

Activity of Imazaquin for Purple Nutsedge Suppression Using Various Application Techniques

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ABSTRACT

An experiment was devised to evaluate application technique, and elucidate the plant response (herbicidal activity) of imazaquin herbicide on single plants of purple nutsedge. Herbicide treated plants showed increased tillering and stunting 31 days after treatment. Soil treatments tended to increase herbicidal response. Imazaquin activity was minimized when the herbicide was not irrigated into the soil. Soil applied-imazaquin postponed the emergence of shoots from viable nutlets, but did not prevent emergence altogether.

INTRODUCTION

Control of purple nutsedge (*Cyperus rotundus*) is problematic in agronomic crops and in turfs. Herbicidal activity may be affected by application to either soil, plant, or a combination of the two. Established infestations of purple nutsedge would ideally be controlled with herbicides that would affect foliage and nutlet activity. The objectives of this experiment were to (1) evaluate control of individual nutsedge plants when treated with imazaquin applied to soil, plants and a combination of the two, and (2) evaluate any potential effect of imazaquin on nutlet sprouting.

MATERIALS AND METHODS

Single shoots of purple nutsedge, each with an attached nutlet (0.38 - 0.5 inch in length) were harvested from a 100% stand of nutsedge. On 22 June 1988, two shoots were placed in one-quart nursery containers, filled with three parts of fine sand (No. 2 washed Engine sand) and one part sandy loam soil v/v. Two 1.5-inch drainage holes were drilled in the bottom of the containers and lined with a fiber-bond cloth in concave fashion to eliminate purchasing. Plants were established for one month before treatments began. Two days before herbicide application, on 20 July, two (2) active nutlets, each supporting one active rhizome were transplanted into additional containers.

Treatments were as follows:

	<u>Area Treated</u>	<u>Method of Irrigation</u>
1.	Nutlets - soil	overhead
2.	Nutlets - untreated	overhead
3.	Foliage and soil	overhead
4.	Soil	overhead
5.	Foliage	overhead
6.	Foliage	surface flooding
7.	Foliage - untreated	overhead

Foliage treatments were implemented by spraying pots after covering the soil surface with vermiculite. Soil

treatments were implemented by covering plants with small plastic cups during application. Imazaquin was applied on 22 July at 0.50 lb ai/a using a 3-nozzle boom 24 inches above the pots at a 3 mph ground speed using 8006 nozzles at 40 psi, providing solution coverage of 60 gpa.

Pots were irrigated with 0.5 inch of water using a fan nozzle 12 hours after application during the early morning on 23 July. Treatment 6 was carefully watered without rinsing the herbicide off the foliage (foliage applied - surface flood irrigated).

Experimental design was randomized complete block with six replications. Pots were fertilized once with 1/2-strength Hoagland's nutrient solution, and watered as needed to prevent soil moisture stress. There was no clipping of the nutsedge plants.

Overall treatment effects were analyzed using the analysis of variance. Mean separation for all treatments was performed using Duncan's Multiple Range tests ($p = 0.05$). Specific pre-planned contrasts were devised to determine which application(s) would be most effective for weed control activity (Table 2). For these three contrasts, a probability value of 0.01 was needed to achieve statistical significance (Bonferroni protected F test).

Pots were evaluated 31 days after treatment (DAT) for control on 22 August. Responses included the number of tillers present, a visual assessment of plant vigor (1 = severely stunted, 6 = no stunting), followed by harvesting and measuring foliage dry weight after three days of oven drying at 135° F. All measurements are expressed on a pot basis.

RESULTS AND DISCUSSION

The overall affect of treatments were significant for the number of tillers, plant vigor and foliage dry weight 30 DAT. (Table 1).

The tillering phenomena was encouraged by the application of imazaquin to the foliage of established plants (Table 1). The foliage applied-flood irrigated nutsedge had a mean of 11.8 tillers, ranging to 7.5 tillers for the nutsedge receiving the soil and foliage treatment. Both the foliar treated nutsedge treatments had significantly more mean tillers than when a soil, or plant and soil application was made. The untreated nutsedge had a mean tiller response of 6.0 tillers/pot. By 31 DAT, the untreated nutlets had a mean of 2.6 tillers at the soil surface.

Contrasts showed significant differences (Table 2) for tillering between soil vs. foliage (flood) treated nutsedge (8.0 and 11.8 tillers/pot, respectively). This data suggests that soil activity is of greater importance than foliar uptake. The newly planted nutlets showed no significant response to imazaquin applications with any of the measurable parameters.

