A PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

TurfGrass TRENDS

Volume 5, Issue 1

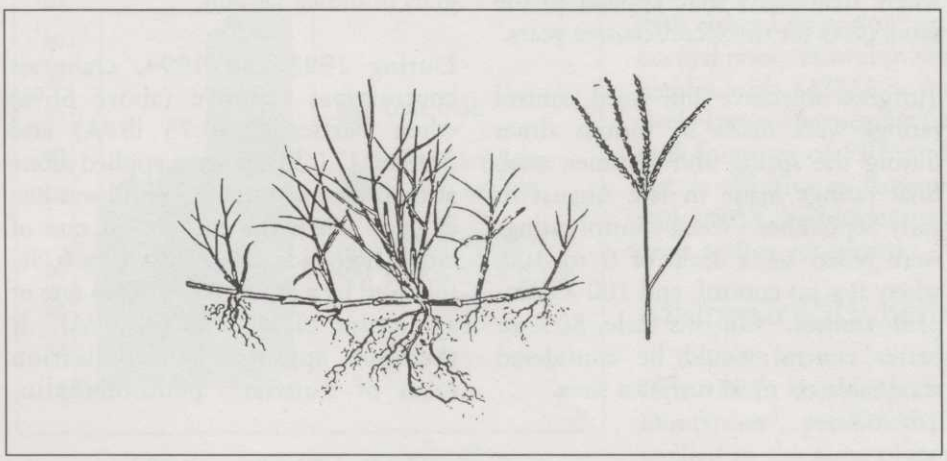
JANUARY 1996

Reduced Herbicide Application Rates:
Crabgrass and Goosegrass Control in Bermudagrass

by B. J. Johnson

Effective cultural and chemical management practices are needed to maintain high quality turf on home lawns, golf courses, athletic fields, parks, and other turfgrass areas. A good weed control program begins with good management practices that encourage a dense, healthy turf (McCarty and Colvin, 1990). A thick, dense turf produces competition to emerging weed seedlings and minimizes the physical space available for weeds to become established. However, regardless of management practices, herbicides must be used to maintain optimum weed control.

Crabgrass (*Digitaria* spp.) and goosegrass [*Eleusine indica* (L.) Gaertn.] are problem summer annuals that actively grow in turfgrasses throughout the spring and summer. Preemergence herbicides – for convenience, referred to here as PRE herbicides – are toxic to crabgrass and goosegrass (Bhowmik and Bingham, 1990; Dernoeden and Krouse, 1991; Johnson and Murphy, 1987; 1989; 1993; Sawyer and Jagschitz, 1987; Watschke and Hamilton, 1990), but for consistent control the selection of the herbicide to be applied and its rate of application are important.



Bermudagrass

(Figure taken from Roberts/Roberts, *THE LAWNSCAPE... Our Most Intimate Experience With Ecology.* Reprinted by permission of The Lawn Institute.)

IN THIS ISSUE

TurfGrass Trends

Maria L. Haber
Publisher
Robert G. Weinland
Editor
Mark Schlossberg
Vice-Pres. of Maryland Turfgrass Council
Pres. of Pro-Lawn-Plus, Inc.
Field Editor
Dr. Richard J. Hull
Science Advisor
Jeanne Stanek
Marketing Manager
Joan Siregar
Circulation Manager
THE DEAN GROUP INC.
Layout & Production

TurfGrass TRENDS
1775 T Street NW
Washington, DC 20009-7124
Phone: 202-483-TURF
Fax: 202-483-5797
76517.2451 @ CompuServe.com

Abstracts: 800-466-8443 TGIF
Reprint Permission: 202-483-TURF

TurfGrass TRENDS is published monthly. ISSN 1076-7207. The annual subscription price is $180.00.

The rate of application depends on the length of the growing season. PRE herbicides applied for crabgrass control in the southeastern United States must be effective for six to seven months. In contrast, in the northeastern United States, where the length of the growing season for this weed is only four to five months, the application rate of PRE herbicides and their required period of efficacy are less. For example, in Georgia, the normal use rate for pendimethalin (WDG) (various trade names) is 3.0 lb. ai/A[1], compared to 1.5 lb./A in the Northeast.

