

# Silviculture Trial

## **Project Subject/Title: Herbicide Impacts - Clopyralid**

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**Abstract:** Herbicides with the active ingredient Clopyralid are used to inhibit competition in some tree plantations. Most species are not affected by the chemical, but in the past, nursery practices have shown that it can seriously impact growth of some tree and shrub species. After experimenting for three seasons, we determined that seedlings are much more sensitive to the timing of the herbicide application rather than the rate of application.

## **Trial Location:**

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| <p><b>County:</b> Sawyer<br/><b>Township:</b> 41N <b>Range:</b> 09W <b>Section:</b> 28<br/><b>GPS Coordinates:</b> Lat: 45.997225 N Long: -91.504945 W<br/><b>Property Name:</b> Hayward Nursery</p> |
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**Baseline Stand Data:** The Division of Forestry's Reforestation staff work with public and private landowners and managers to assist with reforestation and afforestation efforts across Wisconsin. Historically these tree plantations consisted of one or two species of conifer and, on occasion, a few scattered rows of hardwoods or shrubs to act as a wildlife food source. The main landowner goal was timber production.

More recently, landowners' goals have shifted. In surveys, wildlife habitat creation has surpassed timber production as the main reason for tree planting. Landowners are more apt to have a mixed planting of hardwoods and conifers, in some cases planting 6-8 different species. Herbicides that once were effective and easy to use, now need further scrutiny as they may have negative impacts on some species within the planting. Invasive species and aggressive weeds have also become more prevalent.

Reforestation staff began receiving questions related to the impact of certain herbicides on a variety of species. And while labels address many species, they do not address all being planted, especially the hardwoods and shrubs. In addition, some herbicides are not lethal, but can have serious impacts that slow growth and development. With limited knowledge on field application of some of these chemicals and their effects, staff felt it important to test some of the more common herbicides to be able to provide an educated and experienced answer to many of these questions.

In 2016 the Reforestation Program started a field trial with a clopyralid product. Various forms of this herbicide are commonly used in nurseries and reforestation plantings to control alfalfa, clover, thistles, knapweed, burdock, mare's tail, and other herbaceous plants. However, this herbicide has been

implicated in negatively affecting growth on some species of trees and shrubs. The Reforestation program installed trials at the Hayward State Nursery to ascertain the impacts, if any; the herbicide has on nursery stock during the growing season.

**Prescription and Methods:** In 2016, staff planted 3772 seedlings, representing 30 species of varying age classes (white cedar 3-0, eastern hemlock 3-0, jack pine 2-0, red pine 2-0 and 3-0, white pine 3-0, black spruce 3-0, white spruce 2-0, tamarack 2-0, basswood 2-0, river birch 2-0, white birch 1-0, butternut 1-0, black cherry 2-0, hackberry 2-0, shagbark hickory 2-0, silver maple 1-0, bur oak 1-0, red oak 1-0, swamp white oak 1-0, sycamore 1-0, black walnut 1-0, choke cherry 1-0, prairie crab 1-0, highbush cranberry 2-0, red osier dogwood 1-0, silky dogwood 1-0, cockspur hawthorn 1-0, American hazelnut 1-0, ninebark 2-0, and American plum 2-0). In 2017, staff planted 3129 seedlings representing 26 species of varying age classes (white cedar 3-0, balsam fir 3-0, eastern hemlock 3-0, jack pine 2-0, white pine 2-0, black spruce 2-0, white spruce 2-0, tamarack 2-0, aspen spp. 1-0, river birch 1-0, butternut 1-0, black cherry 1-0, hackberry 1-0, bitternut hickory 2-0, shagbark hickory 3-0, red maple 2-0, silver maple 2-0, sugar maple 2-0, bur oak 1-0, red oak 1-0, swamp white oak 1-0, white oak 1-0, black walnut 1-0, highbush cranberry 2-0, American hazelnut 1-0, and ninebark 2-0 [**Note:** In 2017 and 2018 red pine, historically considered very sensitive to clopyralid products, was not included in the trial as it was sold out and unavailable for planting]). In 2018, staff did not plant new seedlings but utilized the seedlings planted in 2017. In 2016 and 2017, the seedlings were planted at the Hayward State

