

## Herbicides and Oak Wilt – A Summary Table

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The following table summarizes some results of using herbicide to arrest the spread of oak wilt with the goal of killing trees adjacent to infected trees, before the oak wilt fungus can spread to those that have not been infected.

Active Ingredient; Brand Name; Mixture Ratio	Application Method	Document or Project	Treatment Layout Model	Number of Sites or Number of Trees; Year(s) and Location of Treatment	Were the roots sampled to confirm death of tree?	Conclusion
Triclopyr (ester version); Brushtox, Garlon 4, Triclopyr 4; Minimum 20% brand name, maximum 80% oil	Cut stump applied to “apparently healthy” trees as defined by Cook (2012)	Michigan Invasive Species Grant Program (MISGP) “Slowing and Preventing Oak Wilt” Grant IS15-3007	Bruhn (Bruhn <i>et al</i> 1991)	7 sites (263 stumps across all sites); Treatments were implemented from 2016 through 2018 in Michigan.	No	While some stumps needed a re-application of herbicide, stump sprouts have been minimal (those stumps were treated again) and no additional stump sprouts were present by the end of the growing season of 2018. Forestry Assistance Program (FAP) foresters and private sector contractors will continue to monitor the sites to determine if oak wilt spreads beyond the treatment area.
Triclopyr (ester version); Triclopyr 4; Minimum 20% brand name, maximum 80% oil	Girdle applied to “apparently healthy” trees, followed by cutting and removal of trunks and tops	MISGP “Slowing and Preventing Oak Wilt” Grant IS15-3007	Bruhn (Bruhn <i>et al</i> 1991)	1 site (26 trees); The treatment was implemented in 2018, in Michigan.	No	No stump sprouts were present by the end of the growing season of 2018. FAP foresters and private sector contractors will continue to monitor the site to determine if oak wilt spreads beyond the treatment area.

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Triclopyr (ester version); Element 4; 25% Element 4, 75% diesel	Double girdle applied to “apparently healthy” trees and “symptomatic” trees as defined by Cook (2012)	5-year Oak Wilt Containment Study ( <a href="https://silvli.b.cfans.umn.edu/content/5-year-oak-wilt-containment-study-wi-dnr">https://silvli.b.cfans.umn.edu/content/5-year-oak-wilt-containment-study-wi-dnr</a> )	Bruhn (Bruhn <i>et al</i> 1991)	44 sites; Treatments were implemented in 2015 and 2016, in Wisconsin.	Not specified, but not likely	Of the 44 sites, herbicide treatments failed to contain oak wilt on 10 sites within first 1-2 years after herbicide was applied. The study will close in 2020, at which point final conclusions will be published.
Triclopyr (ester version); Element 4; 25% Element 4, 75% diesel	Frill girdle (two circles) applied to “apparently healthy” trees and “symptomatic” trees	Marathon County Forest Nine-Mile Recreational Area herbicide trial ( <a href="https://silvli.b.cfans.umn.edu/content/oak-wilt-management-through-girdle-herbicide-marathon-co">https://silvli.b.cfans.umn.edu/content/oak-wilt-management-through-girdle-herbicide-marathon-co</a> )	Bruhn (Bruhn <i>et al</i> 1991)	17 sites; Treatments at 3 sites were implemented in 2003 and 2004, with additional sites treated since that time, all in Wisconsin.	Not specified, but not likely	Oak wilt has not expanded beyond any of the treatment areas as of 2017.

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Triclopyr (amine version); Tahoe 3A; 50% Tahoe 3A, 50% water	Cut stump applied to “apparently healthy” trees	MISGP “Slowing and Preventing Oak Wilt” Grant IS15-3007	Bruhn (Bruhn <i>et al</i> 1991)	2 sites (73 stumps across both sites); Treatments were implemented in 2017, in Michigan.	No	This treatment failed, possibly due to water failing to carry the herbicide. These same sites were re-treated with the ester version of triclopyr mixed with oil. No additional stump sprouts were present by the end of the growing season of 2018. FAP foresters and private sector contractors will continue to monitor the sites to determine if oak wilt spreads beyond the treatment area.
Triclopyr (amine version); Garlon 3A; Undiluted	Frill girdle applied to “apparently healthy” trees	Bruhn <i>et al</i> (2003)	Bruhn (Bruhn <i>et al</i> 1991)	3 sites (200 trees across all sites), consisting of black oak ( <i>Quercus velutina</i> ), northern red oak ( <i>Quercus rubra</i> ), and white oak ( <i>Quercus alba</i> ); Treatments were implemented in 1998 and 1999, in Missouri.	Yes	At sites where trees were checked 31.5 months or more after herbicide was applied, black oak and northern red oak were dead (based on root sampling), but white oak was not. At sites where trees were checked less than 31.5 months after herbicide was applied, live roots remained for all species. All trees looked dead above ground before they were actually dead (again, based on root sampling)!
Triclopyr (amine version) and imazapyr; Garlon 3A and Arsenal AC; Half strength aqueous Garlon 3A + 24 mL of Arsenal AC per L of diluted Garlon 3A	Frill girdle applied to “apparently healthy” trees	Bruhn <i>et al</i> (2003)	Bruhn (Bruhn <i>et al</i> 1991)	3 sites (200 trees across all sites), consisting of black oak ( <i>Quercus velutina</i> ), northern red oak ( <i>Quercus rubra</i> ), and white oak ( <i>Quercus alba</i> ); Treatments were implemented in 1998 and 1999, in Missouri.	Yes	This treatment failed. All trees had live roots, even those checked 31.5 months or more after herbicide was applied. Trees that looked dead above ground still had live roots.

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Glyphosate; Roundup; Concentrated (30% to 50%)	"Stump cup" girdle on "apparently healthy" trees and "symptomatic" trees	Roberts (2016)	Tier Tree Model	1 site; Treatment was applied in 2015, in Michigan.	Not specified , but not likely	Oak wilt had not spread beyond treatment area as of autumn 2016.

\*Root sampling was used by Bruhn et al (2003) to confirm the death of oak trees, which can look dead aboveground before the roots have actually died.

## References

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