Because of increasing environmental concerns and the regulatory efforts they have engendered, it may become necessary to reduce herbicide usage for weed control in turf. In anticipation of this development, several programs utilizing lower herbicide rates for full-season weed control in turfgrasses have been evaluated at the University of Georgia.

Although turfgrass weed control research has been conducted in Georgia since the early 1970's, the reduced rate herbicide programs were initiated in 1991. Each treatment program was conducted over a two or three-year period. Treatments were applied to different weedy plots each year except in the multiyear program, where treatments were applied to the same plots for three consecutive years.

Turfgrass tolerance and weed control ratings were made at various times during the spring and summer, with final ratings made in late August to early September. Weed control ratings were based on a scale of 0 to 100, where 0 = no control, and 100 = complete control. On this scale, 80% or better control would be considered acceptable on most turfgrass sites.

Sequential PRE and POST herbicide treatments

In this program, sequential applications of PRE and POST – i.e., postemergence – herbicides were applied for crabgrass and goosegrass control in common bermudagrass. The PRE herbicides (Ronstar®[2], pendimethalin, Barricade®, and Surflan®) were applied at reduced rates in late winter, prior to weed seed germination. The POST herbicides (MSMA (6.0 lb. gal) for crabgrass and Illoxan® (EC) and MSMA + metribuzin for goosegrass were applied in late spring or early summer, after the weeds had emerged.

Crabgrass control

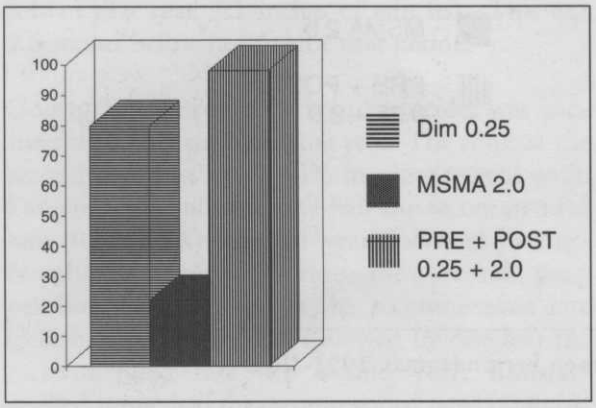
Reduced rate applications of PRE herbicides, followed by an application of MSMA, controlled crabgrass as effectively as did PRE herbicides applied alone at normal rates. The control was excellent (94%) in 1992 when Ronstar® was applied at one-third the recommended rate (1.0 lb./A) in late February, followed by MSMA at 2.0 lb./A in June. This was equal to the degree of control achieved with Ronstar® (applied alone at the normal rate of 3.0 lb./A. Pendimethalin at one-third the recommended rate (1.0 lb./A), followed by MSMA at 2.0 lb./A, controlled crabgrass in similar fashion.

During 1993 and 1994, crabgrass control was effective (above 86%) when Barricade® (0.75 lb./A) and Surflan® (2.0 lb./A) were applied alone at their normal rates. Control was just as good when the application rate of either herbicide was reduced by 67%, followed by a reduced (by 50%) rate of application of MSMA (1.0 lb./A). It therefore appears that application rates of Ronstar®, pendimethalin,

[1] All herbicide rates are presented as pounds active ingredient per acre.

[2] Trade names are included for the benefit of the reader and not imply any endorsement or preferential treatment.

