Triclopyr Ester for Controlling Tree-of-Heaven

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The Bottom Line

A mixture of triclopyr ester herbicide in an oil-based carrier applied as a basal or cut-stump spray is an effective treatment for removing tree-of-heaven up to 16 inches in diameter. The development of symptoms varies in appearance and timing depending on when during the growing season the treatment is applied, but within one year nearly 100% control was achieved.

Abstract

A series of four studies were installed between 2007 and 2009 looking at tree-of-heaven control using triclopyr ester applied at different times during the year by basal spray or cut stump application methods. In all four tests, a 25% solution of Garlon 4 in an oil carrier was applied as a basal spray encircling the stem within 12-18 inches of the ground line. One test (June-July 2007) compared different harvest timing in conjunction with the herbicide treatment. All tests achieved excellent tree-of-heaven control, but the symptoms developed differently in appearance and timing. In the test treated in the summer (June-July), foliar wilting and yellowing symptoms appeared almost immediately, and control was apparent within two to three months. With a spring (March) application, half of the trees leafed out and had healthy foliage two to three months post treatment; but by the end of the growing season, 96% of them were dead and the rest were dying. Following a fall (September) treatment, only 30% of trees smaller than 6 inches in diameter breast height (dbh) had any leaves the next May compared to more than 70% of the larger trees; but by August, all trees less than 7 inches in diameter were dead, 18% of those larger than 7 inches had small tufts of stunted leaves and all appeared to be dying. When the herbicide was applied in the winter (January), more than 90% of trees had heavy defoliation by the following June and all appeared to be dying.

Background

Non-native invasive plants may threaten natural ecosystems because they can replace diverse native plant communities with monocultures. Tree-of-heaven (TOH, *Ailanthus altissima*) is considered by many to be the most serious non-native invasive tree species in Virginia. It occupies forest habitat where canopy gaps or disturbances occur and is currently the 37th most abundant tree species (of 122 identified in the Commonwealth) based on volume.

Methods

The first study was initiated at two locations (VDOF headquarters and a private tract near Batesville – both in Albemarle County, VA) on June 5 and 6, 2006. Three combinations of herbicide treatment and harvest timing – basal stem spray followed by chainsaw harvest one week later; basal stem spray followed by chainsaw harvest four weeks later, and chainsaw harvest followed immediately by a cut stump treatment – were compared to harvesting only (with no herbicide treatment) in a completely randomized experimental design. All herbicide treatments used a tank mix of triclopyr ester (Garlon 4) in a hydrocarbon / limonene oil carrier (JLB Oil Plus) at a ratio of 1:3 Garlon 4: oil (i.e., 25% Garlon 4) applied using a backpack sprayer. For the basal treatment, stems were sprayed around their entire circumference approximately 12-18 inches above ground (Figure 1). For the cut stump treatment, stumps were sprayed around their perimeter (Figure 2). Each of the four treatments was applied to five stems in each of three size categories based on dbh (<4 inches, 4-10 inches, >10 inches) at both locations, resulting in a total of 120 stems in the study. The dbh of treated trees ranged from 1 to 16 inches. The pre-harvest basal spray treatments were applied on June 5-6, 2006 and harvesting occurred either one week later (June 12-14, 2006) or four weeks later (July 5-6, 2006). Also on July 5-6, 2006, the stems receiving the cut-stump treatment and those that had not received any herbicide treatment were harvested. Responses were assessed based on stump sprouting in September 2006 and June 2007 – two and 12 months post-treatment.

Figure 1. Applying the basal spray treatment.

Figure 2. Applying the cut stump treatment.

Two more studies were installed in 2007. The second was established on March 28, 2007 at the Lesesne State Forest in Nelson County, and the third was installed on September 12, 2007 on private property near Batesville in Albemarle County, VA. In the former, 55 trees ranging from 2 to 16 inches in dbh were treated, while the latter included 65 trees ranging from 2 to 11 inches in dbh. A fourth test was installed on January 14, 2009 on private property south of Charlottesville in Albemarle County, VA where 50 trees ranging from 2 to 11 inches in dbh were treated. All herbicide treatments in studies 2 through 4 used the same herbicide mix applied as a basal spray as study 1. Survival and foliage condition of any surviving trees were rated at varying intervals post-treatment. Study 2 was re-assessed in June and September of 2007 and again in late May 2008 – two, six and 14 months after treatment. In study 3, trees were evaluated in May and August 2008 – eight and 11 months post-application. In study 4, the ratings were conducted on June 25, 2009 – six months after treatment.

