5-1-1986

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Bulletin 945 May 1986



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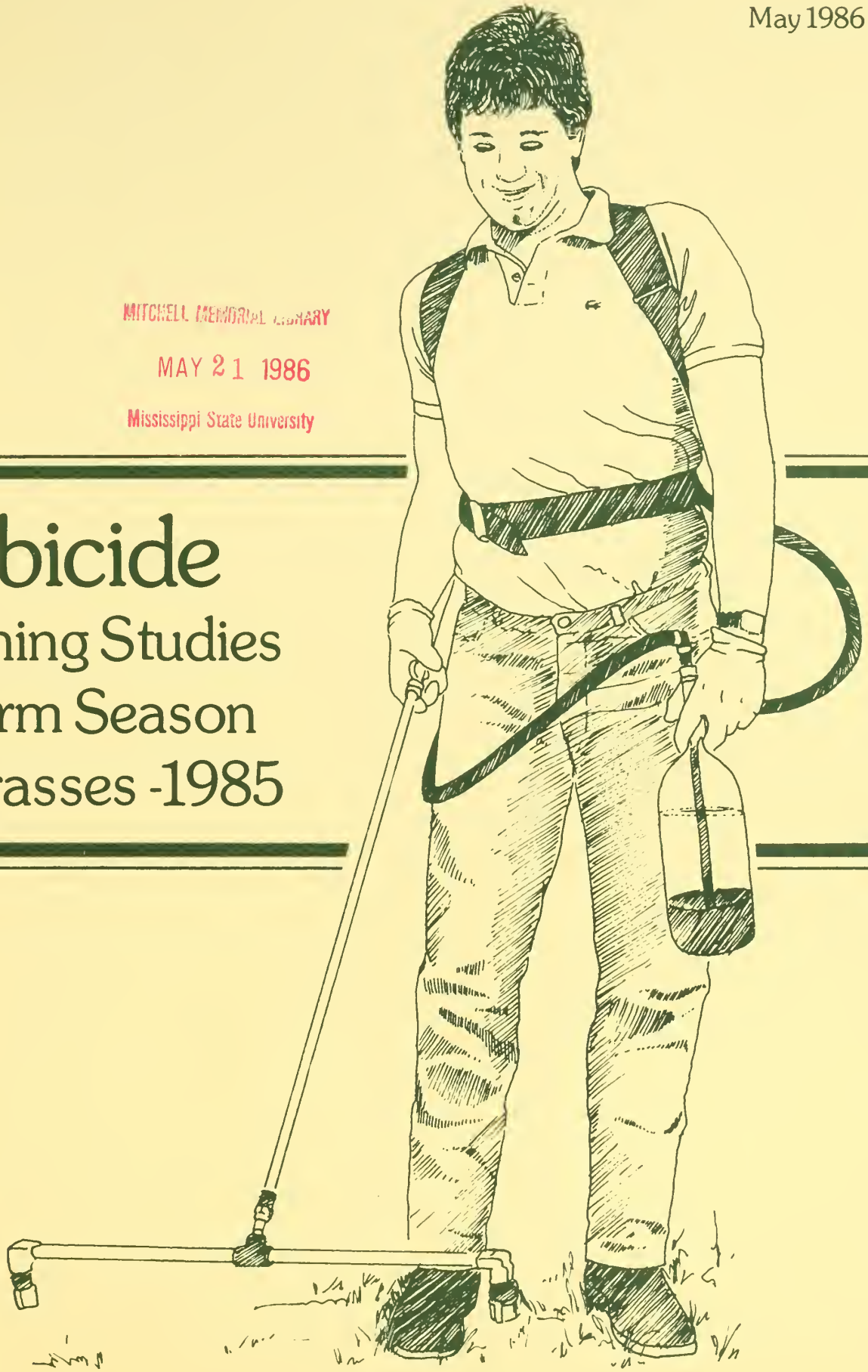

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# Herbicide Screening Studies in Warm Season Turfgrasses–1985

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## Introduction

Numerous herbicides are available for control of grassy and broadleaf weeds in warm season turfgrasses. Preemergence herbicides commonly used in turfgrasses include: Balan®, Betasan®, Dacthal®, Ronstar®, and Princep®.

Buctril® or Brominal®, 2,4-D, MCPP (mecoprop), Banvel®, or dichlorprop–used alone or in various combinations (2,4-D, MCPP, dichlorprop, or Banvel)–are the more important postemergence herbicides for broadleaf weed control in bermudagrass and other warm season turfgrasses.

Postemergence control of grass weeds in bermudagrass and zoysiagrass is achieved with MSMA or other organic arsenical herbicides. Asulox® is the only available postemergence herbicide to selectively control grass weeds in St. Augustinegrass. Poast® is the only available herbicide for grass weed control in centipedegrass.

These herbicides control many of the weeds in warm season turfgrass if applied at the appropriate rate and time. However, many weeds are tolerant of a particular herbicide, or its use is limited by turfgrass species or cultivar intolerance. Consequently, a need exists to evaluate new chemicals and to look at mixtures or formulations of materials presently available to increase our capability of managing weeds in turfgrasses. The purpose of the research reported here was to evaluate the effectiveness of new chemicals and/or formulations and mixtures of herbicides presently labeled for use in warm season turfgrasses.

## Methods and Materials

Tests were initiated in common bermudagrass turf at various locations to evaluate herbicides for a wide range of problems.

**(1)** Postemergence control of broadleaf weeds in late winter was tested at the MAFES Plant Science Research Center and Eupora Country Club, Eupora, MS.

**(2)** Preemergence control of crabgrass was evaluated at the MAFES Plant Science Research Center.

**(3)** Alternatives to Banvel in 2,4-D/Banvel mixture were evaluated for postemergence control of broadleaf weeds in late winter at the Plant Science Research Center.

**(4)** Tolerance and weed control with BAS 514 (BASF) were tested at the Plant Science Research Center.

**(5)** Tolerance and weed control studies with Asulox + atrazine in Raleigh St. Augustinegrass were conducted at Pearl River Valley Turf Farm, Wiggins, MS.

**(6)** Postemergence control of Virginia buttonweed with Super D Trimec® and Weedone® DPC was evaluated at Live Oaks Country Club, Jackson, MS.

**(7)** Weed control with Quadmec® was studied on the Mississippi State University Golf Course, Starkville, MS.

**(8)** Weed control and turf tolerance to XE-1019 (Chevron Chem. Co.) were tested on low maintenance turf at the Plant Science Research Center.

**(9)** The effect of Frigate® on activity of Roundup® for bermudagrass control was measured at the MAFES Plant Science Research Center.

Turfs at the MAFES Plant Science Research Center were maintained as home lawns, grown on a Marietta fine sandy loam soil, mowed weekly at 2-3 inches and fertilized with nitrogen at a rate equivalent to 3-4 pounds per 1,000 square feet annually. The preemergence test was overseeded with smooth crabgrass and goosegrass (2 quarts of each on 18,000 square feet) prior to treatment with herbicides. Infestations of smooth crabgrass mixed with Southern crabgrass in the plot area were extremely heavy, while the goosegrass germination was not sufficient to make control evaluations. The area in which the XE-1019 compound was evaluated was not fertilized during 1985.

