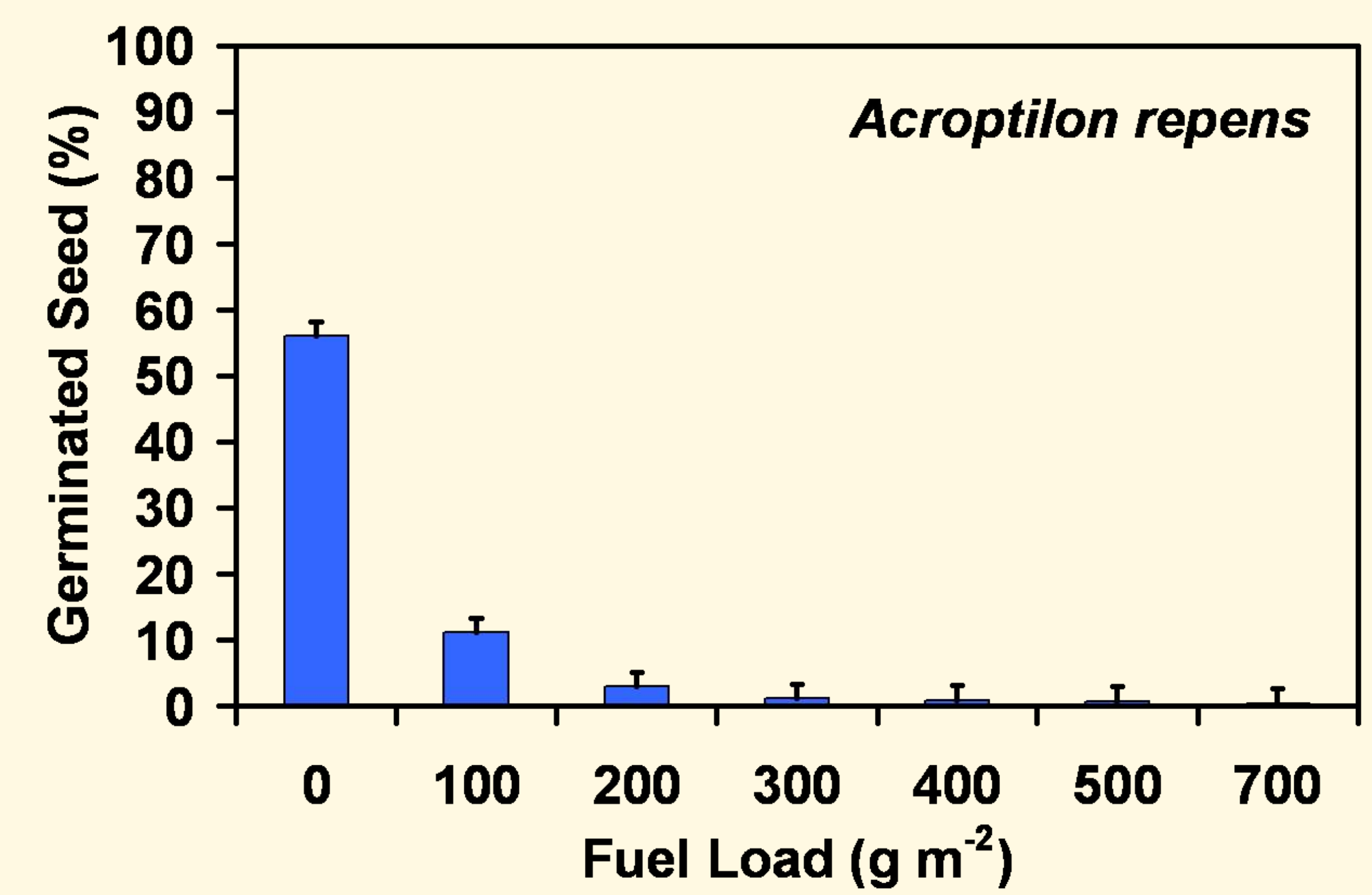
Experiment

- CRD Factorial (7 fuel loads, 4 species, 6 replications)
- Seeds collected from wild populations in SE Montana
- *Agropyron cristatum* cut, dried and weighed for fuel
- From pre-treatment tests, 105, 110, 150, and 700 seeds of Brja, Cebi, Acre, & Eues placed on soil surface in tins
- Pan of each sp. placed in fire cage & covered with fuel
- Soil surface temperature recorded from thermocouples

