**Lesser Celandine Control Study**

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## INTRODUCTION

Lesser celandine (*Ficaria verna*) is an aggressive herbaceous invasive plant that starts growing in late winter/early spring, produces yellow flowers in April, then goes dormant for the year in late May. It is most common in floodplain habitat but can also establish and spread in upland sites. This invasive species has become dominant in some parts of the Jackson Creek and Clear Creek watersheds in Bloomington. Control of this species is difficult given the short treatment window and reported control failure with some herbicide treatments. Given this, in spring 2021 Monroe County – Identify and Reduce Invasive Species (MC-IRIS) and the City of Bloomington – Urban Greenspace established a study at Sherwood Oaks Park in Bloomington to test different methods of lesser celandine control.

## METHODS

Two transects were placed in the floodplain of Jackson Creek where lesser celandine composed most of the ground cover in April and May each year (Figure 1). Each of the two transects had 25 - 0.5 $m^2$ plots. Plots were placed at least 1 m away from each other along the transect to avoid treatments of one plot from impacting adjacent plots. Each plot had center marked with a metal stake.

**Figure 1.** Transect 1 on 4-12-2021.

The April 12, 2021 percent cover of lesser celandine in the 50 plots ranged from 25% to 100%, with a median of 90% and a mean of 80.1%. Because one of the things we were testing in this study was whether treatments before or during flowering were more effective and plants were already flowering, we waited until 2022 to begin treatments.

In spring 2022, ten treatments were applied randomly with 5 plots of each treatment. The treatments varied in the chemical used and the timing of the treatment (before the plants were flowering vs. when the plants were at maximum flowering). All herbicide mixes had 0.25% RRS NNIS surfactant and Alligare Super Marking Dye added to the mix.

The ‘before flowering’ treatments were conducted 3-21-2022 and the ‘flowering’ treatments were on 4-14-2022.

Table 1. Treatment details. Each treatment was applied on 5 - 0.5 $m^2$ plots.

| Treatment # | **Chemical** | **Dilution** | **Treatment Timing** |
|---|---|---|---|
| 1 | None | None | NA |
| 2 | Glyphosate | 3% | Before flowering* |
| 3 | Glyphosate | 3% | Flowering |
| 4 | Triclopyr | 3% | Before flowering |
| 5 | Triclopyr | 3% | Flowering |
| 6 | Ecomazapyr | 0.5% | Flowering |
| 7 | Ecomazapyr/Glyphosate | 0.5%/2% | Before flowering |
| 8 | Ecomazapyr/Glyphosate | 0.5%/2% | Flowering |
| 9 | Ecomazapyr/Triclopyr | 0.5%/2% | Before flowering |
| 10 | Ecomazapyr/Triclopyr | 0.5%/2% | Flowering |
| All mixes contained 0.25% RRS NNIS surfactant and Alligare Super Marking Dye | | | |

On the day they were treated (3-21-2022) the ‘before flowering’ plots had lesser celandine cover range from 30% to 90% with a mean of 71.4% and a median of 75%. The ‘flowering’ treatment (on 4-14-2022) plots had a percent cover of lesser celandine range from 40% to 100% with a mean of 81.9% and median 85%. Because of the great increase in cover that occurs between mid-March and mid-April, all comparisons of change in cover were made by comparing cover in mid-April when cover is at its maximum (see Figure 4 for a visual comparison).

**Figure 2. ‘Before flowering’ treatment of lesser celandine, 3-21-2022.** The plot hoop was first placed over the plot and the edges marked with wire flags; the hoop was removed before treatment.

**Figure 3. 'Flowering' treatment of lesser celandine, 4-14-2022.** Because of higher winds on this day, a windbreak of plastic signs was used to keep herbicide from one plot treatment from affecting adjacent plots.