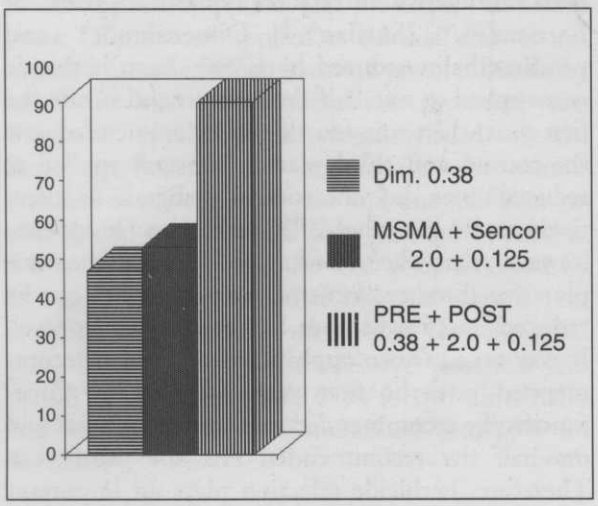
Barricade®, and Surflan® can be reduced without sacrificing crabgrass control if that PRE application is followed by a timely POST application of MSMA. In some instances, the PRE herbicides applied at reduced rates may even control crabgrass throughout the summer. When this occurs, POST applications of MSMA are not needed.



Sequential PRE and POST herbicides in common bermudagrass. 1991. % Crabgrass control

Goosegrass control

Goosegrass in bermudagrass is more difficult to control with herbicides than is crabgrass (Johnson and Murphy; 1993). When applied alone at normal rates, Ronstar® controlled goosegrass more effectively (91%) than did pendimethalin (69%), Dimension® (69%), Barricade ® (71%), or Surflan® (77%) applied at normal rates. However, goosegrass control was 80% or better when these PRE herbicides was applied at reduced (50 to 67%) rates then followed by a POST MSMA + metribuzin application (Johnson 1993a). MSMA + metribuzin was applied at the normal rate (2.0 + 0.125 lb./A) with all PRE herbicides except Surflan®, with which the MSMA + metribuzin application rate was 1.0 + 0.125 lb./A. It therefore appears that the use of sequential PRE and POST herbicide applications not only improved the consistency of goosegrass control, but also permitted a reduction in the PRE herbicide application rate. No apparent advantage in goosegrass control was achieved from sequential applications of PRE herbicides and POST Illoxan®, when compared with application of Illoxan® alone (Johnson 1993a).



Sequential PRE and POST herbicides in common bermudagrass (Average 1991-1992.)
% Goosegrass control

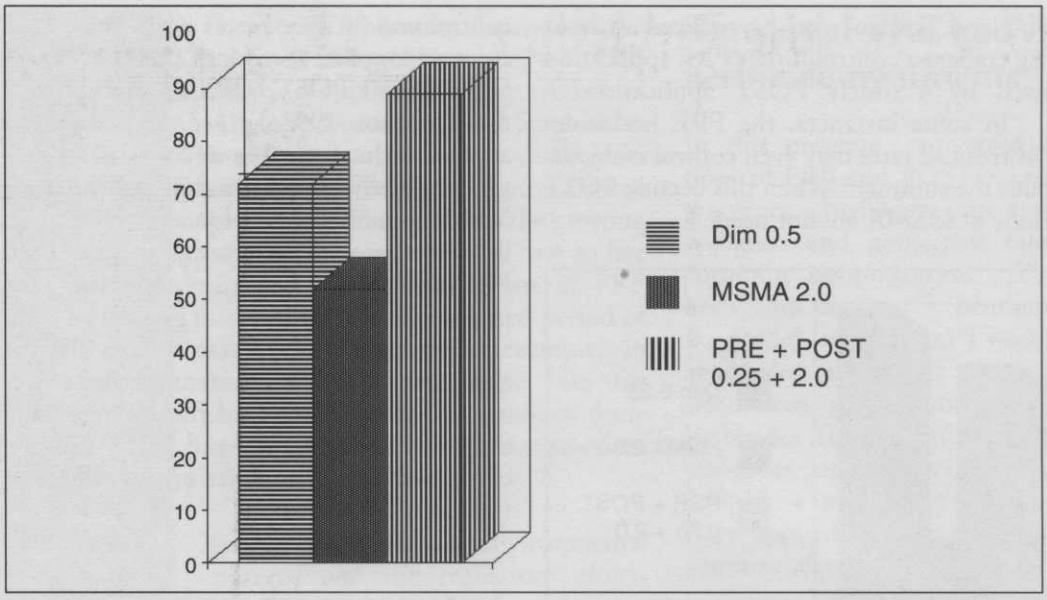
Treatment with tank-mixtures of PRE and POST herbicides

