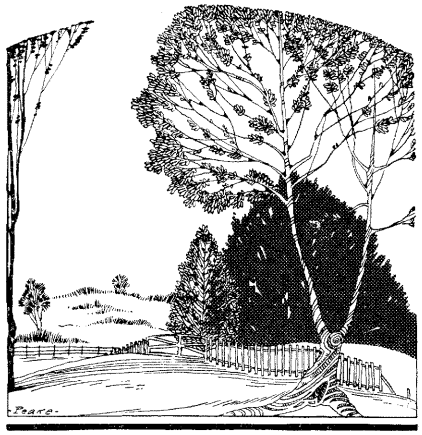

HERBICIDE EVALUATIONS FOR ESTABLISHMENT OF NEWLY-SEEDED BERMUDAGRASS

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IMPACT STATEMENT

Weed control during the establishment of seeded bermudagrass is a major factor in the success of the planting. This study evaluated the effects of several postemergence herbicides on newly-established bermudagrass seedlings. In addition, a second technique was evaluated which used activated charcoal to protect bermudagrass seed rows from preemergence herbicides. All postemergence herbicides tested in this study caused some injury on the juvenile turf, but the turf recovered quickly from injury. The use of activated charcoal and preemergence herbicides proved to be an effective technique for establishing seeded bermudagrass.

BACKGROUND

Bermudagrass is a commonly used warm-season turfgrass in the southern United States. Until recently, seeded bermudagrass cultivars have not matched the quality or performance of vegetatively propagated hybrids. Over the past 20 years the National Turfgrass Evaluation Program (NTEP) has routinely conducted cultivar trials that rate a number of vegetatively and seed-propagated turfgrasses for quality and performance. These trials are generally planted in 20 to 30 locations across the U.S. and evaluated for 4 to 6 years. In early trials, the quality of seeded bermudagrass cultivars was well below those of the vegetatively-propagated standards 'Tifway' and 'Midlawn' (Morris, 1993). 'Mirage' seeded bermudagrass was introduced in 1992 and showed improvement over earlier seeded types, but the quality remained below the vegetatively-propagated standards (Morris, 1997). In the 1997 bermudagrass test, several new seeded cultivars of bermudagrass demonstrated quality that is equal to or higher than the vegetative standards 'Tifway' and 'Midlawn' (Morris, 2000). Of the seeded genotypes, the cultivar, Princess, and the experimental line, OKS 95-1, showed exceptional quality relative to the hybrids. These improvements in overall turf quality of seeded cultivars could make seeding a high-quality bermudagrass turf a realistic option.

A major problem with seeding bermudagrass is the control of grass and broadleaf weeds during establishment. Although many studies have evaluated weed control strategies and herbicide injury in established bermudagrass, minimal work has been done with seeded bermudagrass. Many effective postemergence strategies are available for established bermudagrass, but applications of postemergence herbicides can lead to varying degrees of injury including retardation of growth, altered plant development and ultimately plant death in seedling bermudagrass (Millhollon, 1985). Finding appropriate postemergence herbicides and application timings that are effective in weed control and have limited injury to bermudagrass seedlings is important.

Preemergence herbicides can be effectively used in the establishment of vegetatively-propagated bermudagrass and in established bermudagrass turf, but they have limited applications in seed establishment plantings. The application of a charcoal band over a seeded furrow was developed by Lee (1973) to protect seeds from the effects of preemergence herbicides. Charcoal is an extremely porous, highly-absorbent product that is a result of combustion of carbon-containing compounds (Unruh and Brecke, 1999). Charcoal has the ability to bind and deactivate herbicides, and has been effectively used in conjunction with preemergence herbicides to establish production fields of cool-season grasses (Lee, 1973) and centipedegrass turf (Johnson, 1976). However, this technique has not been attempted for the establishment of a seeded bermudagrass turf.

Recent improvements in seeded bermudagrass turf quality have stimulated increased interest in the turfgrass industry. However, developing effective weed control strategies to aid in the establishment of these grasses will be critical to their long-term success.

RESEARCH DESCRIPTION

A preemergence and postemergence herbicide study was conducted at the Arkansas Agricultural Research and Extension Center, Fayetteville. Prior to planting, both plot areas were fumigated with methyl bromide (67%) and chloropicrin (33%) at a rate of 392 lb/acre to ensure a weed-free site. Since the weed control effectiveness of the herbicides tested was previously established, it was easier to rate herbicide injury without interference from weeds. 'Princess' seeded bermudagrass was chosen for both studies because of its high quality and com-

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mercial availability. Nitrogen was applied bi-weekly as urea (46-0-0) at a rate of 0.5 lb N/1000 ft^2.

