

Assessment of Application Rate and Formulation of Imazaquin Herbicide on Purple Nutsedge Suppression

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ABSTRACT

A field test was implemented at Paradise Valley Country Club to investigate the effect of two rates of imazaquin (Image) herbicide (0.38 and 0.50 lbs ai/a) in both the granular (G) and emulsifiable concentrate formulation on purple nutsedge and common bermudagrass in a mixed stand (85 ± 20% nutsedge).

There was no significant control of nutsedge 14 DAT from the first application. Reduction increased two weeks later at 35 DAT, (17-27% range for Image-treated plots). All chemical treatments caused temporary discoloring, stunting and plot yellowing at 14 DAT. Color was restored to acceptable levels 35 DAT. On 23 October, 1 month after the second treatment, purple nutsedge was significantly reduced as Image-treated plots had 75-83% control, compared to 20% control of MSMA treated plots. There was no difference between the (G) vs. (EC) formulation or rates for purple nutsedge control. For overall turf response, both rates and formulation effects were realized 30 DAT from the second application with the 0.50 lb ai/a rate having lower mean color scores than the 0.38 lb ai/a rate. Also, EC plots a slightly superior color score compared to the G formulation. Stunting was rate-dependent after the second application, but not affected by formulation.

INTRODUCTION

Purple nutsedge (*Cyperus rotundus*) is a troublesome weed in many agronomic crops and turf. This is in part due to the fact that the weed forms underground nutlets, which serve as a source of both food reserves and meristems for plant reproduction. Nutsedge control in turf is moderate at best, requiring repeat applications of MSMA.

The objectives of this research were to evaluate (1) the effect of two application rates (0.38 and 0.50 lbs. AI/A), of (2) both the emulsifiable concentrate (EC), and granular (G) formulations of imazaquin herbicide (Image) on nutsedge control and bermudagrass response in a mixed sward.

MATERIALS AND METHODS

An area of approximately 1200 square feet of common bermuda-nutsedge infested turf was selected for testing at Paradise Valley Country Club in Scottsdale, Arizona. The turf was maintained at a mowing height of 1.5 inches in a rough between fairways. The average infestation was 85 ± 20%. Plots were sprinkler irrigated with 1.5 inches of water in three irrigations weekly. Soil type was a sandy loam. The plot area was fertilized previously in February, April, and June with 1.0 lb of -N- per thousand square feet at each application.

Plot size was 10' x 5'. Treatments were as follows: 1 = IM 0.38 ai/a EC, 2 = IM 0.50 ai/a EC, 3 = IM 0.38 a/ia G, 4 = IM 0.50 a/ia G, 5 = MSMA 2.0 ai/a EC and 6 = control (untreated). A randomized complete block design was implemented with four replications.

The EC formulation was applied using a hand-held pressure tank and a 3-boom nozzle at a solution delivery rate of 80 gpa, 40 psi at a ground speed of 3 mph. The G formulation was preweighed, mixed with 6 quarts of topdressing and then hand applied in 3 directions across the plot.

Applications were made on 19 August and repeated again on 23 September 1988. Plots were evaluated for percent nutsedge infestation on 19 August, 9 September, 23 September, and 23 October. Control was measured as the percentage reduction in nutsedge between successive evaluations relative to initial stand infestations estimated on 19 August 1989.

Plot color was assessed using a visual scale of 1 - 9, with 1 = straw and 9 = dark green. Visual stunting (as an estimate of growth suppression of both bermuda and nutsedge) was assessed by visual scores of 1 - 6, with 1 = no stunting, 6 = severe stunting. Plot yellowing was assessed by assessing visual estimates of 1 - 6, with 1 = no yellowing, and 6 = severe yellowing. The degree of yellowing was observed on a percent plot basis (0-100%). These variables were measured on 2 and 23 September, and on 23 October 1988.

Contrast coefficients were devised to determine if there were significant effects of (1) the 0.38 vs. 0.50 lb ai/a rate averaged over both formulations; (2) the EC vs. G formulation averaged over both application rates; (3) any interaction between rates and formulations; and (4) imazaquin vs. MSMA treated plots.