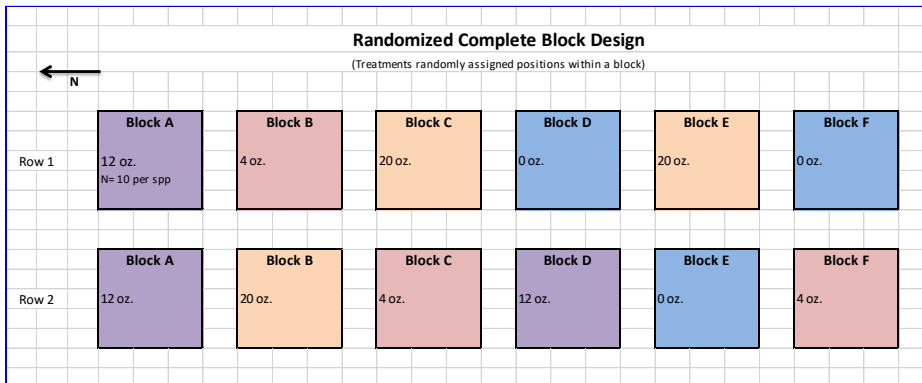


FIGURE 1 BLOCK LAYOUT FOR CLOPYRALID STUDY 2018

Nursery in mid-May. In 2016, the seedlings were observed on June 13, and in 2017, the seedlings were observed on July 5, to determine the baseline health of the seedlings. Then, the nursery foreman sprayed the seedlings with varying rates of clopyralid in early and mid-July, respectfully. The seedlings were observed a few days after spraying to

ascertain any immediate reaction to the chemical. They were observed again 10+/- days later to observe if any effects were still visible. The seedlings planted in 2016 were destroyed, but the seedlings from 2017 were left to grow.

After an inspection in May 2018, it was determined that the seedlings did not appear to be suffering from any effects of the chemical spraying from the previous year. Consequently, after weighing the savings in time and effort, we decided to reuse these seedlings for the 2018 field trial. These seedlings were sprayed with the same rate of chemical from the previous year, but much earlier in the season; June 5<sup>th</sup>, 2018, and observed on June 7<sup>th</sup>, 2018.

In each of the years, the stock was planting into blocks of seedlings of 10 seedlings per species/age. Each block contained 6 rows of about 40-50 seedlings per row. These rows were irrigated to limit the impacts of environmental stresses. The blocks were sprayed with a 3 different herbicide rates, 4 oz./acre, 12 oz./acre, and 20 oz./acre, with a fourth block acting as a control. This was replicated three times and randomly fitted within the study area. The entire study included 12 blocks of seedlings.



**Results:** After three seasons and two different plantings, utilizing most of the species grown at the nursery, we found that even at very high rates, there is little impact on seedlings if they have hardened off a new flush of growth. However, if the chemical is applied while the new growth is elongating or not fully hardened off, several species showed negative impacts. These impacts did eventually go away, with little evidence of any residual effects after a couple weeks. Typically, the impacts were severely cupped foliage, in some cases mimicking drought stresses. There was also some obvious chlorosis affecting the entire leaf. See comments below:

0 oz./acre: Seedlings show no sign of impacts. Minor mortality most likely associated with normal stresses that occur during transplanting.

4 oz./acre: Seedlings show no sign of impacts. Minor mortality most likely associated with normal stresses that occur during transplanting.

12 oz./acre: Highbush cranberry showing signs of stress; leaf wilting and cupping. Hackberry and ninebark also exhibiting some minor wilting, but less

than the highbush cranberry.

20 oz./acre: Highbush cranberry showing signs of stress; all leaves wilting, cupping and some chlorosis. Ninebark is exhibiting the same signs. Hackberry and white oak are also showing signs of some cupping and slight chlorosis.

FIGURE 2: Highbush cranberry seedling with cupped, twisted foliage 1 day after clopyralid application

Photograph by J. Auer June 7, 2018

**Discussion/Recommendations:** Overall, if a clopyralid is used to control weed competition, if it is applied after bud elongation and bud/stem hardening at a low to moderate rate (4 oz./acre or less), there should be few, minor impacts on

seedling growth. However, if the weed species present necessitates a higher spray rate, it is very important to observe the seedling development stage. Especially if some of those species that show a sensitivity to clopyralid are present in the planting.