

Results in the Second Summer After
Foliar Application of Herbicides to Flowering Rush
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Introduction:

The Noxious Weed Trust Fund awarded Salish Kootenai College/University of Montana funds to conduct foliar herbicide application trials on flowering rush (*Butomus umbellatus*) in Flathead Lake (Montana). Replicated plot trials using Habitat (imazapyr), Clearcast (imazamox), and Renovate (triclopyr) were implemented in May 2008 for spring emerging flowering rush when the lake level was below the infestation site, and also implemented in July at full pool when only 6 to 18 inches of leaf was above the water line (4.5 to 5.5 feet of leaf below the water line).

The first replicated plot trial applications were made on May 27, 2008 when Flathead Lake was at low pool and the rhizome mat was exposed and 5 to 7 inches of leaf had emerged. The surface water was totally off the site. The sprayer was mounted on an Argo wetland crawler. A single Boom Buster 125 nozzle elevated 42 inches above the rhizome mat was used. Running at 40 PSI this gave an effective swath width of 15.5 ft and total volume output was 35 GPA. Rates were Habitat at 2 and 3 quarts/acre, Clearcast at 2 quarts per acre, and Renovate (triclopyr) at 8 quarts per acre. Each treatment was applied to three plots in a randomized complete block design. All four treatments included Competitor methylated seed oil at 2 quarts per acre.

The same herbicide treatments were made from a small boat at high pool on July 26, 2008 with a total volume output of 31 GPA. The nozzle was raised to 48 inches above the water surface getting an effective swath width of 21 feet at 40 PSI. On average for the leaves that were above water there were 12 inches exposed, with an average of 40 inches of leaf below water. The Renovate quickly burnt the exposed leaf but had no obvious effect on the portion of the leaf below the waterline. There are no visible symptoms during the first season from the Habitat and Clearcast high pool treatments. The high pool efficacy of these two slow acting herbicides was first determined on 9 July 2009.

Data Analysis:

Low Pool Foliar Treatments

Habitat at 2 and 3 qt/ac applied to the leaves emerging from the exposed rhizome mat at low pool both provided 2008 summer season long suppression in this first growing season after spraying. As of early July 2009, in the second growing season after spraying, both Habitat rates maintained 86.7% suppression of flowering rush at 408 days after treatment (Table 1, Figure 1). However as the second post-spray summer was ending the Habitat plots were filling in with flowering rush. Clearcast control in the first summer after spraying was similar to that of the Habitat treatments but declined more in the fall but this difference relative to the two Habitat treatments was not statistically significant

(pairwise LSD $p=.106$ & $.343$). Clearcast control in the second summer after spraying averaged 53.3 % at 408 DAT but varied considerably among the plots. The Clearcast plot with the poorest control (35%) was likely the first to have been inundated by the rising lake level, and the Clearcast plot with the best control (75%) was likely the last to have been covered by water. The water had covered the plots within 3 days after spraying in 2008. By the end of the second summer (Aug 21, 2009 at 451 DAT) after spraying all the herbicide treated plots were filling back in with flowering rush. Although Renovate slowed initial first year growth, by day 82 after spraying these plots were mostly indistinguishable from the no-spray controls.

Table 1. Percent control of flowering rush, based on visual scoring or point intercept (Dunnett $t > \text{control}$) after low pool foliar spraying on May 27, 2008.