In this study, PRE herbicides at reduced rates and POST herbicides at labeled rates were tank-mixed and applied to common bermudagrass in a single application in May, after crabgrass and goosegrass had emerged. For treatments of this nature to be effective, the POST herbicides must control already-emerged weeds, and the PRE herbicides must provide residual control through the remainder of the growing season.

Crabgrass control was 80% or higher when one-half rates of either Dimension® (0.25 lb./A) or pendimethalin (1.5 lb./A) were tank-mixed with MSMA at the normal rate (2.0 lb./A). This represented a degree of control higher than that achieved with either Dimension® or MSMA applied alone at normal rates. However, tank-mixes of the PRE herbicides with MSMA + metribuzin did not effectively control goosegrass (below 53%). In general, tank-mixtures of PRE and POST herbicides were not as effective as sequential applications of PRE and POST herbicides in controlling either crabgrass and/or goosegrass.

Multiyear PRE herbicide treatments

Five PRE herbicides (Barricade®, Surflan®, Dimension®, pendimethalin, and Ronstar®) were applied to the same plots at various rates annually over a three-year period for crabgrass and goosegrass control in common bermudagrass.



Tank-mixed PRE and POST herbicides in common bermudagrass. 1991-1992 (Average 2-3 Exp.) % Crabgrass control

Crabgrass control

All PRE herbicides controlled 90% or more of the crabgrass during the first year when applied at normal rates. When the rates of application were reduced by one-half the recommended rate the first year, control was 85% in plots treated with Dimension® (0.25 lb./A) and pendimethalin (1.5 lb./A), 75% in plots treated with Barricade® (0.38 lb./A) and Surflan® (1.0 lb./A), and 64% in plots treated with Ronstar® (1.5 lb./A). This reinforces the previous finding that PRE herbicides applied alone at reduced rates may not control crabgrass consistently during the first year of use (Johnson and Murphy 1987; 1989; 1993). Therefore, if reduced PRE herbicide application rates do not result in consistent crabgrass control in bermudagrass, MSMA can be applied subsequently. It should also be emphasized that MSMA can be applied safely to bermudagrass and most of the cool-season grasses, but not to zoysiagrass (*Zoysia* spp.), centipedegrass [*Eremochloa ophiuroides* (Munro) Hack.], St. Augustinegrass [*Stenotaphrum secundatum* (Walt.) Kuntze], or bahiagrass (*Paspalum notatum* Flugge).

Crabgrass control ranged from 83 to 92% during the second year of the study when Barricade®, Surflan®, pendimethalin, and Dimension® were applied at one-half the recommended rate the first year, and one-fourth the recommended rate the second year. However, for Ronstar® to maintain similar control, it was necessary to apply the normal recommended rate the first year, followed by one-half the recommended rate the second year.

With PRE herbicides applied to the same plots for crabgrass control for three consecutive years, acceptable control (88 to 93%) was maintained with cumulative three-year application rates for Barricade®, Surflan®, Dimension®, and pendimethalin reduced by 67%. Each herbicide was applied at one-half the recommended rate the first year, then one-fourth the recommended rate the second and third years. Ronstar® applied at reduced rates did not control crabgrass as effectively as did the other PRE herbicides. It appears, however, that when Ronstar® is applied to the same plots for three consecutive years, the rates can be reduced by 25% without loss of adequate control. It was necessary to apply Ronstar® at the recommended rate the first year, followed by three-fourths the recommended rate the second year, and one-half the recommended rate the third year. Therefore, herbicide selection plays an important role in maintaining an optimum level of crabgrass control utilizing application rates below those recommended.