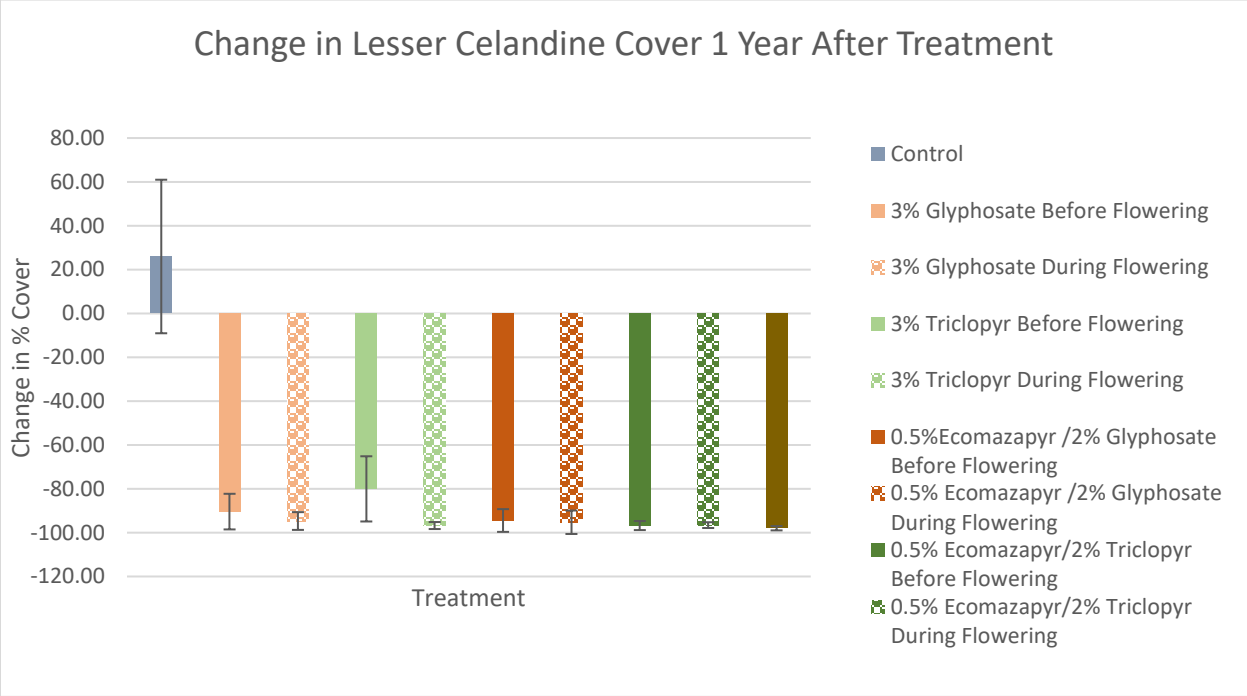

**Figure 4. Plot 1-1 (3% triclopyr 'before flowering' treatment): photos from pre-treatment (4-12-2021 and 3-21-2022), 1 year after treatment (3-28-2023), after full expansion of lesser celandine 1 year after treatment (4-11-2023) and after full expansion of lesser celandine 2 years after treatment (4-9-2024).** Note the greater cover of lesser celandine on 4-11-2023 versus 3-28-2023. For this reason, all impacts were compared after full expansion in mid-April.

4-12-2021 3-21-2022 3-28-2023 4-11-2023 4-9-2024

**RESULTS AND DISCUSSION**

Paired two-tailed t-tests were used to assess whether treatments were significantly different at the $p<0.05$ level.

**Figure 5.** Results for each treatment one year after treatment.




**Does it matter which chemical you use to control lesser celandine?** All five chemical mixes – 3% glyphosate, 3% triclopyr, 0.5% ecomazapyr, 0.5% ecomazapyr+ 2% glyphosate, and 0.5% ecomazapyr + 2% triclopyr – provided significant control of lesser celandine one year after treatment compared to the control (Figure 5).

**Any significant differences between chemical treatments?** None of the treatments were significantly different from one another. In part this is due to high standard deviations, and that is in part due to the plots being in a riparian area where flooding could change lesser celandine cover in the plots.

**What about non-target damage?** Most plots had native and other nonnative plants as a small component of the overall plant cover. While percent cover data on species other than lesser celandine were not collected, it was clear that all chemical treatments impacted species that were aboveground at the time of treatment. The early treatments avoided impact to some plant species because they were not yet aboveground. The triclopyr treatments did not impact the grasses and sedges in the plots because the chemical is broadleaf specific. Two years after treatment very few of the native species that were killed by the chemical treatments had reestablished, though lesser celandine was creeping back into the plots.