Dependent Variable	(I) Treatment	(J) Treatment	% Control	Std. Error	Sig.	95% Confidence Interval
						Lower Bound
% Control ^r 25 Days After Treatment (DAT) June 21, 2008	Clearcast	No-Spray	99.7(*)	.2582	.000	99.03
	Habitat 2 qt/ac	No-Spray	100.0 (*)	.2582	.000	99.36
	Habitat 3 qt/ac	No-Spray	99.8 (*)	.2582	.000	99.20
	Renovate	No-Spray	97.3 (*)	.2582	.000	96.70
% Control ^r 82 Days After Treatment (DAT) Aug 18, 2008	Clearcast	No-Spray	97.3 (*)	2.0221	.000	92.35
	Habitat 2 qt/ac	No-Spray	98.7(*)	2.0221	.000	93.68
	Habitat 3 qt/ac	No-Spray	98.0 (*)	2.0221	.000	93.01
	Renovate	No-Spray	5.0 (*)	2.0221	.049	.01
% Control ^o ~115 Days After Treatment (DAT) Sept 15, 2008	Clearcast	No-Spray	64.8(*)	8.9008	.000	42.85
	Habitat 2 qt/ac	No-Spray	82.0(*)	8.9008	.000	60.05
	Habitat 3 qt/ac	No-Spray	74.5(*)	8.9008	.000	52.52
	Renovate	No-Spray	22.4(*)	8.9008	.046	0.49
% Control ^r 408 Days After Treatment (DAT) July 9, 2009	Clearcast	No-Spray	53.3(*)	8.270	.000	32.94
	Habitat 2 qt/ac	No-Spray	86.7(*)	8.270	.000	66.28
	Habitat 3 qt/ac	No-Spray	86.7(*)	8.270	.000	66.28
	Renovate	No-Spray	6.0	8.270	.506	-14.39
% Control ^o 451 Days After Treatment (DAT) Aug 21, 2009	Clearcast	No-Spray	38.1(*)	9.895	.005	13.736
	Habitat 2 qt/ac	No-Spray	31.4(*)	9.895	.016	6.97
	Habitat 3 qt/ac	No-Spray	53.4(*)	9.895	.001	29.00
	Renovate	No-Spray	5.9	9.895	.562	-18.46

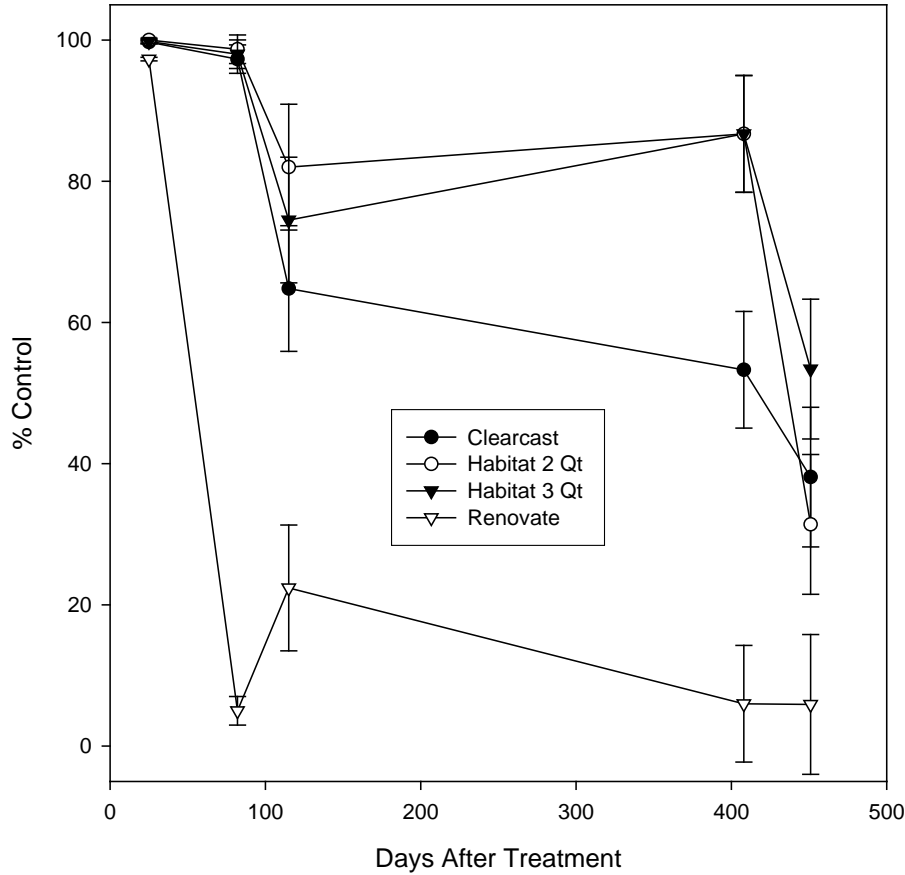
(*)The mean difference is significant at the .05 level or lower.

^r% Control based on visual scoring

^o% Control based on point intercept

this Dunnett t-test compares each herbicide treatment to the No-Spray Controls

Figure 1. Percent control of flowering rush \pm one standard error after low pool (exposed sediments) foliar treatments on May 27, 2008.