Imazaquin-treated nutsedge manifested stunting 31 DAT. Soil applications had more stunting than foliage-applied treatments (Tables 1 and 2). The least effective imazaquin treatment was that of the foliage treatment, followed by foliage treatment which was flood irrigation (Table 2). In the latter case, there was little or no herbicide allowed to reach the soil surface. Stunting increased slightly for the foliage treatment followed by sprinkle irrigation, to significant increases with the soil, and the soil and foliage-treated nutsedge. These results clearly indicate increased activity via the soil route. This is supported by the findings (Table 2) that the contrast for foliage and soil vs. foliage treated, was significant (2.7 vs. 4.0 mean vigor scores, respectively).

Foliage dry weights also supported the trend of enhanced soil activity vs. foliar applied Imazaquin. Soil treated plants had a dry matter mean value of 1.38 gm vs. 1.91 for foliage treated plants, (both sprinkler irrigated). The nutsedge which received this soil and foliage application had a mean gm dry weight of 1.24 gm. Foliage applied, flood irrigated plants had a mean dry matter production of 2.0 gms, second only to the control's value of 2.4 (Table 1).

CONCLUSIONS

Imazaquin increased tillering and promoted the stunting of nutsedge plants 31 DAT at the 0.50 lb. ai/rate. Soil applications tended to have a greater affect on nutsedge growth than the foliar applications. Applications to both foliage and soil had the greatest effects. This was also true for tillering (less response), plant vigor (greater stunting) and greater dry weight reduction of foliage (above-ground biomass production). Soil applications were surpassed only by the soil and foliage applied treatments for these responses.

Imazaquin activity was minimized when the herbicide was not irrigated into the soil (foliage - flood irrigation treatment). Soil-applied imazaquin had little effect on development from viable nutlets 3.0 inches beneath the soil surface 31 days after treatment.

Table 1. Mean response values of purple nutsedge plants and nutlets from applications of imazaquin using various application techniques 30 DAT².

Tiller Production		Response ³		Surface Biomass	
Treatment ⁴	Mean ¹	Treatment ⁴	Mean ¹	Treatment ⁴	Mean ¹
Foliage (IM) flood only	11.8 ⁵ a	Plant-untreated	4.7 ⁵ a	Plant-untreated	2.4 ⁵ a
Foliage (IM)	9.5ab	Foliage (IM) flood irrig.	4.3 a	Foliage (IM) flood irrig.	2.0 a
Soil (IM)	8.0 b	Foliage (IM)	4.0 ab	Foliage (IM)	1.9 a
Foliage & Soil (IM)	7.5 b	Soil (IM)	3. bc	Soil (IM)	1.4 b
Foliage-untreated	6.0 b	Foliage & Soil (IM)	2.7 cd	Plant & Soil (IM)	1.3 b
Nutlet untreated	2.6 c	Nutlet (IM)	1.7 d	Nutlet-check	0.3c
Nutlet w/Image	0.7 c	Nutlet-untreated	1.5 d	Nutlet (IM)	0.1c
Significance ⁶	XXX		XXX		XXX

1. Mean of six replications.
2. 30 days after treatment, 0.50 lb ai/a, EC formulation plus 0.5% surfactant v/v.
3. Tiller production = number of tiller shoots/pot. Vigor, 1-6. 1 = severe stunting, 6 = no stunting. Surface biomass = gm dry wt/pot.
4. All treatments sprinkler irrigated except Foliage (IM) flood irrigation.
5. Means followed by the same letter in common are not significantly different from each other, Duncan Multiple Range Test, P=0.05.
6. Significant at the 0.01 level of probability.

Table 2. Contrast significance and mean response of various application methods of imazaquin herbicide applied to individual plants of purple nutsedge - 0.50 lb ai/a

Significance and Means									
Response	Contrast								
	<u>Soil vs. Foliage (Flood)</u>			<u>Foliage and Soil</u>			<u>Foliage vs. Foliage (Flood)</u>		
	Sig ¹	Mean ²	Value ³	<u>vs. Foliage</u>			Sig ¹	Mean ²	Value ³
	Sig ¹	Mean ²	Value ³	Sig ¹	Mean ²	Value ³	Sig ¹	Mean ²	Value ³
Tiller Number	X	8.0	11.8	X	7.5	9.5	NS	9.5	11.8
Vigor	X	3.0	4.3	X	2.7	4.0	X	4.0	4.3
Foliage biomass (gm dry weight)	X	1.4	2.0	X	1.2	1.9	X	1.9	2.0

1/ Significant at the 0.01 probability level.

2/ Mean of six (6) replications.

3/ All plants receiving overhead irrigation, except plant (flood), which received image to plant foliage only, followed by flood irrigation only.

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Response	Contrast								
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	Sig ¹	Mean ²	Value ³	Sig ¹	Mean ²	Value ³	Sig ¹	Mean ²	Value ³
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