Tests at Eupora Country Club were on common bermudagrass maintained as golf course turf on an Oaklimeter silt loam soil, mowed one or two times weekly, and fertilized with 2 pounds active N per thousand square feet annually.

Plot areas at Live Oaks Country Club were on common bermudagrass, golf course rough, mowed weekly at 2 inches and receiving one to 2 pounds active N per thousand square feet.

At Pearl River Valley Turf Farm, Raleigh St. Augustinegrass was grown under sod production conditions, mowed weekly, and fertilized with 6-8 pounds active N per thousand square feet yearly.

Postemergence control of winter

broadleaf weeds was evaluated at the MAFES Plant Science Research Center and Eupora Country Club on natural infestations of weeds. The common bermudagrass was dormant and the plot areas had not been mowed since late the previous fall.

Plots were 5 feet by 15 feet with one exception—the test with XE-1019 was on plots measuring 15 feet by 40 feet. Each plot was replicated four times in a randomized complete block design or a two-way whole split plot design (Banvel alternative study). In this latter test, whole plots were 2,4-D or no 2,4-D and alternative treatments were main plots. Herbicide applications were made with a carbon dioxide powered backpack sprayer in water at 25 gallons per acre (175 gallons per acre of the 10% PRE-M® prill formulation in the preemergence test); or the appropriate amount of granular herbicide was mixed with sand (approximately 2 quarts per 50 square feet) and uniformly applied to the plots. Specific treatments are shown in tables in the results section.

## Results and Discussion

### Winter Postemergence Tests

New herbicides evaluated at the MAFES Plant Science Research Center included sulfonated ureas (Ally®, Classic®, Glean®, and Oust®), Scepter®, Super Trimec, and CGA-131036 (Ciba-Geigy experimental compound) compared to Trimec® (Tables 1 and 2). Broadleaf weed control was generally poor for all herbicides including the herbicide standard, Trimec, which is an amine formulation of a mixture of dimethylamine salts of 2,4-D plus mecoprop plus Banvel. Of the newer compounds, Ally, Classic, Glean, Oust, and Scepter showed potential activity on white clover at the highest rates. The herbicidal activity of CGA-131036 on white clover was noticeably weaker than that of the other newer materials. Super Trimec (2,4-D isoctyl ester plus dichlorprop butoxyethanol ester plus Banvel acid) gave significantly better control in this test than Trimec.

Dandelion control was good with all herbicides except Trimec at either rate tested. Also, control of mouseear chickweed was good except with Trimec and the lowest rate of Scepter. Annual fleabane control was poor with all herbicides.

Ally, Glean, Super Trimec, and the higher rates of Scepter appear to have potential use for corn speedwell control based on the response observed in this study. The activity on corn speedwell observed with Scepter, which gave good control at 1.0 pound active ingredient per acre, is inconsistent with observations in other studies with Scepter conducted during the

**Table 1. Evaluation of postemergence herbicides for late winter weed control in bermudagrass turf[1].**

| Herbicide | Rate[2] lb ai/A | % White clover control [3] | | | % Dandelion control [3] | | | % Mouseear chickweed control[3] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 4 WAT | 6 WAT | 10 WAT | 4 WAT | 6 WAT | 10 WAT | 4 WAT | 6 WAT | 10 WAT |
| CGA-131036 | 0.022 | 23 | 18 | 0 | 33 | 50 | 68 | 33 | 0 | 70 |
| CGA-131036 | 0.036 | 28 | 35 | 10 | 18 | 75 | 68 | 40 | 15 | 80 |
| CGA-131036 + Trimec | 0.022 0.375 | 38 | 30 | 8 | 25 | 75 | 80 | 43 | 8 | 85 |
| Trimec | 0.375 | 25 | 23 | 0 | 10 | 45 | 3 | 0 | 8 | 13 |
| Trimec | 0.75 | 25 | 10 | 10 | 15 | 65 | 0 | 30 | 10 | 63 |
| Scepter | 0.25 | 18 | 53 | 25 | 23 | 0 | 68 | 40 | 10 | 38 |
| Scepter | 0.50 | 28 | 75 | 48 | 33 | 20 | 70 | 38 | 8 | 53 |
| Scepter | 1.00 | 23 | 85 | 68 | 30 | 38 | 78 | 48 | 78 | 60 |
| S-Trimec | 0.75 | 100 | 55 | 78 | 58 | 88 | 83 | 73 | 85 | 90 |
| Glean | 0.031 | 35 | 55 | 58 | 53 | 23 | 75 | 35 | 85 | 35 |
| Glean | 0.063 | 35 | 78 | 73 | 45 | 45 | 73 | 38 | 88 | 65 |
| Classic | 0.031 | 50 | 23 | 63 | 45 | 63 | 58 | 38 | 28 | 68 |
| Classic | 0.013 | 38 | 23 | 53 | 38 | 73 | 25 | 33 | 33 | 65 |
| Oust | 0.031 | 38 | 90 | 78 | 43 | 90 | 78 | 58 | 90 | 85 |
| Oust | 0.063 | 45 | 88 | 78 | 43 | 90 | 78 | 58 | 90 | 85 |
| Ally | 0.031 | 43 | 78 | 80 | 50 | 90 | 75 | 25 | 83 | 88 |
| Ally | 0.063 | 38 | 90 | 83 | 48 | 90 | 80 | 50 | 90 | 85 |
| Check | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LSD (0.05) | | 16 | 38 | 18 | 14 | 31 | 20 | 20 | 28 | 18 |
| Coefficient of variability | | 33 | 54 | 30 | 31 | 39 | 24 | 38 | 49 | 20 |

[1] Conducted at MAFES Plant Science Research Center. All treatments were applied in combination with a non-ionic surfactant (Ortho X-77 Spreader®) at 0.25% by volume. Herbicide applications were made on March 13, 1985.

[2] Rate for Trimec and Super Trimec is that of the 2,4-D in the three-way mixture.

[3] WAT = Weeks after treatment.

late winter and early spring of 1985. This was the only one of six studies in which corn speedwell was present that any significant control was observed.

Within this group of newer herbicides, the broadest spectrum of broadleaf weed control was generally observed with Super Trimec, which differs from Trimec in two ways. First, the mixture contains dichlorprop instead of mecoprop. Secondly, 2,4-D and dichlorprop are esters and the Banvel is the acid formulation in Super Trimec while all three components of the Trimec mixture are amines. The differences in herbicidal activity of dichlorprop versus mecoprop and the differences in activity of an ester formulation of the two phenoxy materials in the mixture probably accounts for the better weed control observed with Super Trimec.