RESULTS AND DISCUSSION

Nutsedge Control - There was no significant control of nutsedge at 14 DAT after the first application. Control ranged from 9.3% - 12.7%. Nutsedge reduction increased 2 weeks later at 35 DAT, ranging from 17.2 - 27.2% for imazaquin-treated plots (Table 1). At this time there was no significant treatment effect, even though the MSMA control decreased from 11.4 to 1.1% at 35 DAT. MSMA plots were inconsistent and highly variable in control, contributing to experimental error.

There was a significant treatment effect for nutsedge control between treatments on 23 October. Mean control ranged from 75% - 83% for imazaquin-treated plots, as MSMA had a mean control of 20%. Contrasts were not significant, showing essentially no difference between rate, formulation or interaction when using imazaquin. Imazaquin treated turfs had significantly better control than MSMA.

The need for a second application has been realized in other tests, especially when dealing with severely infested nutsedge areas (70% or greater nutsedge). The effect of single vs. repeat applications was not possible, without doubling the size and number of treatments in the test.

Secondary Responses - Color, stunting, degree of yellowing (plot discoloration) and percent plot yellowing.

2 September: All chemical treatments caused some discoloration of treated areas 14 DAT after the first application (2 September). There was no relationship between rates or formulations of imazaquin for this discoloration (Table 2). All turfs were stunted from chemical treatments. The greatest stunting was from imazaquin at 0.50 ai/a EC. Imazaquin-treated plots were more severely stunted than those of MSMA treated plots. The degree of plot yellowing was not significant between treatments, ranging from 2.0 for the control to 4.0 for the imazaquin at 0.38G. The granular formulation had slightly more yellowing than the EC, but again this was inconsequential. Percent plot yellowing was not significant, although the control had the lowest mean yellowing (13% plot basis).

23 September: Color scores had improved at 35 DAT. The MSMA plot was of slightly poorer color, but this was nonsignificant. By this time, stunting was somewhat minimized, but still present. Slightly cooler night temperatures had decreased growth of the checks as well. The degree of plot yellowing (discoloration) was not significant, however the percentage of the plot discolored was. The MSMA turf had over 50% discoloration at this time. There was no effect of formulation or rate with imazaquin for any of these variables at this date.

23 October: Color and stunting differences were realized among the plots one month after the second application (30 DAT) which was made on 23 September. There was a difference in turf color between rate and formulation among imazaquin-treated plots. Plots treated at the 0.38 and 0.50 lb. ai/a rates had mean color scores of 4.3 and 3.2, respectively, averaged over formulations. The EC and G formulations had mean color scores of 4.2 and 3.3, respectively, averaged over rates.

Substantial stunting was realized as plots ranged from 1.5 - 6 (severe stunting) (Table 2). At this time there was a significant effect between the 0.38 and 0.5 lb ai/a rates for mean stunting (3.8 and 5.7) when averaged over both formulations. There was no effect of chemical treatments for the degree of plot yellowing (discoloration) or percent plot yellowing.

Table 1. Percent of purple nutsedge infested turf on three evaluation dates. Applications were made on 19 August and 23 September, 1988. Paradise Valley Country Club, Paradise Valley, Arizona.

Treatment	Percent Control ³		
	<u>2 September</u>	<u>23 September</u>	<u>23 October</u>
	14 DAT (1)	35 DAT (1)	30 DAT (2)
IMAZAQUIN 0.38 (G)	12.7	25.4	75.5 a ⁵
IMAZAQUIN 0.50 (G)	9.4	23.3	75.3 a
IMAZAQUIN 0.38 (EC)	9.3	17.2	75.2 a
IMAZAQUIN 0.50 (EC)	10.7	27.2	83.4 a
MSMA 2.00 (EC)	11.4	1.1	20.0 b
CONTROL - -	-	-	-
Effect of Treatment ⁴	NS	NS	XXX
Contrast			
Rate 0.38 vs. 0.50	NS	NS	NS
Formulation (G) vs. (EC)	NS	NS	NS
Formulation x Rate	NS	NS	NS
IMAZAQUIN vs. MSMA	NS	NS	XXX

1 = DAT, days after treatments = 1st application 19 August.

2 = DAT, days after treatment - 2nd application 23 September.

3 = Percent control of original weed infestation on 19 August.