Goosegrass control

None of the PRE herbicides controlled goosegrass effectively (better than 80%) in common bermudagrass during the first year. The poor control was probably related to rainfall. No irrigation water was applied at this test site. From May through July of that year, 7.1 inches of rain fell. This was 9.8 inches below normal for that period.

Goosegrass control with these herbicides was consistently higher the following year. The control the second year was above 80% in plots treated with: Dimension® applied at one-half the recommended rate (0.38 lb./A) the first year, followed by one-fourth recommended rate the second year; pendimethalin applied at the recommended rate (3.0 lb./A) the first year, followed by one-half the recommended rate the second year; Ronstar® applied at one-half the recommended rate (1.5 lb./A) both years; and Barricade® applied at the recommended rate (0.75 lb./A) the first year, followed by three-fourths the recommended rate the second year. Surflan® did not control goosegrass effectively at any rate.

Goosegrass control during the third year was effective when PRE herbicides were applied to the same plots for three consecutive years. To maintain better than 86% control during the third year, application rates for the herbicides were: pendimethalin and Ronstar® applied at one-half the recommended rate the first year, followed by one-fourth the recommended rate the second and third years; Dimension® applied at one-half the recommended rate the first and second years, followed by one-fourth the recommended rate the third year; Barricade® applied at the recommended rate the first year, followed by three-fourths the recommended rate the second year and one-half the recommended rate the third year; Surflan® applied at the recommended rate the first year, followed by one-half the recommended rate the second year and one-fourth the recommended rate the third year. In this program, the rates over the three-year period can be reduced by 67% for pendimethalin and Ronstar®, 58% for Dimension®, and 25% for Barricade®.

These results indicate that application of herbicides at recommended rates may not be needed each year to maintain acceptable crabgrass and goosegrass control in bermudagrass turf. When herbicides are applied to turfgrasses not previously treated, however, the rates cannot be reduced as much during the initial year as during subsequent years. Care should also be taken to select the herbicide and rate of application needed to perform best against whichever weed species are posing problems.

Turfgrass species response

The response of crabgrass to PRE herbicides varies among turfgrass species (Johnson 1993b). Programs to reduce herbicide rates for weed control will consequently vary with the turfgrass species being supported. Pendimethalin and Ronstar® applied at one-third the recommended rate in each of two applications (late February and late April) controlled crabgrass effectively (above 90%) in common bermudagrass. Ronstar® applied at one-third the recommended rate controlled crabgrass in tall fescue (96%), but pendimethalin did not (53%). Barricade® applied at one-fourth the recommended rate controlled crabgrass in common bermudagrass (89%), but one-half the recommended rate was required for similar control in tall fescue (82%). Dimension® applied at one-fifth the recommended rate in each of two applications controlled crabgrass in common bermudagrass (87%), but not in tall fescue, regardless of rate (control was below 65%).

The higher crabgrass control from pendimethalin and Dimension® in common bermudagrass, compared to that achieved in tall fescue, was probably related to differing levels of competition from the surrounding turfgrass during mid- to late summer. Canopy growth of tall fescue is upright. This allowed crabgrass to germinate and seedlings to emerge. In contrast, common bermudagrass grows actively during the summer and has a denser turf canopy than tall fescue. This probably suppressed crabgrass germination and seedling emergence. It is not known how other PRE herbicides applied at reduced rates will control crabgrass in tall fescue grown under severe stress conditions. In a preliminary study, Surflan® did not control crabgrass in tall fescue at any rate. It should be emphasized that herbicide performance on tall fescue would probably be better in geographical areas where heat stresses are not as severe.

Turfgrass injury

The injury to common bermudagrass treated sequentially with PRE and POST herbicides was related to the application rates of the POST, not the PRE, herbicides (Johnson 1993a). The maximum turfgrass injury observed was about 35% with MSMA at 2.0 lb./A and 40% with MSMA + metribuzin at 2.0 + 0.125 lb./A. The symptoms of injury to common bermudagrass was moderate leaf discoloration with some plant necrosis. It should be noted that, in all instances, the turfgrass recovered fully within 2 to 3 weeks after the POST treatments.