These materials were evaluated in a duplicate experiment at Eupora Country Club. All herb-

**Table 2. Evaluation of postemergence herbicides for late winter weed control in bermudagrass turf[1].**

| Herbicide | Rate[2] lb ai/A | % Annual fleabane control[3] 4 WAT | % Corn speedwell control[3] 6 WAT |
|---|---|---|---|
| CGA-131036 | 0.022 | 35 | 0 |
| CGA-131036 | 0.036 | 46 | 15 |
| CGA-131036 + Trimec | 0.022 + 0.375 | 33 | 8 |
| Trimec | 0.375 | 25 | 8 |
| Trimec | 0.75 | 20 | 10 |
| Scepter | 0.25 | 30 | 10 |
| Scepter | 0.50 | 28 | 8 |
| Scepter | 1.00 | 37 | 78 |
| S-Trimec | 0.75 | 53 | 85 |
| Glean | 0.031 | 50 | 85 |
| Glean | 0.063 | 40 | 88 |
| Classic | 0.031 | 38 | 28 |
| Classic | 0.013 | 38 | 33 |
| Oust | 0.031 | 33 | 23 |
| Oust | 0.063 | 33 | 90 |
| Ally | 0.031 | 43 | 83 |
| Ally | 0.063 | 43 | 90 |
| Check | | 0 | 0 |
| LSD (0.05) | | 16 | 28 |
| Coefficient of variability | | 32 | 49 |

[1] Conducted at MAFES Plant Science Research Center. All treatments were applied in combination with a non-ionic surfactant (Ortho X-77 Spreader) at 0.25% by volume. Herbicide applications were made on March 13, 1985.

[2] Rate for Trimec and Super Trimec is that of the 2,4-D in the three-way mixture.

[3] WAT = Weeks after treatment.

**Table 3. Evaluation of postemergence herbicides for late winter weed control in bermudagrass turf[1].**

| Herbicide | Rate[2] lb ai/A | % White clover control[3] 4 WAT | 6 WAT | % Buttercup control[3] 4 WAT | 6 WAT | % Mouseear chickweed control[3] 4 WAT | 6 WAT |
|---|---|---|---|---|---|---|---|
| CGA-131036 | 0.022 | 25 | 40 | 28 | 48 | 38 | 58 |
| CGA-131036 | 0.036 | 33 | 45 | 48 | 92 | 48 | 53 |
| CGA-131036 + Trimec | 0.022 + 0.375 | 18 | 40 | 33 | 55 | 45 | 40 |
| Trimec | 0.375 | 10 | 15 | 23 | 48 | 28 | 28 |
| Trimec | 0.75 | 15 | 25 | 23 | 58 | 35 | 55 |
| Scepter | 0.25 | 18 | 30 | 33 | 63 | 40 | 60 |
| Scepter | 0.50 | 18 | 40 | 50 | 78 | 43 | 65 |
| Scepter | 1.00 | 30 | 48 | 48 | 78 | 55 | 83 |
| S-Trimec | 0.75 | 47 | 93 | 50 | 100 | 58 | 95 |
| Glean | 0.031 | 33 | 58 | 50 | 83 | 50 | 78 |
| Glean | 0.063 | 28 | 50 | 38 | 85 | 50 | 70 |
| Classic | 0.031 | 30 | 30 | 55 | 83 | 43 | 63 |
| Classic | 0.013 | 30 | 45 | 62 | 83 | 40 | 68 |
| Oust | 0.031 | 35 | 68 | 55 | 90 | 60 | 75 |
| Oust | 0.063 | 35 | 73 | 73 | 90 | 55 | 85 |
| Ally | 0.031 | 33 | 63 | 55 | 90 | 63 | 78 |
| Ally | 0.063 | 50 | 73 | 65 | 88 | 60 | 85 |
| Check | | 0 | 0 | 0 | 0 | 0 | 0 |
| LSD (0.05) | | 12 | 16 | 19 | 21 | 16 | 16 |
| Coefficient of variability | | 30 | 25 | 30 | 20 | 25 | 19 |

[1] Conducted at Eupora Country Club. All treatments were applied in combination with a non-ionic surfactant (Ortho X-77 Spreader) at 0.25% by volume. Herbicide applications were made on March 18, 1985.

[2] Rate for Trimec and Super Trimec is that of the 2,4-D in the three-way mixture.

[3] WAT = Weeks after treatment.

icides performed better at this location than at the MAFES Plant Science Research Center on white clover and mouseear chickweed, the two weed species present in both studies (Table 3). When comparisons were made 6 weeks after treatment, Super Trimec again performed better than Trimec or other herbicides on white clover, mouseear chickweed, and buttercup.

### Standard Preemergence Test

A number of herbicides were evaluated at the MAFES Plant Science Research Center (Tables 4, 5, and 6). Note that direct comparisons can be made between the data within rating dates.

Extremely poor control of crabgrass (a mixture of smooth and Southern crabgrasses) was observed with CGA-131036 and with combinations of this experimental compound and Bicep® or Aatrex® (Table 6). Other compounds in which control was assessed as poor (less than 70%) were Balan, EL 107 (Elanco Products), and Glean.

All formulations and rates of PRE-M, with the exception of the wettable powder (wp) formulation at 2.7 pound active ingredient per acre, gave 70% or greater control of the crabgrass mixture (Table 5). This level of control with PRE-M was observed for the duration of the study, i.e., 6 months following a single application or 6 months following the initial application of a multiple application treatment. Although not significantly better at the final evaluation, 6 months after the first or initial application control with the 10% prill fertilizer formulation of PRE-M was slightly higher than with either the wettable powder formulation or the water dispersable (WD) formulations. An additional application of 1.5 pounds active ingredient per acre PRE-M 60 or 90 days following