Results

Study 1

The data from the first study are summarized in Table 1. The trees wilted and were leafless within weeks (Figure 3). There is evidence that they were dead within one week, since there was no re-sprouting even in the plots where the trees were cut one week after treatment. All the herbicide treatments had worked well within three months; fewer than 10% of the original stems receiving the treatments had re-sprouted, compared to nearly 70% of those left unsprayed. The assessment one year after application was consistent with the earlier results: only the stumps that did not receive the herbicide treatment re-sprouted (Figure 4) and the largest trees tended to have the most stump sprouts. These results showed that a mixture of Garlon 4 herbicide in an oil-based carrier applied as a basal or cut-stump spray after leaves are fully expanded is an effective treatment for removing tree-of-heaven up to 16 inches in diameter.

Table 1. Average number of stump sprouts per stem by diameter class in September 2006 and June 2007 following triclopyr ester treatments applied in June-July 2006.

	Treatment	September 2006			June 2007		
		<4 in.	4-10 in.	> 10 in.	<4 in.	4-10 in.	> 10 in.
Batesville	Check	5.8	5.2	5.8	10.2	11.6	15.0
	Cut Stump	0.0	0.0	0.4	0.0	0.2	0.6
	Basal 1 Week	0.0	0.6	0.2	0.0	0.0	0.0
	Basal 4 Weeks	0.0	0.0	0.2	0.0	0.0	0.0
VDOF	Check	5.0	0.4	0.6	2.8	2.4	6.0
	Cut Stump	0.2	0.0	0.0	0.0	0.0	0.0
	Basal 1 Week	0.0	0.0	0.0	0.0	0.0	0.0
	Basal 4 Weeks	0.0	0.0	0.0	0.0	0.0	0.0
Average	Check	5.4	2.8	3.2	6.5	7.0	10.5
	Cut Stump	0.1	0.0	0.2	0.0	0.1	0.3
	Basal 1 Week	0.0	0.3	0.1	0.0	0.0	0.0
	Basal 4 Weeks	0.0	0.0	0.1	0.0	0.0	0.0

Figure 3. Treated tree showing wilted and necrotic foliage two weeks after treatment in the mid-season study.

Figure 4. Treated stump (left) and untreated stump (right)

Study 2

In the study treated in late March, the results were different. Two months after treatment, half of the trees still had most or all their foliage intact and healthy. Four months later – at the end of the growing season – virtually all (96%) were dead and more than 98% were dead one year post-treatment (i.e., they failed to leaf out the next spring).

Study 3

On the late-season (September 12) application area we observe a relationship between tree size and the amount of time required for control. At the end of May (eight months after treatment,) only 40% of the trees were dead; the remaining 60% had stunted leaves on a few branches (Figure 5). Only 30% of trees smaller than 6 inches in dbh had any leaves compared to more than 70% of the larger trees. By August (11 months after treatment), all the trees less than 7 inches in diameter were dead, and only 18% of those larger than 7 inches still had small tufts of stunted leaves. It appeared likely (due to their poor condition, tiny crowns, and secondary infestations with wood boring insects – Figure 6) that all the remaining trees would die.

Figure 5. Stunted leaves still present on treated trees at the end of May in the growing season after application in the late-season study.

Figure 6. Emergent frass tubes and accumulating sawdust result from the boring of ambrosia beetles, which can attack Ailanthus following treatment with herbicides.

Study 4

When the basal spray was applied in the dormant season (mid-January), all the trees showed heavy foliar effects by mid growing season with more than 90% of stems showing near complete foliage loss (Table 2). As with study 3, symptoms indicated that the trees were all dying and would succumb by the end of the growing season.

Table 2. Percent defoliation of trees in the dormant season study six months after application.

Defoliated (%)	# Trees	Proportion of Trees	Average DBH (in.)
100%	17	36%	4.7
99%+	11	22%	6.2
90%+	16	32%	6.2
75%+	5	10%	7.4

In summary, it appears that tree-of-heaven is consistently controlled by triclopyr ester herbicide in a 25% solution with hydrocarbon/limonene oil carrier, but the response pattern varies depending on application timing. With a March application, about half of the trees leafed out initially although all were dead by the end of the growing season. After a June application, the trees were already at full leaf but wilted and were dead within one week after application. Following a September application, more than half of the trees leafed out in the spring although all the foliage was severely stunted and very few branches had any leaves at all. By August, more than 80% were completely dead and indications were that none would be alive by the end of the season. Even when the treatment was applied in the dormant season, the majority of stems were leafless by June and the rest were in declining condition.