Weed Technology 2012 26:499–505

Safening of Native Grass to Herbicides by Using Carbon Bands

W. James Grichar, John Lloyd-Reilley, Jeff Rahmes, W. R. Ocumpaugh, and Jamie L. Foster*

Greenhouse and field experiments were conducted to evaluate the use of a carbon band to provide a "safe zone" for seedling emergence and growth of three native grass species. 'KIKA677' streambed bristlegrass germplasm, 'Alamo' switchgrass, and 'Waelder' shortspike windmillgrass germplasm were used in combination with several PRE- and POST-applied herbicides including cloransulam, flumioxazin, imazapic, imazethapyr, and 2,4-D. In a greenhouse experiment, switchgrass emergence was improved when a carbon band was used with imazapic or imazethapyr at 0.04 and 0.07 kg ai ha^{-1} or 2,4-D at 2.12 kg ae ha^{-1}. Windmillgrass emergence was improved when carbon was used in combination with flumioxazin at 0.05 and 0.1 kg ai ha^{-1}, imazapic at 0.04 and 0.07 kg ha^{-1}, imazethapyr at 0.07 kg ha^{-1}, and 2,4-D at 1.06 kg ha^{-1}, whereas bristlegrass emergence was improved when carbon was used in combination with flumioxazin at 0.1 kg ai ha^{-1}, imazapic at both rates, and imazethapyr at 0.04 kg ha^{-1}. Field studies indicated that flumioxazin at 0.05 and 0.1 kg ha^{-1}, imazapic at 0.04 kg ha^{-1}, and imazethapyr at 0.04 and 0.07 kg ha^{-1}, were safened for bristlegrass and switchgrass emergence when used with carbon. Windmillgrass emergence and growth were improved when carbon was used in combination with flumioxazin at 0.1 kg ha^{-1}.

Nomenclature: Cloransulam; 2,4-D; flumioxazin; imazapic; imazethapyr; switchgrass, *Panicum virgatum* L. 'Alamo'; streambed bristlegrass, *Setaria leucopila* (Scribn. & Merr.) K. Schum. 'KIKA677'; shortspike windmillgrass, *Chloris subdolichostachya* Nash 'Waelder'.

Key words: Native grass tolerance, weed management.

Se realizaron experimentos de invernadero y de campo para evaluar el uso de una banda de carbón activado para propiciar una 'zona segura' para la emergencia de plántulas y el crecimiento de tres especies de zacate nativas. El germoplasma 'KIKA677' de *Setaria leucopila*, 'Alamo' de *Panicum virgatum*, y 'Waelder' de *Chloris subdolichostachya* fueron usados en combinación con varios herbicidas aplicados PRE y POST incluyendo cloransulam, flumioxazin, imazapic, imazethapyr y 2,4-D. En un experimento de invernadero, la emergencia de *P. virgatum* mejoró cuando se usó una banda de carbón con imazapic o imazethapyr a 0.04 y 0.07 kg ha^{-1} o 2,4-D a 2.12 kg ha^{-1}. La emergencia de *C. subdolichostachya* fue mejorada cuando se usó carbón en combinación con flumioxazin a 0.05 y 0.1 kg ha^{-1}, imazapic a 0.04 y 0.07 kg ha^{-1}, imazethapyr a 0.07 kg ha^{-1} y 2,4-D a 1.06 kg ha^{-1}; mientras la emergencia de *S. leucopila* mejoró cuando se usó carbón en combinación con flumioxazin a 0.1 kg ha^{-1}, imazapic a ambas dosis e imazethapyr a 0.04 kg ha^{-1}. Estudios de campo indicaron que flumioxazin a 0.05 y 0.1 kg ha^{-1}, imazapic a 0.04 kg ha^{-1} e imazethapyr a 0.04 y 0.07 kg ha^{-1} fueron seguros para la emergencia de *S. leucopila* y *P. virgatum* cuando se usaron con carbón. La emergencia y crecimiento de *C. subdolichostachya* mejoraron cuando el carbón fue usado en combinación con flumioxazin a 0.1 kg ha^{-1}.

The grasslands of North America, at one time among the most diverse and floristically rich communities in the world, are now among the most reduced (Jordan et al. 1988; Masters et al. 1996). Reasons for the reduction of these grasslands include conversion to cropland and overstocking of domestic livestock (Masters et al. 1996). More than 11.6 million ha of tallgrass prairie in Iowa were converted to cropland between 1825 and 1920 (Smith 1992) and in Nebraska about 40%, or 7.7 million ha, of mixed-grass and tallgrass prairies has been converted to cropland (Masters et al. 1996).

Grassland ecosystems have the potential to provide high-quality forage for livestock as well as habitat for wildlife, water, and recreation, and to serve as a repository for diverse native plant germplasm (Masters et al. 1996). To realize this potential, strategies are needed to reestablish native grasses over large areas of degraded grasslands and marginal cropland. Current guidelines for grassland revegetation are usually anecdotal, based on experiences of practitioners (Betz 1986; Mlot 1990; Schramm 1992; Shirley 1994). These practitioners consistently indicate that weed interference is the primary obstacle to efficient and effective grassland restoration (Masters et al. 1996). Because native grasses are slow growing, weeds compete with these plants during establishment.

One approach to reducing weed pressure during establishment is the use of activated carbon slurry sprayed in approximately a 3-cm band to provide a "safe zone" for the perennial grasses when PRE-applied herbicides are used. Activated carbon readily absorbs many organic compounds (Fishel 1996; Hassler 1963; Smisek and Cerny 1970) and a wide range of uses of activated carbon in conjunction with herbicides have been reported (Burr et al. 1972; Lee 1973; Linscott and Hagin 1967; Rolston et al. 1979a,b). When activated carbon was sprayed in a slurry as a narrow band above the seed row, it protected perennial grasses (Burr et al. 1972; Lee 1973), subterranean clover (*Trifolium subterraneum* L.) (Kay 1972), and rose clover (*Trifolium hirtum* All.) (Kay 1972) from PRE-applied nonselective herbicides. Alfalfa (*Medicago sativa* L.) has previously been successfully established by use of the carbon band technique with methylthio-*s*-triazine herbicide (Linscott and Hagin 1967). However,

DOI: 10.1614/WT-D-11-00147.1

* First, third, fourth, and fifth authors: Senior Research Scientist, Technician, Professor Emeritus, and Assistant Professor, respectively, Texas AgriLife Research, Beeville, TX 78102; second author, Manager, U.S. Department of Agriculture Natural Resources Conservation Service, Kika de la Garza Plant Materials Center, Kingsville, TX 78363. Corresponding author's E-mail: w-grichar@tamu.edu