FIELD NOTE

Efficacy of Stem Injection Treatments on Striped Maple in Central West Virginia

Jeffrey D. Kochenderfer and James N. Kochenderfer

ABSTRACT

Hack-and-squirt injection treatments were applied to individual striped maple (*Acer pennsylvanicum* L.) stems and to the largest stem in sprout clumps in a 25-year-old clearcut in central West Virginia to evaluate seasonal efficacy of imazapyr as Arsenal (28.7%) and glyphosate as Glypro Plus (41.0%) in water carriers. Complete control of injected stems was achieved with all treatments. However, the Arsenal treatments resulted in greater control of basal sprouting, untreated striped maple stems, and sprout clumps. Treatment efficacies were higher in September than in June. Land managers can use the application methods described here and a 6% solution of Arsenal to effectively control individual striped maple stems and sprout clumps.

Keywords: herbicides, striped maple, efficacy, stem injection

Striped maple (*Acer pennsylvanicum* L.) is a small tree or shrub that commonly occurs on good sites above a 2,000-ft elevation in central West Virginia. Repeated partial cutting in the stands that developed after the heavy cutting at the turn of the century in this area often has encouraged the development of shade-tolerant understories containing striped maple. Preferential browsing on other species by white-tailed deer (*Odocoileus virginianus*) also has favored less desirable species such as striped maple (Marquis and Brenneman 1981). Research studies have shown that dense understories of striped maple can interfere with the establishment and development of desirable shade-intolerant species (Horsley and Bjorkbom 1983). Most striped maple originates from seed although it also reproduces by basal sprouting (Gabriel and Walters 1990).

Manual herbicide treatments often can be used to control undesirable stems in the steep topography and small ownerships found in Appalachia (Kochenderfer et al. 2004). They determined that the hack-and-squirt injection method was the cheapest and most target-specific way to manually control stems that are 1.0 in. dbh or more. However, in subsequent injection treatments using 50% solutions of Glypro Plus near that study site, some basal sprouting occurred on top-killed striped maple and red maple (*Acer rubrum* L.) trees. Using mechanical foliar spraying to control interfering understories in Allegheny hardwood stands is described by Horsley (1991). Striped maple stems that are over 15.0 ft tall, which are often not controlled by mechanical foliar spraying in dense understories, can be controlled using stem injection. A field trial was established to evaluate seasonal efficacy (top kill and basal sprouting) of four injection treatments on individual striped maple stems (1.0 in. dbh or more) and sprout clumps.

Methods

The study site is located in a southern extension of the Allegheny hardwood forest at an elevation of 3,200 ft in central West Virginia. Thirty-six 0.01-ac circular treatment plots, which contained at least 13 striped maple stems 1.0 in. dbh or more, were established in a 25-year-old clearcut containing a large component of striped maple. When possible, plots were located where they would contain at least one black cherry (*Prunus serotina* Ehrh.) crop tree that could be evaluated for collateral herbicide damage. A 15-ft untreated buffer was left between plots. A 0.025-ac circular plot was established around each treatment plot center to determine untreated stem mortality. The diameters of all striped maple stems that were 1.0 in. dbh or more were recorded on each plot and the stems were marked with flagging. The number of required incisions (one incision per inch of dbh) was written on each flagged stem. Standing dead striped maple stems on the plots and surrounding buffer areas were removed.

The two herbicides used in the injection treatments were isopropylamine salt of imazapyr as Arsenal (28.7%) and glyphosate (*N*-[phosphonomethyl]) glycine as Glypro Plus (41.0%) in water carriers. Five treatments were distributed randomly among the 36 plots. The five treatments included (1) 6% Arsenal, (2) 9% Arsenal, (3) 50% Glypro Plus, (4) 100% Glypro Plus, and (5) control (no treatments).

The four injection treatments were applied in September 2004 and June 2005 using two applicators. Each herbicide treatment was replicated four times on each treatment date. One incision per inch of dbh was made using a hatchet with a ground-down bit 1.75 in. wide. A plastic spray bottle calibrated to dispense 0.9 ml per squirt was used to apply 1.5 ml of solution into each incision. The actual volume of herbicide solution used for each herbicide application was recorded for each treatment plot.

The study was evaluated in September 2005 and June 2006, 12 months after treatment. A numerical rating system based on visual estimation of crown control ranging from 1 to 7 (0–100% crown affected) using visual symptoms was used to evaluate the efficacy of each treatment (Kochenderfer et al. 2001). Two observers rated all trees on each plot. A mean treatment efficacy rating was determined for both treatment periods.

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Jeffrey D. Kochenderfer (jdkochenderfer@fs.fed.us), US Forest Service, Monongahela National Forest, HC 59 Box 240, Petersburg, WV 26847. James N. Kochenderfer (retired), US Forest Service, Northern Research Station, PO Box 404, Parsons WV 26287. *The authors thank Douglas N. Toothman, Western Pocahontas Properties, for providing the study site, and Mark and Douglas Owens and Layne Godwin, Northern Research Station, for providing assistance in establishing the study.*

Table 1. Average number of striped maple stems 1.0 in. and larger, stem diameters, and volume of herbicide solution used by treatment.