Tank-mixes of MSMA + metribuzin, with either Dimension® or pendimethalin, injured common bermudagrass more than when either herbicide was applied alone (Johnson 1994). The injury at one week after treatment with MSMA + metribuzin was 26%, compared to 48% injury in plots treated with the tank-mixes. By two weeks after application, the injury from PRE plus POST tank-mixes was approximately 75% higher than that observed from MSMA + metribuzin alone. There were no differences in injury when MSMA + metribuzin was tank-mixed with Dimension® or pendimethalin, and turf treated with the tank-mixes required longer than four weeks to recover. There was no difference in turfgrass injury from tank-mixed herbicides, compared with POST treatment alone. The injury to turfgrass at one to two weeks after herbicide treatment averaged 40% where MSMA + metribuzin was applied alone or with PRE herbicide.

PRE herbicides applied at a reduced rate in one or two annual applications generally maintain a higher quality turf than that found in untreated plots. The lower turf quality in untreated plots probably resulted from weed competition.

Dr. B. J. Johnson is a Professor of Crop and Soil Sciences at the University of Georgia. Professor Johnson has been employed by the University of Georgia since 1954, with the exception of two years military leave and two years graduate school at Texas A&M. Although he has worked with several crops during this period, his interest since 1972 has been on weed control, fertilization, and plant growth regulators in cool- and warm-season turfgrasses. During the last five years his major research has focused on utilizing reduced herbicide rates for optimum weed control in turfgrasses. This is his first contribution to *TurfGrass TRENDS.*

References

Bhowmik, P.C. and S.W. Bingham. 1990. "Preemergence activity of dinitroaniline herbicides used for weed control in cool-season turfgrasses." *Weed Technology.* 4:387-393.

Dernoeden, P.H. and J.M. Krouse. 1991. "Selected crabgrass control evaluations for Maryland in 1990." *Proc. Northeast. Weed Sci. Soc.* 45:117-118.

Johnson, B.J. 1994. "Tank-mixed herbicides on large crabgrass (*Digitaria sanguinalis*) and goosegrass (*Eleusine indica*) control in common bermudagrass (*Cynodon dactylon*) turf." *Weed Science.* 42:216-221.

Johnson, B.J. 1993a. "Sequential herbicide treatments for large crabgrass (*Digitaria sanguinalis*) and goosegrass (*Eleusine indica*) control in bermudagrass (*Cynodon dactylon*) turf." *Weed Technology.* 7:674-680.

Johnson, B.J. 1993b. "Differential large crabgrass control with herbicides in tall fescue and common bermudagrass. " *HortScience* 28:1015-1016.

Johnson, B.J. and T.R. Murphy. 1993. "Summer weed control with herbicides in turfgrasses." *Georgia Agric. Res. Bul.* 411.

Johnson, B.J. and T.R. Murphy. 1989. "Summer annual weed control in turfgrass." *Georgia Agric. Res. Bul.* 388.

Johnson, B.J. and T.R. Murphy. 1987. "Control of large crabgrass and goosegrass in warm-season turfgrasses." *Georgia Agric. Res. Bul.* 364.

McCarty, L.B. and D.L. Colvin. 1990. Weed control guide for Florida's Turfgrass Professionals." Proc. Florida Turfgrass Conf. 38:37-60.

Sawyer, C.D. and J.A. Jagschitz. 1987. "Timing of preemergence herbicides for crabgrass control." *Proc. Northeast. Weed Sci. Soc.* 41:211-212.

Watschke, T.L., G. Hamilton, and S. Harrison. 1988. "Preemergence control of crabgrass in a mixed stand of cool-season turfgrasses." *Proc. Northeast. Weed Sci. Soc.* 42:166-167.

Watschke, T.L. and G.W. Hamilton. 1990. "Pre-post combinations for weed control in turf." Proc. Northeast. *Weed Sci. Soc.* 44:138-139.