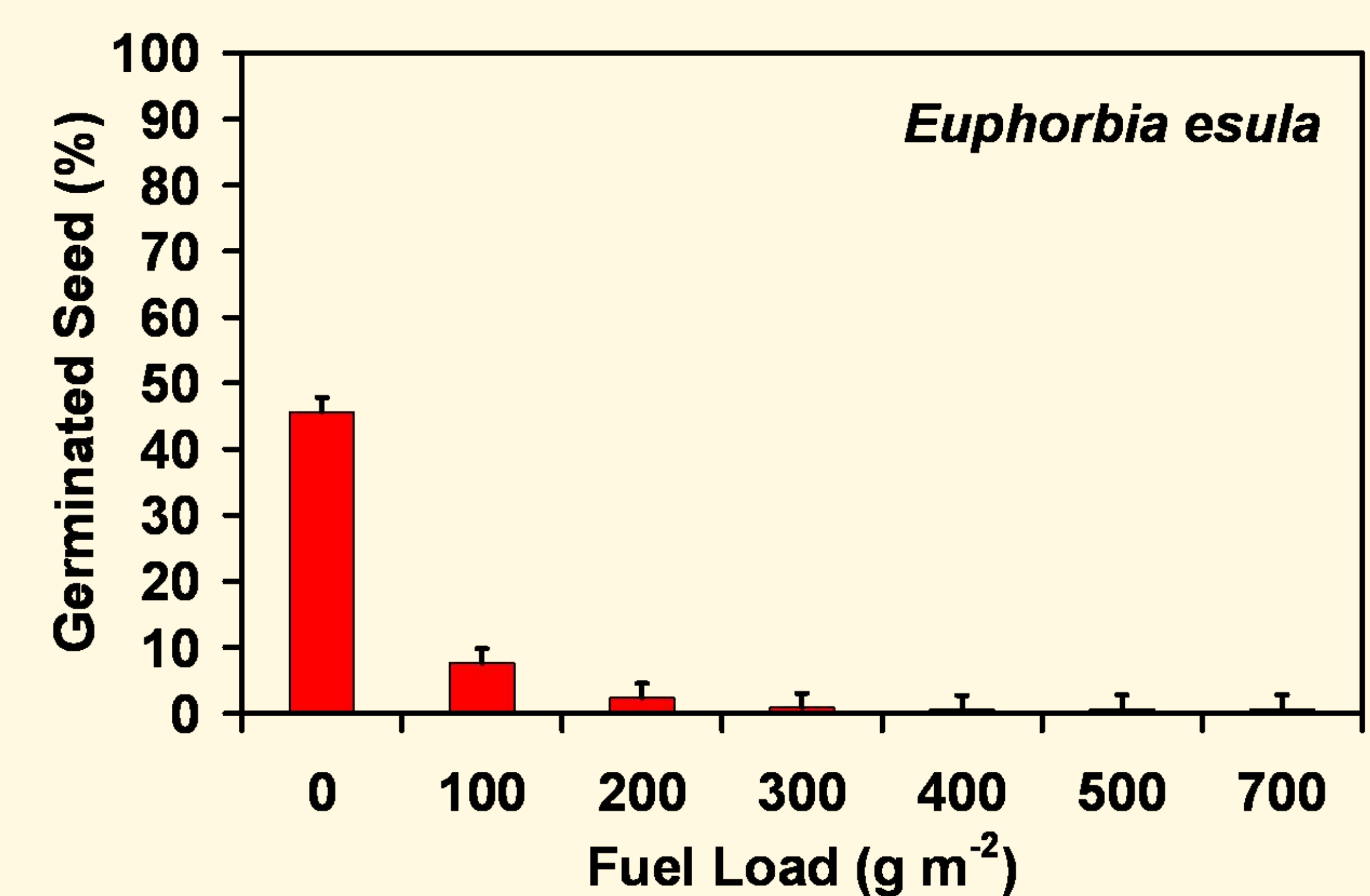
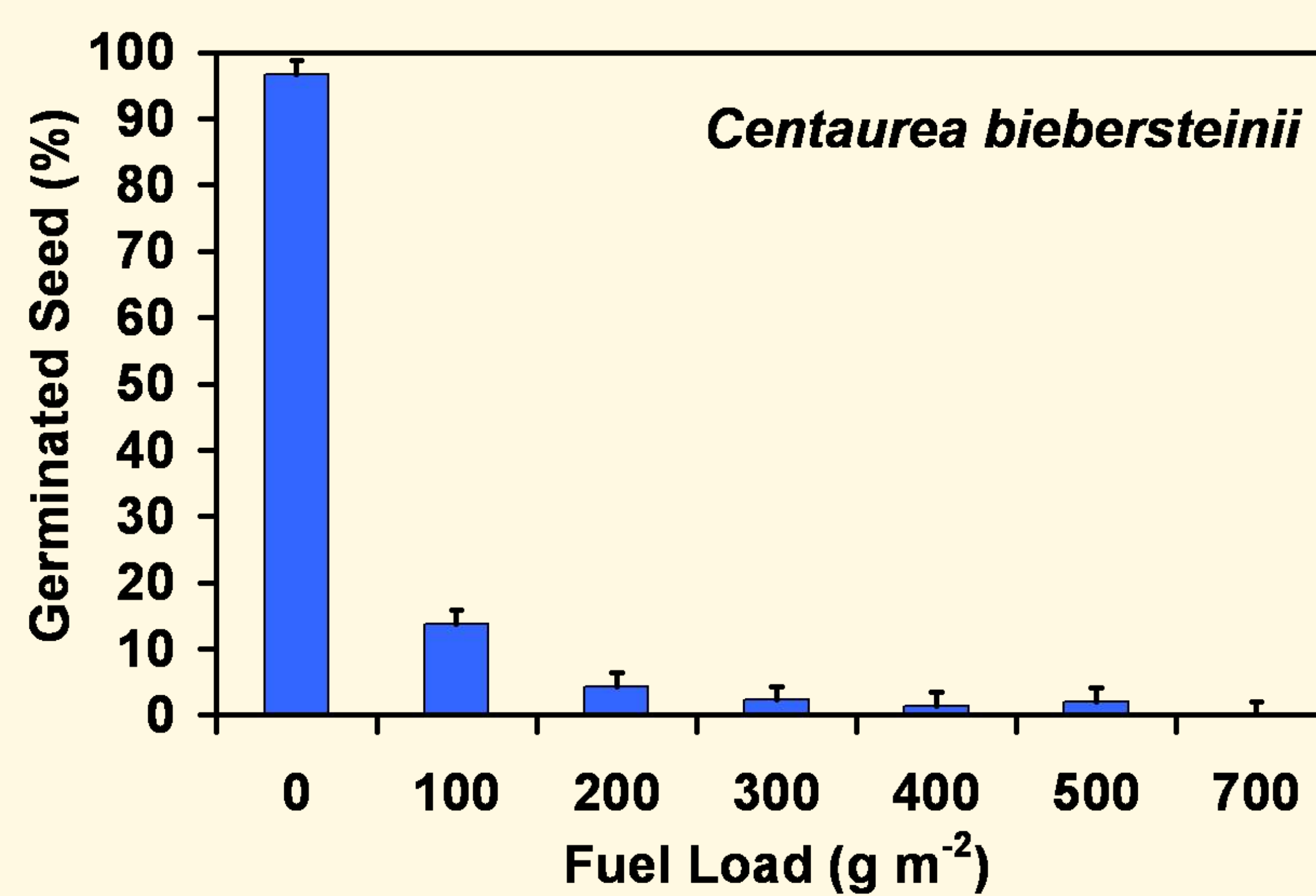
Pans placed in growth chamber & seedling emergence monitored daily