**Table 4. Crabgrass control in common bermudagrass[1].**

| Herbicide | Formulation | Rate lb ai/A | Applied Date | % Crabgrass control[2] | | | |
|---|---|---|---|---|---|---|---|
| | | | | 2 MAIT | 3 MAIT | 4 MAIT | 6 MAIT |
| CGA-131036 | 20 DF | 0.022 | March | 0 | 0 | 0 | 0 |
| CGA-131036 | 20 DF | 0.036 | March | 0 | 8 | 5 | 0 |
| CGA-131036 | 20 DF | 0.054 | March | 5 | 0 | 0 | 0 |
| Bicep | 4.5 LF | 4.0 | March | 100 | 98 | 83 | 58 |
| Bicep | 4.5 LF | 6.0 | March | 100 | 88 | 73 | 48 |
| Bicep | 4.5 LF | 8.0 | March | 100 | 100 | 93 | 63 |
| CGA-131036 | 20 DF | 0.022 | March | 78 | 63 | 43 | 25 |
| + Bicep | 4.5 LF | 2.0 | March | | | | |
| CGA-131036 | 20 DF | 0.022 | March | 35 | 18 | 15 | 5 |
| + Aatrex | 4 LF | 2.0 | March | | | | |
| Glean | 75 DF | 0.022 | March | 20 | 38 | 3 | 0 |
| EL-107 | 75 DF | 0.5 | March | 18 | 28 | 28 | 5 |
| EL-107 | 75 DF | 1.0 | March | 33 | 70 | 33 | 18 |
| Surflan | 4 AS | 3.0 | March | 100 | 100 | 98 | 83 |
| Surflan | 4 AS | 3.0 | March | 100 | 100 | 98 | 85 |
| + Surflan | 4 AS | 3.0 | May | | | | |
| Balan | 75 DF | 3.0 | March | 20 | 55 | 13 | 0 |
| Balan XL | 2 G | 3.0 | March | 100 | 100 | 95 | 90 |
| Balan XL | 2 G | 3.0 | March | 100 | 100 | 93 | 85 |
| + Balan XL | 2 G | 3.0 | May | | | | |
| Ronstar | 50 WP | 2.0 | March | 98 | 100 | 73 | 58 |
| Ronstar | 50 WP | 4.0 | March | 100 | 100 | 93 | 75 |
| Ronstar | 50 WP | 8.0 | March | 100 | 100 | 100 | 93 |
| Ronstar | 50 WP | 3.0 | March | 100 | 100 | 98 | 85 |
| + Buctril | 2 EC | 1.0 | March | | | | |
| Devrinol | 50 WP | 4.0 | March | 95 | 100 | 98 | 68 |
| Devrinol | 50 WP | 6.0 | March | 100 | 100 | 98 | 83 |
| LSD (0.05) | | | | 22 | 20 | 20 | 22 |
| Coefficient of variability | | | | 22 | 17 | 19 | 27 |

[1] Conducted at MAFES Plant Science Research Center. Initiated on March 13 and 14, 1985 with 60-day applications on May 10, 1985 and 90-day applications on June 6, 1985.

[2] MAIT = Months after initial treatment.

the initial treatment did not significantly increase crabgrass control (Table 5). Similar observations were made with 60 or 90-day followup applications of Balan XL® and Surflan® (Table 4).

Combination treatments in which a preemergence herbicide was tank mixed (Dacthal, Devrinol®, or PRE-M) or applied at the same time as a granular formulation (Ronstar or Balan XL) with the first of a two-application postemergence MSMA treatment in May gave good control of crabgrass (Table 6). Although the combination treatments Balan XL, Devrinol, PRE-M, and Ronstar exhibited slightly higher levels of control, they were not significantly better than the MSMA treatment alone.

### Alternative to Banvel

Ally, Classic, Glean, and Scepter were evaluated as alternatives to Banvel in a 2,4-D/Banvel mixture for winter broadleaf weed control at the MAFES Plant Science Research Center. All alternative herbicides were compared to 0.1 pound active ingredient per acre Banvel or 1.0 pound active ingredient per acre 2,4-D amine + 0.1 pound active ingredient per acre Banvel (Table 7). None of the alternative herbicides in combination with 2,4-D gave significantly higher control of white clover, mouseear chickweed, or dandelion than the herbicide without 2,4-D if 40% control was achieved. Ally at 0.063 pounds (1 ounce) active ingredient per acre was consistently the best treatment with 80% or

**Table 5. Crabgrass control with three formulations of PRE-M[1].**

| Herbicide | Formulation | Rate lb ai/A | Applied Date | % Crabgrass control[2] 2 MAIT | 3 MAIT | 4 MAIT | 6 MAIT |
|---|---|---|---|---|---|---|---|
| Ronstar | 50 WP | 2.0 | March | 98 | 100 | 73 | 58 |
| ----------Water dispersable formulation[3]---------- | | | | | | | |
| PRE-M | 60 WD | 2.7 | March | 98 | 100 | 93 | 70 |
| PRE-M | 60 WD | 3.0 | March | 100 | 100 | 90 | 70 |
| PRE-M | 60 WD | 3.3 | March | 100 | 100 | 95 | 70 |
| PRE-M | 60 WD | 3.0 | March | 100 | 100 | 98 | 73 |
| + PRE-M | 60 WD | 1.5 | May | | | | |
| PRE-M | 60 WD | 3.0 | March | 100 | 100 | 95 | 75 |
| + PRE-M | 60 WD | 1.5 | June | | | | |
| ----------Wettable powder formulation[3]---------- | | | | | | | |
| PRE-M | 50 WP | 2.7 | March | 98 | 90 | 90 | 55 |
| PRE-M | 50 WP | 3.0 | March | 98 | 100 | 98 | 70 |
| PRE-M | 50 WP | 3.3 | March | 100 | 100 | 100 | 75 |
| PRE-M | 50 WP | 3.0 | March | 100 | 100 | 100 | 85 |
| + PRE-M | 50 WP | 1.5 | May | | | | |
| PRE-M | 50 WP | 3.0 | March | 98 | 100 | 98 | 73 |
| + PRE-M | 50 WP | 1.5 | June | | | | |
| ----------Fertilizer prill formulation[4]---------- | | | | | | | |
| PRE-M | 10 PL | 2.7 | March | 100 | 100 | 100 | 85 |
| PRE-M | 10 PL | 3.0 | March | 100 | 100 | 98 | 88 |
| PRE-M | 10 PL | 3.3 | March | 100 | 100 | 98 | 90 |
| PRE-M | 10 PL | 3.0 | March | 100 | 100 | 100 | 90 |
| + PRE-M | 10 PL | 1.5 | May | | | | |
| PRE-M | 10 PL | 3.0 | March | 100 | 100 | 100 | 88 |
| PRE-M | 10 PL | 1.5 | June | | | | |
| LSD (0.05) | | | | 22 | 20 | 20 | 22 |
| Coefficient of variability | | | | 22 | 17 | 19 | 27 |

[1] Conducted at MAFES Plant Science Research Center. Initiated on March 13 and 14, 1985 with 60-day applications on May 10, 1985 and 90-day applications on June 6, 1985.
[2] MAIT = Months after initial treatment.
[3] Applied in water at 25 gallons per acre.
[4] Applied in water at 175 gallons per acre.

better control of all three weeds being observed.

### Evaluation of BAS 514

This experimental compound from BASF Wyndotte was screened for weed control and tolerance of three turfgrasses at the MAFES Plant Science Research Center. Poast was included as the standard herbicide for comparison on common bermudagrass, Tifway bermudagrass, and common centipedegrass mowed weekly at a 2 to 3-inch height under home lawn conditions.

Significant injury was observed with BAS 514 on common centipedegrass at all rates for 21 days following treatment (Table 8). This injury was evident throughout the 51-day duration of the study except at the 0.5 pound active ingredient per acre rate.

Injury was also observed on both common and Tifway bermudagrasses but the injury, except at 9 days after treatment on the Tifway bermudagrass, was significantly less than that observed with the Poast treatment. Slight injury was observed on common bermudagrass at 15 days after treatment, but was not significant.