Treatment	September			June		
	No. of stems (no./ac)	Diameter (in.)	Solution used (gal/ac)	No. of stems (no./ac)	Diameter (in.)	Solution used (gal/ac)
Arsenal						
6%	2,750	1.8	2.4	2,375	1.5	1.8
9%	2,875	2.0	2.6	2,075	1.7	2.0
Glypro Plus						
50%	2,875	2.0	2.1	2,300	1.6	2.0
100%	2,525	2.1	1.8	2,350	1.8	1.9
Control	2,800	1.8	0	2,800	1.8	0

Table 2. Percentage of treated stems controlled, basal sprouting, and number of untreated stems controlled 12 months after treatment.

Treatment	September 2004			June 2005		
	Treated stems controlled[a] (%)	Treated stems sprouted (%)	Untreated stems controlled (no./ac)	Treated stems controlled (%)	Treated stems sprouted (%)	Untreated stems controlled (no./ac)
Arsenal						
6%	100	0	420	100	0	140
9%	100	0	800	100	0	160
Glypro Plus						
50%	100	1	20	100	16	0
100%	100	2	20	100	13	0

[a] Control required at least 75% of crowns to be necrotic.

Table 3. Number of treated striped maple sprout clumps, average number of stems per clump, injected stem diameter, and sprout clump efficacy by treatment.

Treatment	No. of treated clumps	Average stems per clump (no.)	Average injected stem diameter (in.)	Injected stems controlled (%)	Percent of clumps controlled[a] (%)
Arsenal					
6%	18	3	2.6	100	90
9%	16	3	2.4	100	100
Glypro Plus					
50%	16	3	2.1	100	19
100%	25	3	2.1	100	44

[a] Control required at least 75% of the stems in each clump to be controlled.

Striped maple sprout clumps were also treated on four areas of the clearcut during the September application. Each area was used to evaluate one of the herbicide treatments. The largest stem in each clump was injected using the same procedure described for the individual stem treatments.

Results and Discussion

The number of stems, stem diameter, and amount of herbicide used are shown for each treatment in Table 1. The number of individual stems treated exceeded the 2,000 stems/ac upper limit recommended by Zedaker (1986) but provided more observations for treatment comparisons. Stem diameter averaged 1.9 and 1.7 in. for the September and June treatment periods, respectively. The amount of chemical applied per incision averaged 1.6 and 2.0 ml in the September and June applications, respectively. This was higher than the intended dosage rate of 1.5 ml/in. dbh and was attributed to applicator error.

Treatment efficacy is shown in Table 2. All the herbicide treatments controlled 100% of the treated stems. No basal sprouting was observed on stems treated with Arsenal. Some sprouting was observed on the stems treated with Glypro Plus. Basal sprouting was higher on stems treated in June and where the lowest concentrations of Glypro Plus were used. These results are consistent with Horsley and Bjorkbom (1983) who found that the efficacy of foliar applications of glyphosate on striped maple was lower in June than in late summer. They also observed that lower application rates were most sensitive to time of application.

Several untreated striped maple stems on the plots and in the buffer areas were controlled also, especially on the plots treated with Arsenal (Table 2). The number of untreated stems controlled was highest on the plots treated in September usually with the highest concentrations of herbicide. Although the mode of translocation was not studied in this trial, we feel that most of the herbicide was transferred to untreated stems through root grafts. Black cherry crop trees occurred on 66% of the treated plots. However, only one black cherry was slightly damaged by the treatments despite the relatively large amount of herbicide used in treating the high densities of striped maple found on these plots. This occurred on a plot where a 9% Arsenal treatment was used. This herbicide probably was absorbed from the soil because Arsenal has soil activity and interspecific grafts between roots of different species are rare (Graham and Bormann 1966). Because glyphosate has no soil activity, mortality of untreated stems on plots treated with Glypro Plus can be attributed to translocation of the herbicide through root grafts to untreated stems.

Striped maple sprout clump characteristics and treatment efficacies are shown in Table 3. There was an average of three stems per clump. Average diameter of the injected clump stems was 2.3 in. All the treatments controlled 100% of the injected stems; however, efficacy of the Arsenal treatments on sprout clumps was much higher than the Glypro Plus treatments. The 6 and 9% Arsenal treatments controlled 90 and 100% of the sprout clumps, respectively, whereas the 50 and 100% Glypro Plus treatments only controlled 19 and 44% of the sprout clumps, respectively. Restricting injection treatments to the largest stem in each sprout clump can substantially reduce herbicide requirements and treatment costs. Fewer stems are treated and the difficulty of injecting several closely spaced stems in each sprout clump is eliminated.

The hack-and-squirt stem injection treatments described here can be used by land managers to effectively control individual striped maple stems and sprout clumps. We recommend using the 6% Arsenal treatment because it was almost as effective as the 9% Arsenal treatment and use of the lower concentration will reduce treatment costs and the possibility of damaging nontarget plants. Injecting the largest stem in sprout clumps using the Arsenal treatments effectively controlled all stems in most clumps. Limited herbicide trials indicate that this recommended treatment is effective also on red maple.

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