- Fuel load explained 97% of heat dose variation
- % germinated seed varied by species without fire
- Fire with 100 g m⁻² reduced germinated seed 80-86%

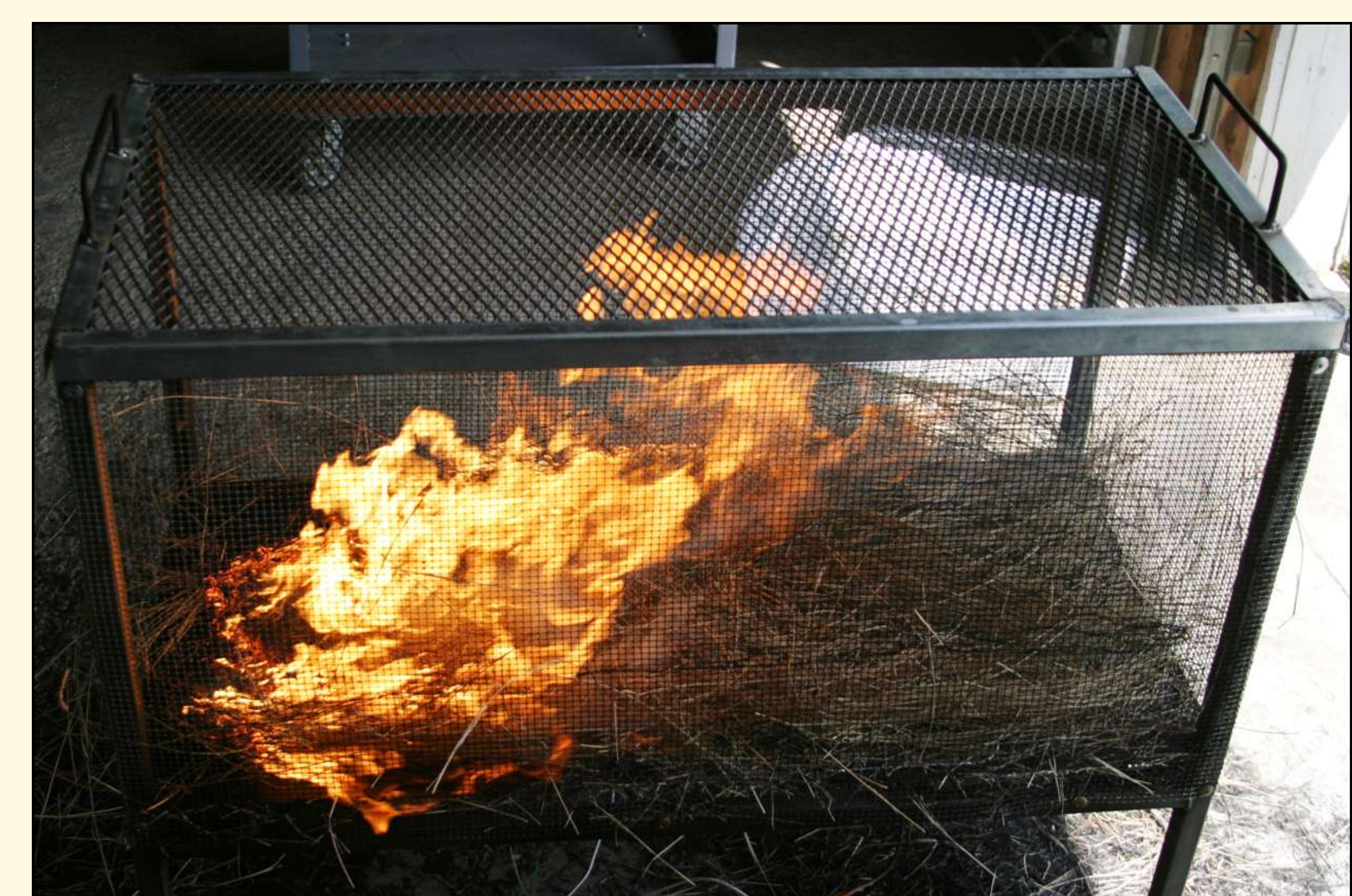


- With 200 g m⁻² or more fuel, % germinated seed was similar across species and averaged less than 1%
- No Brja seeds germinated with fuel loads > 400 g m⁻²
- No Cebi seeds germinated with fuel loads > 500 g m⁻²



Implications

Fire, even at light fuel loads, can cause complete or near-complete mortality in soil surface-deposited seeds of four prominent invasive weed species. Successful application of fire alone to prevent or control weed invasions is complicated by the facts that: 1) Fire behavior and seed depth vary across landscapes, presenting opportunities for some seeds to escape fire-induced mortality; 2) Adult plants of some species can tolerate fire and may even increase shoot density; and 3) Greater bare soil and nutrient availability following fire may facilitate establishment from surviving seeds. Combined with other weed control methods, such as grazing and herbicide, fire may have synergistic effects by altering grazing behavior or increasing weed exposure to herbicide through litter removal and short-term reductions in canopy overlap. Results indicate fire has potential for reducing weed invasion and expansion through seed mortality.



Caged fire treatment (500 g m⁻²) on seeds of 4 weed species

Take home message:

Weed seeds at the canopy, litter layer or soil surface are susceptible to damage from fire.

Fire may improve integrated weed management by:

- Killing seeds**
- Focusing grazing pressure**
- Increasing herbicide coverage**
- Exhausting the seed bank**