Smooth crabgrass control with BAS 514 was equal to that observed with Poast (Table 9). BAS 514 gave 70 to 90% control of smooth crabgrass, and with a few exceptions, of dandelion, slender aster, and white clover when evaluated at 51 or 78 days after the

**Table 6. Smooth crabgrass control with preemergence herbicides applied at the time of MSMA treatment in common bermudagrass[1].**

| Herbicide | Formulation | Rate lb ai/A | Applied Date | % Crabgrass control[2] | | | |
|---|---|---|---|---|---|---|---|
| | | | | 2 MAIT | 3 MAIT | 4 MAIT | 6 MAIT |
| Check | | | | 0 | 0 | 0 | 0 |
| Ronstar | 50 WP | 2.0 | March 13 | 98 | 100 | 73 | 58 |
| Dacthal | 75 WP | 10.5 | March 13 | 85 | 70 | 55 | 20 |
| + Dacthal | 75 WP | 7.5 | May 10 | | | | |
| Dacthal | 75 WP | 10.5 | May 10 | 100 | 98 | 78 | -- |
| + MSMA | 6 L | 2.0 | May 10 | | | | |
| + X-77 | | 0.25% | May 17 | | | | |
| + Dacthal | 75 WP | 7.5 | July 8 | | | | |
| PRE-M | 60 WD | 3.0 | May 10 | 100 | 100 | 88 | -- |
| + MSMA | 6 L | 2.0 | May 10 | | | | |
| + X-77 | | 0.25% | May 10 | | | | |
| + MSMA | 6 L | 2.0 | May 17 | | | | |
| + X-77 | | 0.25% | May 17 | | | | |
| Devrinol | 50 WP | 4.0 | May 10 | 100 | 80 | 80 | -- |
| + MSMA | 6 L | 2.0 | May 10 | | | | |
| + X-77 | | 0.25% | May 10 | | | | |
| + MSMA | 6 L | 2.0 | May 17 | | | | |
| + X-77 | | 0.25% | May 17 | | | | |
| Ronstar | 2 G | 3.0 | May 10 | 100 | 100 | 88 | -- |
| + MSMA | 6 L | 2.0 | May 10 | | | | |
| + X-77 | | 0.25% | May 10 | | | | |
| + MSMA | 6 L | 2.0 | May 17 | | | | |
| + X-77 | | 0.25% | May 17 | | | | |
| Balan XL | 2 G | 3.0 | May 10 | 100 | 100 | 90 | -- |
| + MSMA | 6 L | 2.0 | May 10 | | | | |
| + X-77 | | 0.25% | May 10 | | | | |
| + MSMA | 6 L | 2.0 | May 17 | | | | |
| + X-77 | | 0.25% | May 17 | | | | |
| MSMA | 6 L | 2.0 | May 10 | 100 | 100 | 75 | -- |
| + X-77 | | 0.25% | May 10 | | | | |
| + MSMA | 6 L | 2.0 | May 17 | | | | |
| + X-77 | | 0.25% | May 17 | | | | |
| LSD (0.05) | | | | 22 | 20 | 20 | 22 |
| Coefficient of variability | | | | 22 | 17 | 19 | 27 |

[1] Conducted at MAFES Plant Science Research Center. Initiated on March 13 and 14, 1985.
[2] MAIT = Months after initial treatment.

September 4, 1985 application (Table 10).

### St. Augustine Tolerance to Atrazine Plus Asulox

Can atrazine for preemergence control be applied at the same time Asulox is applied for postemergence grass weed control? This study was conducted at the Pearl River Valley Turf Farm on July 19, 1985 to answer this question.

No significant injury was observed on Raleigh St. Augustinegrass following Asulox applications of 1.5, 2.0, or 2.5 pounds active ingredient per acre alone or in combination with atrazine at 1.5 pounds active ingredient per acre (Table 11). Broadleaf signalgrass control was increased by the addition of atrazine only when Asulox was used at the 1.5 pounds active ingredient per acre.

### Hormone Mixtures for Virginia Buttonweed

All herbicide treatments resulted in 75% or better control at 25 days after treatment (Table 12). However, control had declined at the 39-day rating in all treatments. EH 680 gave the highest level of control throughout the duration of the experiment. No significant bermudagrass injury was observed.

### Evaluation of Quadmec for Goosegrass

Quadmec treatment resulted in less than 60% goosegrass control at both rating dates (Table 13). Quadmec is a prepackaged formulation of MSMA + Trimec (2,4-D + mecoprop + Banvel). Injury to common bermudagrass and goosegrass control were both higher than the equivalent tank mixed treatment. However, goosegrass control was considered unacceptable in this study with either the prepackage mix (Quadmec) or the tank mix of Trimec plus MSMA.

### Evaluation of XE-1019

This study was located on a three-to-one sloped ditch bank at the MAFES Plant Science Research Center to evaluate the experimental herbicide in low maintenance turf. XE-1019 caused injury and reduced height of both common bermudagrass and tall fescue (Tables 14 and 15). Injury to common bermudagrass was greater than to tall fescue. XE-1019 + MSMA caused greater injury, especially at the earliest rating date (2 weeks after treatment) and the last rating date (11 weeks after treatment). Johnsongrass control was better than dallisgrass control with

**Table 7. Winter broadleaf control with 2,4-D combinations at six weeks after treatment[1].**

| Treatment | Rate lb ai/A | % Weed control[2] | | | | | |
|---|---|---|---|---|---|---|---|
| | | White clover | | Mouseear chickweed | | Dandelion | |
| | | No | Yes | No | Yes | No | Yes |
| Banvel | 0.10 | 60 | 68 | 18 | 15 | 0 | 33 |
| Scepter | 0.125 | 18 | 28 | 75 | 78 | 0 | 33 |
| Scepter | 0.25 | 20 | 10 | 15 | 25 | 0 | 10 |
| Scepter | 0.063 | 3 | 0 | 10 | 20 | 0 | 0 |
| Scepter | 0.031 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scepter | 0.016 | 3 | 5 | 5 | 13 | 20 | 20 |
| Glean | 0.063 | 70 | 75 | 75 | 80 | 63 | 70 |
| Glean | 0.031 | 35 | 43 | 48 | 53 | 43 | 43 |
| Glean | 0.016 | 23 | 43 | 40 | 45 | 83 | 83 |
| Glean | 0.008 | 23 | 50 | 13 | 35 | 35 | 40 |
| Glean | 0.004 | 3 | 13 | 18 | 18 | 35 | 35 |
| Classic | 0.063 | 70 | 75 | 43 | 55 | 53 | 55 |
| Classic | 0.031 | 43 | 58 | 38 | 25 | 28 | 48 |
| Classic | 0.016 | 43 | 48 | 5 | 0 | 15 | 30 |
| Classic | 0.008 | 0 | 0 | 0 | 0 | 0 | 10 |
| Classic | 0.004 | 0 | 18 | 0 | 0 | 0 | 0 |
| Ally | 0.063 | 85 | 88 | 88 | 90 | 88 | 90 |
| Ally | 0.031 | 90 | 90 | 85 | 83 | 60 | 85 |
| Ally | 0.016 | 83 | 88 | 48 | 80 | 40 | 60 |
| Ally | 0.008 | 75 | 83 | 53 | 50 | 63 | 73 |
| Ally | 0.004 | 90 | 90 | 25 | 25 | 43 | 43 |
| LSD (0.05) | | 31 | | 36 | | 28 | |
| Coefficient of variability | | 54 | | 77 | | 219 | |

[1] Conducted at MAFES Plant Science Research Center. Two-way whole split plot design.
[2] With (Yes) or without (No) 1 lb/A 2,4-D.