The objective of the postemergence study was to evaluate injury and application timings of seven postemergence herbicides (Table 1) on newly-seeded bermudagrass. The plot area was broadcast seeded on 31 May 2000 with 'Princess' at a rate of 0.5 lb/1000 ft^2. Herbicide applications were applied at 1, 2, and 4 weeks after emergence (WAE) in a spray volume of 40 gal/acre. The experimental design was a completely randomized block design with four replications. Individual plot size was 4 x 5 ft and a spray shield was used to eliminate herbicide drift from plot to plot. Visual injury ratings were taken at 3, 5, 7, 15, 30, and 60 days after treatment (DAT). Data were analyzed using analysis of variance procedures and mean separations determined by Fisher's Protected LSD *(P=0.05)*.

The preemergence experiment evaluated activated charcoal banding and three preemergence herbicides (Table 1) as a means of establishing seeded bermudagrass. 'Princess' was planted on 12 in. centers on 26 July 2000 using a 48 in. Gandy® Overseeder/Dethatcher. The seeding rate was 84 seeds/ linear foot and was applied with Greens Grade Milorganite (6-2-0) as a carrier at a rate of 4 lb/1000 ft^2. For half of each block, activated charcoal was banded (1 in.) directly over the seeded row using a CO_2 sprayer at a rate 0.5 g charcoal/ linear ft. Preemergence herbicides were applied directly after planting in a volume of 40-gal/acre. The experimental design was a split plot design with charcoal treatments assigned as main plots and herbicide treatments assigned as sub plots. Visual emergence ratings were taken at 3, 5, and 7 days after emergence (DAE). Percentage turfgrass cover was evaluated weekly using digital image analysis with SigmaScan software (Richardson et al., 2000). The effects of charcoal banding and herbicide treatments were analyzed by analysis of variance of the split-plot model.

FINDINGS

Time after emergence for herbicide applications had no effect on the injury caused by the various postemergence herbicides (data not shown). As such, all three application timings were averaged for this report. All postemergence herbicides caused some degree of injury on newly seeded 'Princess' (Fig. 1). Diclofop, metsulfuron, and 2,4-D produced the highest levels of injury. Surprisingly, monosodium methanearsenate (MSMA) produced very little injury, which will allow turf managers to effectively control grassy weeds such as crabgrass during the establishment period. There were no statistically-significant differences between MSMA, clopyralid, quinclorac, and dicamba, while diclofop, metsulfuron, and 2,4-D did show statistically higher total injury over other herbicides (Fig. 1). Plots that were injured by herbicides recovered fully and injury was insignificant from controls at 30 DAT. At 60 DAT there was no evidence of herbicide injury in any treatments (Fig.1). These data suggest that several postemergence weed control strategies will be available for control of both broadleaf and grassy weeds in newly-seeded bermudagrass turf.

Activated charcoal successfully protected seeds from preemergence herbicides (Figs. 2, 3), while those not treated with charcoal failed to germinate (data not shown). In addition, there were no significant differences between control, charcoal-banded treatments and control, non-charcoal banded plots (data not shown). Control plots showed 86% germination in charcoal treated plots (Fig. 2). Seeds in charcoal-banded plots treated with diuron germinated equivalently to the control. Germination in charcoal-banded plots treated with prodiamine or oxadiazon was less but acceptable at 7 DAE. In the charcoal-banded plots, there were no significant differences in percentage turfgrass cover at 1 WAE between all herbicide treatments. However, plots treated with oxadiazon produced significantly less cover at 2, 3, and 4 weeks after planting than control plots or diuron-treated plots (Fig. 3). These differences were not statistically significant at 6 weeks after planting. Although complete cover was not reached in this trial due to a late July establishment date, it is predicted that complete cover will be possible in 6 to 8 weeks of good growing conditions.

In summary, significant injury resulted from several postemergence herbicides, including diclofop, metsulfuron, 2,4-D, and dicamba. However, all plots recovered fully from herbicide injury by 30 DAT. These data suggest that postemergence herbicide programs can be used effectively to control weeds in newly-seeded bermudagrass. Charcoal banding effectively protected seed rows and allowed bermudagrass to establish from seeds in the presence of preemergence herbicides. However, diuron-treated plots showed better results than those treated with oxadiazon or prodiamine. These studies will be repeated during the 2001 growing season to confirm these results.

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Table 1. Herbicide treatments used in preemergence and postemergence studies.