4 = NS = nonsignificant. XXX = significant at 0.001 probability level. Values are mean of four replications.

5 = DMRT. Duncan's multiple range test. Means with the same letter in common are not significantly different. P = 0.05.

Table 2. Secondary responses of purple nutsedge infested common bermudagrass turf on three evaluation dates. Applications were made on 19 August and 23 September 1988. Paradise Valley Country Club, Paradise Valley, Arizona.

Treatment	2 September						23 September						23 October					
	Color ¹	Stunt ²	Degree of Yellow ³	Percent of plot Yellow ⁴	Color ¹	Stunt ²	Degree of Yellow ³	Percent of plot Yellow ⁴	Color ¹	Stunt ²	Degree of Yellow ³	Percent of plot Yellow ⁴	Color ¹	Stunt ²	Degree of Yellow ³	Percent of Yellow ⁴		
Imazaquin 0.38 G	3.4 b ⁶	4.5 a ⁶	4.0	68	5.3	2.5	2.3	16 b ⁶	3.6 bc ⁶	3.8 b ⁶	3.3	46	3.6 bc ⁶	3.8 b ⁶	3.3	46		
Imazaquin 0.50 G	3.3 b	4.0 a	3.8	56	4.6	2.8	2.5	30 ab	2.9 c	6.0 a	3.3	45	2.9 c	6.0 a	3.3	45		
Imazaquin 0.38 EC	3.4 b	4.5 a	3.3	34	4.8	2.5	3.0	23 ab	4.9 a	3.8 b	3.8	34	4.9 a	3.8 b	3.8	34		
Imazaquin 0.50 EC	3.8 b	5.3 a	3.5	45	4.8	3.0	1.5	11 b	3.4 bc	5.3 a	3.0	43	3.4 bc	5.3 a	3.0	43		
MSMA 2.0 EC	3.9 b	2.2 b	3.0	60	4.0	2.3	3.8	54 a	4.3 ab	1.2 c	3.5	43	4.3 ab	1.2 c	3.5	43		
Control	5.4 a	1.2 b	2.0	13	5.0	2.0	2.8	22 b	4.8 a	1.5 c	4.0	35	4.8 a	1.5 c	4.0	35		
Effect of Treatment	XXX ⁵	XXX	NS	NS	NS	NS	NS	X	XXX	XXX	NS	NS	XXX	XXX	NS	NS		
Contrasts	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		
0.38 vs 0.50 ai/a	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		
EC vs GRAN	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		
Formulation x Rate	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		
Imazaquin vs MSMA	NS	XX	NS	NS	X	NS	XX	XX	X	XXX	NS	XX	X	XXX	NS	NS		

1. Colors = 1-9, 1 = straw, 9 = dark green.

2. Stunting = 1-6, 1 = no stunting, 6 = severe.

3. Degree of yellow = measure of discoloration: 1 = none, 6 = severe.

4. Percent plot yellow = percent of plot which is discolored, 1 - 100%.

5. XXX, XX, X, NS = significant at the 0.001, 0.05, 0.10 and non-significant, respectively.

6. DMRT = Duncan's Multiple Range Test Values. Means with the same letter in common are not statistically different from each other at the 0.05 probability level.

CONCLUSIONS

1. Repeat applications of imazaquin 30 days apart resulted in control of nutsedge from 75 - 83% (65 DAT), without effect from formulation or rates of 0.38 or 0.50 lb. ai/a.
2. At 14 DAT from initial application, changes in color and visual estimates of stunting (plant growth regulator effect) were realized, with imazaquin-treated plots being affected more so than MSMA treated plots.
3. At 35 DAT from the first application (23 September), discoloration was reduced in all plots receiving a chemical application.
4. Turfgrass color and visual stunting were affected on 23 October, 30 DAT from the second repeat application on 23 September. Both rates and formulation effects were realized with the 0.5 lb ai/a rate having lower mean color scores than the 0.38 lb ai/a rate. Also, the EC plots had a slightly superior color score, compared to the G formulations. Stunting was rate dependent after the second application, but not affected by formulation.
5. This test should be evaluated another year following treatment, with a continuing program, in order to determine if imazaquin will provide satisfactory control of purple nutsedge using either formulation.