Table 8. Turfgrass tolerance to BAS 514[1].

| Turfgrass | Treatment | Rate lb ai/A | % Turfgrass Injury[2] 9 DAT | 15 DAT | 21 DAT | 51 DAT |
|---|---|---|---|---|---|---|
| Common centipedegrass | BAS 514 | 0.5 | 20 | 20 | 28 | 3 |
| | BAS 514 | 1.0 | 25 | 25 | 40 | 10 |
| | BAS 514 | 2.0 | 35 | 33 | 58 | 25 |
| | Poast | 0.5 | 0 | 13 | 0 | 0 |
| | + COC[3] | 1.3% | | | | |
| | LSD (0.5) | | 15 | 16 | 18 | 8 |
| | Coefficient of variability | | 59 | 59 | 46 | 69 |
| Common bermudagrass | BAS 514 | 0.5 | 0 | 0 | 0 | 0 |
| | BAS 514 | 1.0 | 3 | 0 | 18 | 0 |
| | BAS 514 | 2.0 | 3 | 5 | 25 | 0 |
| | Poast | 0.5 | 25 | 10 | 90 | 25 |
| | + COC[3] | 1.3% | | | | |
| | LSD (0.05) | | 5 | 4 | 4 | 9 |
| | Coefficient of variability | | 54 | 86 | 51 | 22 |
| Tifway bermudagrass | BAS 514 | 0.5 | 0 | 5 | 0 | 0 |
| | BAS 514 | 1.0 | 5 | 20 | 0 | 0 |
| | BAS 514 | 2.0 | 10 | 23 | 0 | 0 |
| | Poast | 0.5 | 10 | 65 | 23 | 0 |
| | + COC[3] | 1.3% | | | | |
| | LSD (0.5) | | 8 | 4 | 11 | 3 |
| | Coefficient of of variability | | 99 | 52 | 31 | 50 |

[1] Conducted at MAFES Plant Science Research Center. Initiated Sept. 4, 1985.
[2] DAT = Days after treatment.
[3] COC = Crop oil concentrate (Booster Plus E®).

Table 9. Weed control with BAS 514 in three turfgrasses[1].

| Turfgrass | Treatment | Rate lb ai/A | % Crabgrass control[2] 9 DAT | 15 DAT | 30 DAT | 51 DAT |
|---|---|---|---|---|---|---|
| Common centipedegrass | BAS 514 | 0.5 | 45 | 63 | 53 | 53 |
| | BAS 514 | 1.0 | 55 | 68 | 70 | 55 |
| | BAS 514 | 2.0 | 50 | 83 | 85 | 75 |
| | Poast | 0.5 | 38 | 70 | 70 | 63 |
| | + COC[3] | 1.3% | | | | |
| | LSD (0.5) | | 8 | 15 | 3 | 19 |
| | Coefficient of variability | | 13 | 17 | 33 | 25 |
| Common bermudagrass | BAS 514 | 0.5 | 30 | 53 | 70 | 20 |
| | BAS 514 | 1.0 | 48 | 73 | 70 | 48 |
| | BAS 514 | 2.0 | 60 | 83 | 78 | 68 |
| | Poast | 0.5 | 45 | 88 | 65 | 45 |
| | + COC[3] | 1.3% | | | | |
| | LSD (0.5) | | 9 | 11 | 10 | 13 |
| | Coefficient of variability | | 15 | 7 | 7 | 23 |
| Tifway bermudagrass | BAS 514 | 0.5 | 25 | 50 | 0 | 23 |
| | BAS 514 | 1.0 | 40 | 58 | 20 | 53 |
| | BAS 514 | 2.0 | 48 | 65 | 23 | 65 |
| | Poast | 0.5 | 38 | 78 | 23 | 35 |
| | + COC[3] | 1.3% | | | | |
| | LSD (0.5) | | 10 | 16 | 21 | NS |
| | Coefficient of variability | | 22 | 20 | 39 | 183 |

[1] Conducted at MAFES Plant Science Research Center. Initiated on Sept. 4, 1985.
[2] DAT = Days after treatment.
[3] COC = Crop oil concentrate (Booster Plus E®).

**Table 10. Broadleaf weed control with BAS 514 in three turfgrasses[1].**

| | | | % Weed control[2] | | | |
|---|---|---|---|---|---|---|
| | | | Slender aster | Dandelion | | White clover |
| Turfgrass | Treatment | Rate lb ai/A | 51 DAT | 51 DAT | 78 DAT | 78 DAT |
| Common centipedegrass | BAS 514 | 0.5 | | 90 | 85 | 80 |
| | BAS 514 | 1.0 | | 90 | 90 | 85 |
| | BAS 514 | 2.0 | | 90 | 90 | 90 |
| | Poast + COC[3] | 0.5 1.3% | | 28 | 30 | 23 |
| | Check | 0 | | 0 | 18 | 33 |
| | LSD (0.5) | | | 22 | 27 | 43 |
| | Coefficient of variability | | | 24 | 28 | 45 |
| Common bermudagrass | BAS 514 | 0.5 | 85 | 85 | 35 | |
| | BAS 514 | 1.0 | 98 | 90 | 85 | |
| | BAS 514 | 2.0 | 100 | 90 | 90 | |
| | Poast + COC[3] | 0.5 1.3% | 0 | 0 | 0 | |
| | Check | 0 | 0 | 0 | 0 | |
| | LSD (0.5) | | 7 | 4 | 2 | |
| | Coefficient of variability | | 8 | 5 | 27 | |
| Tifway bermudagrass | BAS 514 | 0.5 | 75 | 78 | 50 | 70 |
| | BAS 514 | 1.0 | 93 | 90 | 88 | 90 |
| | BAS 514 | 2.0 | 93 | 90 | 90 | 90 |
| | Poast + COC[3] | 0.5 1.3% | 73 | 0 | 8 | 28 |
| | Check | 0 | 0 | 0 | 13 | 35 |
| | LSD (0.5) | | 15 | 7 | 3 | 4 |
| | Coefficient of variability | | 16 | 8 | 20 | 44 |

[1] Conducted at MAFES Plant Science Research Center. Initiated Sept. 4, 1985.
[2] DAT = Days after treatment.
[3] COC = Crop oil concentrate (Booster Plus E®).