High Pool Foliar Treatments

Efficacy for all the high pool foliar treatments was poor at approximately one year after spraying (Table 2, Figure 2). The Renovate plots could not be distinguished from the no-spray controls on July 9, 2009 at approximately one year (349 days) after having been sprayed back in July 26, 2008. The calculated mean control of 35% on the 2 qt/ac Habitat plots was slightly better than the mean control (31.7%) for the 3 qt/ac Habitat plots although this difference certainly was not a significant (pairwise LSD $p = .682$, Figure 2). The Clearcast plots exhibited 23.3% control.

Table 2. Percent control of flowering rush, based on visual scoring (Dunnett $t >$ control) at 349 days (9 July 2009) after high pool foliar spraying on 26 July 2008.

(I) Treatment	(J) Treatment	% Control	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Clearcast	No-Spray	23.3(*)	7.888	0.022	3.88	38.78
Habitat 2	No-Spray	35.0(*)	7.888	0.002	15.55	54.45
Habitat 3	No-Spray	31.7(*)	7.888	0.004	12.22	51.22
Renovate	No-Spray	0.000	7.888	0.800	-19.45	19.45

* The mean difference is significant at the .05 level.

this Dunnett t-test compares each herbicide treatment to the No-Spray Controls

Figure 2. Percent control (visual scoring) \forall 95% confidence intervals for flowering rush 349 days after high pool foliar treatments.

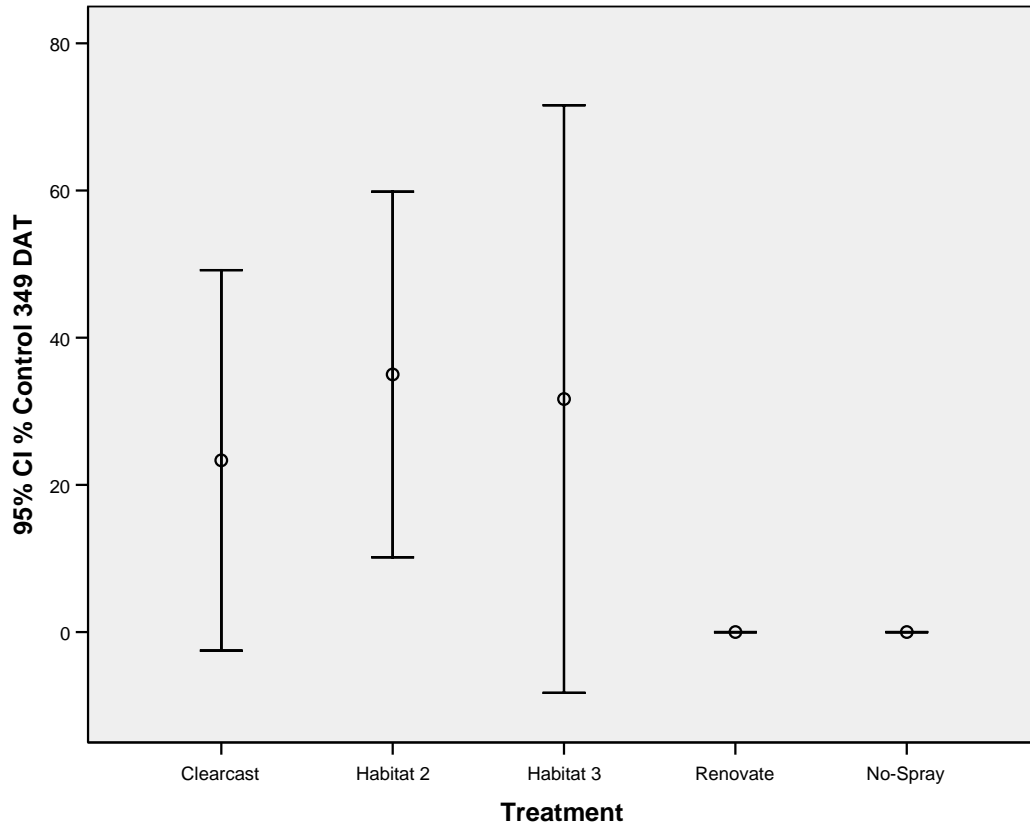


Figure 3. Example flowering rush no-spray control plot at Flathead Lake on 9 July 2009.



Figure 3, Example flowering rush plot at 409 days (9 July 2009) after treatment of low pool foliar spraying of Habitat at 2 qt/ac on 27 May 2008.



Figure 4. Example flowering rush plot at 349 days (9 July 2009) after treatment of high pool foliar spraying of Habitat at 2 qt/ac on 26 July 2008. Note numerous shorter leaves of flowering rush below the water.