Herbicide	Rate (lb ai/acre)
Postemergence	
MSMA	1.0
metsulfuron	0.019
diclofop	1.0
clopyralid	0.5
dicamba	0.5
2, 4-D Amine	0.5
quinclorac	0.75
Preemergence	
prodiamine	1.0
oxadiazon	2.0
diuron	1.0

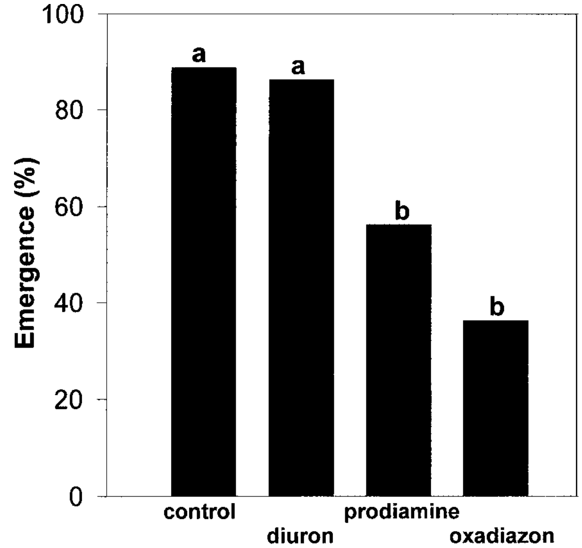

Fig. 2. Seedling emergence of 'Princess' bermudagrass as affected by charcoal banding and preemergence herbicides. Different letters indicate a significant difference between herbicide treatments *(P≤0.05)*.

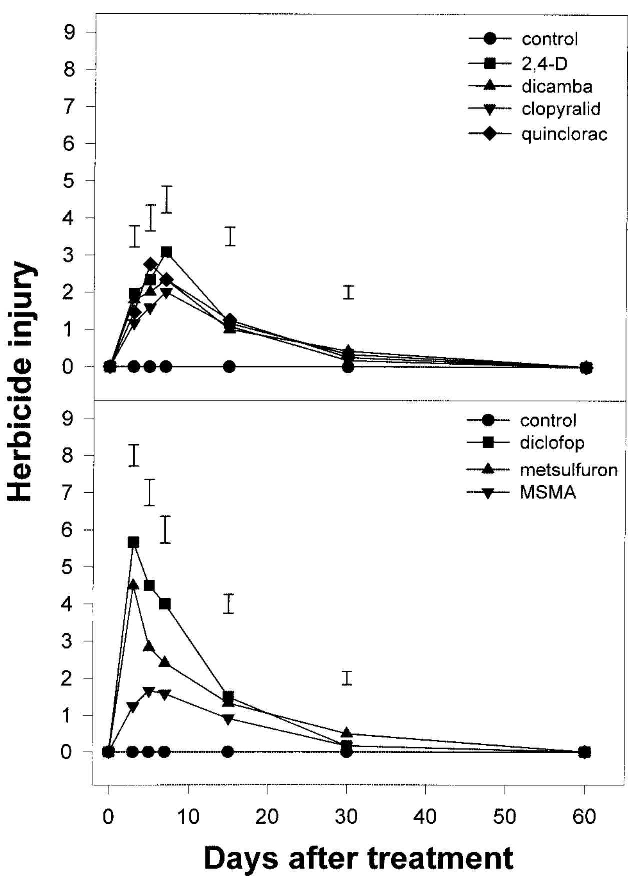

Fig. 1. Herbicide injury of newly-seeded 'Princess' bermudagrass as affected by broadleaf (top) and grass (bottom) herbicides. Herbicides were applied at 1, 2, and 4 weeks after emergence and data for this graph are averaged across all application periods. Error bars indicate significant differences between herbicide treatments at each evaluation periods *(P≤0.05)*.

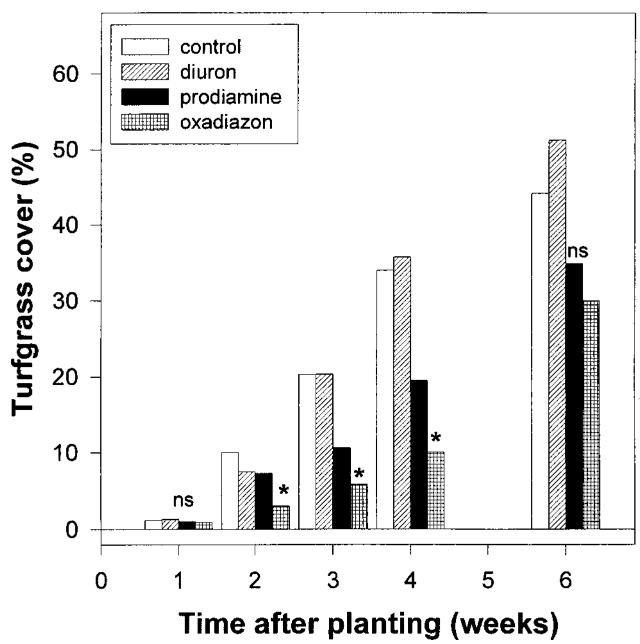

Fig. 3. Turfgrass cover over time as affected by charcoal banding and preemergence herbicides. * = Significantly different from control at that evaluation date, ns= not significantly different from control *(P≤0.05)* .