**Table 11. Crabgrass control and Raleigh St. Augustinegrass tolerance to Asuloc and atrazine[1]**

| | | % Control[2] smooth crabgrass | | % Injury-St.[2] Augustinegrass | |
|---|---|---|---|---|---|
| Treatment | Rate lb ai/A | 11 DAT | 25 DAT | 11 DAT | 25 DAT |
| Asulox | 1.5 | 80 | 0 | 0 | 0 |
| Asulox | 2.0 | 83 | 85 | 8 | 0 |
| Asulox | 2.5 | 78 | 83 | 5 | 0 |
| Asulox + atrazine | 1.5 1.5 | 90 | 88 | 10 | 0 |
| Asulox + atrazine | 2.0 1.5 | 78 | 88 | 3 | 0 |
| Asulox + atrazine | 2.5 1.5 | 90 | 83 | 10 | 0 |
| LSD (0.5) | | 17 | 8 | NS | NS |
| Coefficient of variability | | 14 | 57 | 146 | 0 |

[1] Conducted at Pearl River Valley Turf Farm. Initiated July 19, 1985.
[2] DAT = Days after treatment.

Table 12. Evaluation of 2,4-D mixtures for Virginia buttonweed control in common bermudagrass[1].

| Treatment | Rate[2] 2,4-D lb ai/A | % Control[3] Virginia buttonweed | | | | % Injury[3] bermudagrass turf | | |
|---|---|---|---|---|---|---|---|---|
| | | 7 DAT | 14 DAT | 25 DAT | 39 DAT | 14 DAT | 25 DAT | 39 DAT |
| EH 680[4] | 0.75 | 40 | 70 | 90 | 68 | 10 | 20 | 0 |
| EH 791[5] | 0.91 | 38 | 63 | 80 | 43 | 10 | 18 | 0 |
| EH 553[6] | 1.00 | 30 | 55 | 63 | 48 | 10 | 13 | 0 |
| EH 637[7] | 0.68 | 40 | 70 | 80 | 45 | 10 | 25 | 0 |
| DPC[8] | 0.93 | 33 | 63 | 75 | 48 | 10 | 23 | 0 |
| Check | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LSD (0.05) | | 4 | 7 | 7 | 3 | NS | NS | 10 |
| Coefficient of variability | | 9 | 9 | 8 | 48 | 0 | 0 | 41 |

[1] Conducted Live Oaks Country Club. Initiated Aug. 1, 1985.
[2] Rate is 2,4-D rate in the mixture (EH series and DPC).
[3] DAT = Days after treatment.
[4] Mixture of 2.0 lb 2,4-D ester + 2.0 lb dichlorprop ester + 0.5 lb Banvel per gallon (Super Trimec).
[5] Mixture of 2.43 lb 2,4-D amine + 1.21 lb mecoprop amine + 0.24 lb Banvel per gallon.
[6] Mixture 2.03 lb 2,4-D + 1.08 lb mecoprop amine + 0.21 lb Banvel amine per gallon (Trimec).
[7] Mixture 3.35 lb 2,4-D amine + 1.13 lb mecoprop amine + 0.14 lb Banvel per gallon.
[8] Weedone DPC, 1.85 + 1.85 lb/gallon of 2,4-D + dichlorprop.

Table 13. Evaluation of Quadmec and Trimec plus MSMA in common bermudagrass turf[1].

| Treatment | Rate [3] lb ai/A | No. of Applications | % Turf injury[2] | | % Goosegrass control[2] | |
|---|---|---|---|---|---|---|
| | | | 14 DAIT | 42 DAIT | 14 DAIT | 42 DAIT |
| Quadmec + X-77 | 0.53 0.25% | 1 | 3 | 20 | 3 | 18 |
| Quadmec + X-77 | 0.53 0.25% | 2 | 25 | 26 | 40 | 53 |
| Trimec + MSMA + X-77 | 0.64 2.00 0.25% | 1 | 8 | 20 | 10 | 18 |
| Trimec + MSMA + X-77 | 0.64 2.00 0.25% | 2 | 8 | 33 | 20 | 35 |
| MSMA + X-77 | 2.00 0.25% | 1 | 0 | 18 | 3 | 10 |
| MSMA + X-77 | 2.00 0.25% | 2 | 5 | 10 | 13 | 18 |
| LSD (0.05) | | | 9 | 22 | 18 | 19 |
| Coefficient of variability | | | 76 | 69 | 83 | 50 |

[1] Conducted at Mississippi State Univ. Golf Course. Initiated July 26, 1985 with second of two treatments being made Aug. 2, 1985.
[2] DAIT = Days after initial treatment.
[3] Rate given is the 2,4-D rate in the mixture Quadmec and Trimec.

**Table 14. Evaluation of XE 1019 in low maintenance bermudagrass turf[1].**

| Treatment | Rate lb ai/A | Bermudagrass[2] % injury 2 WAT | 4 WAT | 6 WAT | 8 WAT | 11 WAT | Height inches 11 WAT |
|---|---|---|---|---|---|---|---|
| XE 1019 | 0.5 | 8 | 10 | 10 | 15 | 5 | 12.8 |
| XE 1019 | 1.0 | 5 | 15 | 18 | 35 | 25 | 8.8 |
| XE 1019 | 2.0 | 5 | 15 | 33 | 45 | 45 | 5.5 |
| XE 1019 + MSMA + X-77 | 0.5 3.0 0.25% | 23 | 15 | 25 | 10 | 33 | 7.5 |
| XE 1019 + MSMA + X-77 | 1.0 3.0 0.25% | 25 | 20 | 25 | 15 | 43 | 7.0 |
| XE 1019 + MSMA + X-77 | 2.0 3.0 0.25% | 35 | 28 | 48 | 35 | 75 | 3.3 |
| MSMA + X-77 | 3.0 0.25% | 32 | 13 | 3 | 0 | 0 | 16.8 |
| Check | | 0 | 0 | 0 | 5 | 0 | 11.8 |
| LSD (0.05) | | 12 | 10 | 21 | 11 | 16 | 3.8 |
| Coefficient of variability | | 48 | 48 | 61 | 38 | 39 | 28 |

[1] Conducted at MAFES Plant Science Research Center. Initiated on June 25, 1985.
[2] WAT = Weeks after treatment.

