

THE EFFECTS OF GRAZING, MOWING, GLYPHOSATE AND BURNING ON SMOOTH BROME IN FESCUE GRASSLAND*

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BACKGROUND

Smooth brome (*Bromus inermis* Leyss.), was introduced to North America from Eastern Europe more than 100 years ago and is now valued for its high forage productivity and effective erosion control. However, its aggressive rhizomatous growth and prolific seed production enable it to invade native grassland and displace indigenous species. As smooth brome becomes dominant, biodiversity, winter forage value and habitat quality are reduced. Smooth brome invasion has important implications for grassland conservation because more than 80% of the Canadian native prairie has been lost to agriculture, the energy industries and urbanization (World Wildlife Fund Canada 1988). Only 10% of the fescue grassland remains, much of which has been modified by grazing and haying (World Wildlife Fund Canada 1988).

MATERIALS AND METHODS

In this study, sheep and cattle grazing, mowing, glyphosate wicking and early spring burning were combined to potentially weaken smooth brome and thereby enhance the competitiveness of native plants. Over two growing seasons (1994 and 1995), twelve treatment combinations were applied to four blocks in a randomized complete block design. The blocks were located on smooth brome dominated areas adjacent foothills fescue grassland on south facing slopes in the Ann and Sandy Cross Conservation Area, 3 km west of Calgary, Alberta. The hot dry south facing slopes were thought to be the most likely place to stress and weaken the moisture and nutrient loving smooth brome. A single grazing, whether by sheep or cattle late in the first summer, was followed by sheep or cattle grazing (3 times) or by mowing (2, 3, or 4 times) in the second growing season. All grazing was heavy, except for one sheep treatment where the midsummer grazing intensity was lighter to allow the native grasses greater recovery time. A 2:1 solution of water:glyphosate was selectively applied to smooth brome using a hand-held hockey stick wick applicator. Selective application was possible because smooth brome was taller than most other plants present. A single mid-summer glyphosate wicking in the first year was followed in the second year with further glyphosate application (1 or 2 times), mowing (3 times), or early spring strip headfires combined with more herbicide (2 times) or mowing (3 times). Reference plots, where no management action was taken, were also included in the experimental design.

Species composition was assessed in 10 randomly located permanent 0.1 m² quadrats per plot prior to treatment implementation (July 1994) and at the end of the second growing season (September 1995). Tiller density was counted in 5 stratified random permanent 0.1 m² quadrats per plot in July 1994, September 1994, May 1995 and September 1995. Soil plant cores (6 per plot) were collected at the end of the study for analysis of etiolated regrowth and total nonstructural carbohydrates (expressed as % fructose) of smooth brome.

RESULTS AND DISCUSSION

Smooth brome decreased in all treatments over the course of the study. Minimal change occurred in the reference plots (-2%), whereas maximum change was effected by glyphosate treatments (-29 to -51%). Defoliation, whether by cattle, sheep or mowing removed a large proportion of smooth brome biomass (-13 to -29%).

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Smooth brome tillering was stimulated by three or more summer defoliations by cattle (37%), mowing (42%) and sheep (50%). Generally the more frequent and intense the defoliation, the greater the increase in tiller density (up to 75% in the case of three heavy sheep grazings in the second year). Mowing only twice in the second year caused minimal change (6%), similar to the change observed in the reference (7%). Herbicide impact on smooth brome tiller density quickly diminished over time. In September 1994, after one mid-summer application of glyphosate, smooth brome tiller density was reduced 68%. One year later, with one or two additional glyphosate applications in the second growing season, smooth brome tiller densities were only 25 to 42% less than pretreatment densities. There was no significant difference whether glyphosate was applied once or twice in the second year. Although early spring burning removed litter, it did not stimulate smooth brome growth and improve herbicide efficacy as anticipated (Grilz 1992). Rather, the burn stressed smooth brome which was just beginning to grow. Tiller stimulation by three mowings in the second year more than compensated for the original decrease caused by herbicide in the first year (net 20% increase). When burning was combined with mowing, a slight decrease (-8%) in tillers occurred. However, it is unlikely that this decrease was directly due to the effect of the burn but rather the indirect effect of increased competition by Kentucky bluegrass (*Poa pretensis* L.), the subdominant species, whose tiller densities increased 249% from 539 to 1924 tillers m⁻². Kentucky bluegrass was dormant at the time of the burn and is very tolerant to mowing. Although not as dramatically, Kentucky bluegrass tiller density and species composition increased in all treatments, including the reference.

Etiolated regrowth and total nonstructural carbohydrates were not statistically different among treatments. However, etiolated regrowth from reference plot samples was greatest, indicating somewhat greater energy reserves.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Glyphosate wicking effected the greatest decrease in smooth brome tiller density over the course of the study. However, in order to protect the desirable species, not all smooth brome could be contacted and reapplication will be necessary. Further follow-up is required to determine the longevity of the effect on smooth brome tiller density and whether the reduced tiller density facilitates increased competitiveness in native species. Heavy defoliation to stimulate tillering and growth prior to glyphosate application may increase herbicide effectiveness. Where there are few native species, it may be more effective to spray the entire area with glyphosate and reseed with desirable species.

After two seasons of defoliation, smooth brome did not appear severely stressed as evidenced by tiller stimulation, carbohydrate reserves and etiolated regrowth. Although, sheep and cattle selectively graze smooth brome over the harder native fescue in the summer, heavy grazing pressure causes almost all species present to be grazed. Several years of frequent heavy grazing or close mowing may reduce smooth brome tiller density, however, many desirable species may also be reduced.

To fully evaluate management options, research is needed to determine the impact of treatments repeated for several years on all species in the plant community. Plant physiological stage at time of treatment implementation must be carefully considered.

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