

less costly than the use of mechanical methods. The herbicide, tebuthiuron (Spike® 80 DF; 800 g ai/kg) can be used to provide the broad spectrum vegetation control required for firebreak installation and maintenance on non-crop areas and rangelands. Tebuthiuron offers residual control of many grass, forb, and woody species. Tebuthiuron use rates can range from 1.1 to 4.4 kg ai/ha (1.25 to 5 lb Spike 80DF/acre) depending on land management objectives and plant species to control. This dry flowable formulation can be applied with most types of herbicide spray equipment. Banded applications of the herbicide may be made with ground equipment in many states or with a helicopter in AL, KS, LA, MO, MS, NM, OK, and TX. Tebuthiuron can be used to create high quality, lasting firebreaks that facilitate prescribed fire activities, wildfire prevention and containment, fireline monitoring, and improved escape routes during wildfire control activities. [15]

HERBICIDE TOLERANCE IN GRASSES AND NATIVE FORB SPECIES. Kimberly A. Edvarchuk* and Corey V. Ransom, Utah State University, Logan.

Native forb seed is needed to restore the rangelands of the Intermountain West. Studies were conducted to identify herbicides that can be used to control weeds in forb seed production with limited injury to the forbs. The forbs evaluated in this project include: basalt milkvetch (*Astragalus filipes*), Western prairie clover (*Dalea ornata*), and Searls' prairie clover (*Dalea searlsiae*). Field trials were conducted in 2009 in Logan, UT on established fields transplanted in 2005 from cone-tainers and treatments were applied with a shielded bicycle sprayer delivering 20 gpa at 30 psi. Basalt milkvetch was treated with bromoxynil (0.25 lb ai/A), 2,4-DB (0.25 ae/A), clopyralid (0.124 ae/A), quinclorac (0.248 ai/A), and imazamox (0.078 ai/A). Treatments were applied on May 15 on milkvetch and May 21 on both *Dalea* species and injury was evaluated on May 26 and June 25. For milkvetch, clopyralid was most injurious at both evaluation dates showing 59 and 64% injury. Injury with bromoxynil and imazamox was initially high (41% and 39% respectively) but declined by the last evaluation date to 28% and 20% injury. Injury from 2,4-DB was minimal. Western prairie clover treatments included pendimethalin (0.71 ai/A), dimethenamid-P (0.84 ai/A), oxyfluorfen (0.25 ai/A), flumioxazin (0.064 ai/A), metribuzin (0.5 ai/A), bromoxynil and 2,4-DB (0.25 ai/A), clopyralid (0.124 ai/A), quinclorac (0.248 ai/A), imazamox (0.078 ai/A), and aminopyralid (0.047 ae/A). Results at 5 DAT and 35 DAT show that clopyralid injury was high initially (41%) and remained high (44%), while injury from aminopyralid was moderately high 5 DAT (35%) and increased significantly by 35 DAT (63%). Bromoxynil, clopyralid, and aminopyralid caused significant declines in seed head biomass. Plant heights and volume were also negatively impacted by oxyfluorfen, flumioxazin, clopyralid, imazamox, and aminopyralid. Plant height, width, and volume were similar to the control plots for plants treated with pendimethalin, dimethenamid-P, metribuzin, bromoxynil, and 2,4-DB. Searls' prairie clover plots were treated with the same treatments as the Western prairie clover except for dimethenamid-P and aminopyralid. Injury to Searls' prairie clover was similar to that observed for Western prairie clover. Injury with oxyfluorfen and flumioxazin was severe at 5 DAT (65% and 58%, respectively) but declined at 35 DAT (16% and 21%, respectively). Pendimethalin, bromoxynil, and 2,4-DB caused little injury at 35 DAT (8%, 6%, and 5%, respectively). Oxyfluorfen, flumioxazin, and imazamox all reduced the average plant height, diameter, and volume when compared to the untreated. Plots treated with 2,4-DB had among the highest plant growth and were significantly greater than those treated with metribuzin, clopyralid, oxyfluorfen, flumioxazin, and imazamox. At this time, 2,4-DB

appears to hold promise for use in controlling weeds in all three native forb species while several herbicides appear to have potential use in weed control in Searls' and Western prairie clover seed production. Further testing will be required to determine herbicide effects on seed production and viability. An additional trial evaluated native grass tolerance to preplant and preemergence herbicide treatments. Grasses evaluated included bluebunch wheatgrass, indian ricegrass, basin wildrye, bottlebrush squirreltail, and big bluegrass. Imazapic (0.94 and 0.125 lb ai/A) and sulfosulfuron were applied November 8, 2008. Aminopyralid was applied at 0.078, 0.109, and 0.219 lb ae/A on December 1, 2008. Grasses were broadcast planted on November 24, 2008. Grass injury was evaluated October 22, 2009. Injury from aminopyralid ranged from 0 to 14% across all varieties and aminopyralid rates. Imazapic caused 0 to 13% injury across rates and grass varieties. Injury from sulfosulfuron was severe on all varieties and ranged from 41 to 87, 83 to 97, and 93 to 99% at rates of 0.035, 0.062, and 0.094 lb ai/A, respectively. [16]

INTEGRATED STRATEGIES FOR CONTROLLING SCOTCH BROOM (*CYTISUS SCOPARIUS*) . Timothy B. Harrington*, USDA Forest Service, Olympia, WA.

Scotch broom is a large, non-native shrub that has invaded extensive areas throughout 16 eastern and six western U.S. states. Three research projects were undertaken to determine potential strategies for preventing or controlling this common invasive species in the Pacific Northwest. (1) In a forest productivity study near Matlock WA, third-year cover of Scotch broom was reduced by 71% when logging debris was retained, rather than removed, after timber harvest. Subsequent survival of planted Douglas-fir (*Pseudotsuga menziesii*) seedlings was 28% greater where debris was retained versus removed because of reduced competition from Scotch broom. (2) In laboratory studies, sulfometuron reduced root biomass of Scotch broom seedlings by 58 to 95%, but seedling mortality was only 5 to 9%. Imposing soil drought conditions to the herbicide-treated soils caused seedling mortality to increase abruptly to 20%. Results suggested that increased control of Scotch broom with sulfometuron is likely if pre-emergent application is timed to expose recently emerged seedlings to developing conditions of soil drought, such as those that occur during late April to early May in the Pacific Northwest. (3) Greenhouse studies were conducted to compare the competitive abilities of three native grass species to inhibit development of Scotch broom seedlings. Aboveground biomass of Scotch broom seedlings was reduced up to 76% when grown with spike bentgrass (*Agrostis exarata*) or blue wildrye (*Elymus glaucus*), but only 19% when grown with western fescue (*Festuca occidentalis*). The grasses were able to inhibit Scotch broom development because of more rapid growth in cover and height of bentgrass and wildrye, respectively. [18]

ECOPHYSIOLOGY OF THE RANGELAND WEED *BERTEROA INCANA* (HOARY ALYSSUM). H. Madani*, G. Stopps, and Mahesh K. Upadhyaya, University of British Columbia, Vancouver.

Berteroa incana (hoary alyssum), a rangeland weed of BC, has no significant primary seed dormancy and maintains a large soil seed bank (132.4 m seeds/ha). Little information on loss of these seeds from seed banks and on interaction of this weed with associated grasses is available. Midday soil surface temperatures at *B. incana*-infested sites in BC can reach 83 C. Objectives of this study were to investigate the effect of high temperature on survival of *B. incana* seeds and the possible role of allelopathy in its interaction with associated grasses. Dry or imbibed *B.*