**Table 15. Evaluation of XE 1019 in low maintenance bermudagrass turf[1].**

| Treatment | Rate lb ai/A | Tall fescue[2] % injury 2 WAT | 4 WAT | 6 WAT | 8 WAT | 11 WAT | Height inches 11 WAT |
|---|---|---|---|---|---|---|---|
| XE 1019 | 0.5 | 0 | 5 | 5 | 0 | 3 | 19.5 |
| XE 1019 | 1.0 | 0 | 8 | 10 | 0 | 13 | 12.3 |
| XE 1019 | 2.0 | 0 | 10 | 10 | 0 | 23 | 9.5 |
| XE 1019 + MSMA + X-77 | 0.5 3.0 0.25% | 5 | 10 | 8 | 15 | 8 | 20.0 |
| XE 1019 + MSMA + X-77 | 1.0 3.0 0.25% | 8 | 10 | 5 | 3 | 10 | 21.5 |
| XE 1019 + MSMA + X-77 | 2.0 3.0 0.25% | 8 | 10 | 13 | 0 | 23 | 9.8 |
| MSMA + X-77 | 3.0 0.25% | 5 | 8 | 5 | 5 | 0 | 25.0 |
| Check | | 0 | 0 | 0 | 10 | 0 | 20.8 |
| LSD (0.05) | | 6 | 4 | 5 | NS | 7 | 5.1 |
| Coefficient of variability | | 129 | 41 | 62 | 297 | 52 | 20 |

[1] Conducted at MAFES Plant Science Research Center. Initiated on June 25, 1985.
[2] 2WAT = Weeks after treatment.

**Table 16. Evaluation of XE 1019 in low maintenance bermudagrass turf[1].**

| Treatment | Rate lb ai/A | % Johnsongrass control[2] | | | | |
|---|---|---|---|---|---|---|
| | | 2 WAT | 4 WAT | 6 WAT | 8 WAT | 11 WAT |
| XE 1019 | 0.5 | 10 | 34 | 65 | 30 | 13 |
| XE 1019 | 1.0 | 1 | 34 | 60 | 25 | 50 |
| XE 1019 | 2.0 | 14 | 45 | 78 | 50 | 78 |
| XE 1019 | 0.5 | 51 | 80 | 83 | 63 | 53 |
| + MSMA | 3.0 | | | | | |
| + X-77 | 0.25% | | | | | |
| XE 1019 | 1.0 | 42 | 85 | 83 | 38 | 58 |
| + MSMA | 3.0 | | | | | |
| + X-77 | 0.25% | | | | | |
| XE 1019 | 2.0 | 45 | 70 | 90 | 73 | 90 |
| + MSMA | 3.0 | | | | | |
| + X-77 | 0.25% | | | | | |
| MSMA | 3.0 | 47 | 36 | 73 | 40 | 13 |
| + X-77 | 0.25% | | | | | |
| Check | | 0 | 13 | 0 | 20 | 0 |
| LSD (0.05) | | 27 | 28 | 17 | 37 | 36 |
| Coefficient of variability | | 62 | 37 | 17 | 59 | 57 |

[1] Conducted at MAFES Plant Science Research Center. Initiated on June 25, 1985.
[2] WAT = Weeks after treatment.

**Table 17. Evaluation of XE 1019 in low maintenance bermudagrass turf[1].**

| Treatment | Rate lb ai/A | % Dallisgrass control[2] | | | | % Foxtail control[2] |
|---|---|---|---|---|---|---|
| | | 2 WAT | 4 WAT | 6 WAT | 8 WAT | 11 WAT |
| XE 1019 | 0.5 | 0 | 0 | 28 | 13 | 33 |
| XE 1019 | 1.0 | 0 | 0 | 43 | 18 | 75 |
| XE 1019 | 2.0 | 0 | 0 | 60 | 33 | 88 |
| XE1019 | 0.5 | 10 | 50 | 50 | 83 | 38 |
| + MSMA | 3.0 | | | | | |
| + X-77 | 0.25% | | | | | |
| XE 1019 | 1.0 | 5 | 43 | 60 | 90 | 88 |
| + MSMA | 3.0 | | | | | |
| + X-77 | 0.25% | | | | | |
| XE 1019 | 2.0 | 3 | 45 | 83 | 90 | 90 |
| + MSMA | 3.0 | | | | | |
| + X-77 | 0.25% | | | | | |
| MSMA | 3.0 | 3 | 45 | 45 | 58 | 0 |
| + X-77 | 0.25% | | | | | |
| Check | | 0 | 0 | 0 | 0 | 0 |
| LSD (0.05) | | 8 | 5 | 18 | 33 | 26 |
| Coefficient of variability | | 25 | 118 | 26 | 48 | 35 |

[1] Conducted at MAFES Plant Science Research Center. Initiated on June 25, 1985.
[2] WAT = Weeks after treatment.

XE-1019 applied with MSMA (Tables 16 and 17). XE-1019 + MSMA gave better control of both johnsongrass and dallisgrass than when XE-1019 was applied alone.

### Effect of Frigate on Activity of Roundup

This study was designed to evaluate Frigate as an additive to Roundup for control of common bermudagrass (Table 18). Neither X-77® or Frigate at 0.5% by volume increased the control of bermudagrass in this study as compared to Roundup without surfactant added. Eighty percent or higher control of bermudagrass was observed with all treatments containing Roundup. No consistent differences in control of smooth crabgrass or white clover were observed due to additive.

## Acknowledgments

The authors wish to thank the following chemical companies for partial financial support of this research: American Cyanamid, Princeton, NJ; BASF, Parsippany, NJ; Chevron Chemical Co., San Francisco, CA; CIBA-Geigy, Greensboro, NC; Elanco Products Co., Indianapolis, IN; ICI Americas, Inc., Wilmington, DE; Lesco, Rocky River, OH; PBI Gordon Corp., Kansas City, KA; Rhone Poulenc, Inc., Monmouth Junction, NJ; SDS Biotech, Painesville, OH; and Stauffer Chemical Co., Westport, CT.

**Table 18. Effect of additives on bermudagrass control with Roundup[1].**

| Roundup Rate lb ai/A | Additive @ 0.5%[2] | % Bermudagrass control[3] | | | | % Smooth crabgrass control[3] | | % White clover control[3] | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 WAT | 3 WAT | 5 WAT | 7 WAT | 1 WAT | 3 WAT | 1 WAT | 3 WAT |
| 0 | None | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 20 |
| 4.0 | None | 35 | 73 | 80 | 90 | 70 | 90 | 44 | 78 |
| 4.0 | Frigate | 28 | 68 | 80 | 85 | 48 | 90 | 27 | 78 |
| 4.0 | X-77 | 33 | 58 | 80 | 90 | 55 | 68 | 33 | 65 |
| 3.0 | None | 28 | 70 | 80 | 85 | 53 | 90 | 30 | 80 |
| 3.0 | Frigate | 23 | 65 | 80 | 85 | 63 | 90 | 37 | 85 |
| 3.0 | X-77 | 25 | 73 | 78 | 83 | 65 | 90 | 43 | 85 |
| LSD (0.05) | | 7 | 9 | 3 | 8 | 11 | 25 | 15 | 10 |
| Coefficient of variability | | 20 | 11 | 3 | 8 | 15 | 22 | 32 | 9 |

[1] Conducted at MAFES Plant Science Research Center. Initiated on Aug. 13, 1985.
[2] Additive concentration by volume in 25 gallons per acre application volume.
[3] WAT = Weeks after treatment.