**Does it matter if you treat lesser celandine early (before it flowers) or late (when it is flowering)?**

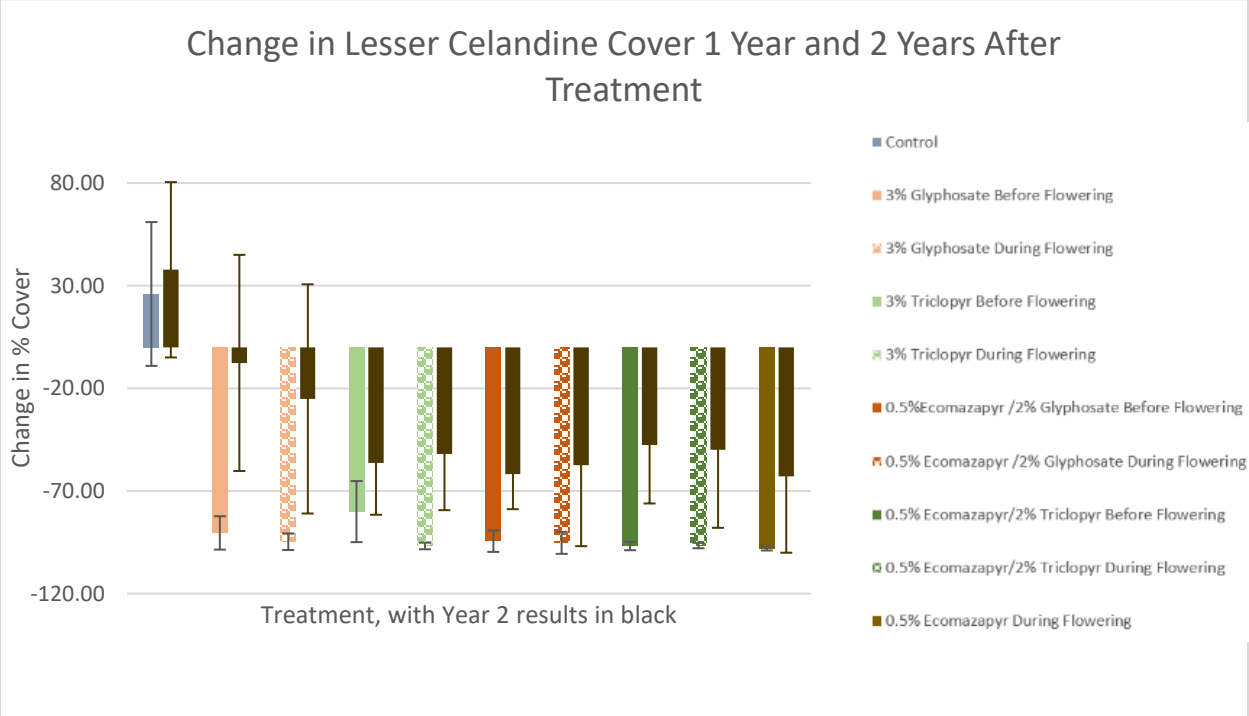
Four different herbicide treatments were applied both before the lesser celandine plants flowered (March 21, 2022) and when flowering appeared to be at peak (April 14, 2022). Each treatment – 3%

glyphosate, 3% triclopyr, 0.5% ecomazapyr+2% glyphosate, and 0.5% ecomazapyr+2% triclopyr – significantly reduced lesser celandine cover regardless of timing, and no significant difference was found between a particular herbicide being applied before or during flowering (all $p>0.05$) (Figure 5)

**Is there a difference in impact when adding Ecomazapyr to glyphosate or triclopyr versus using them alone?** No significant difference was found when comparing glyphosate alone versus glyphosate with added ecomazapyr, either before or during flowering. The same is true for triclopyr alone versus triclopyr with added ecomazapyr.

**How long did the control last?** Given that ecomazapyr is active longer in the soil, it was expected that plots where ecomazapyr was used would have longer lasting control. This was not found to be the case. By two years after the treatment (April 2024) lesser celandine had started to spread back into the treated plots from the surrounding infestations. Due to high standard deviations, there are no significant differences in level of lesser celandine increase by treatment.

**Figure 6.** Results comparing one and two years (in black) after treatment to the original lesser celandine cover in the plot.




## SUMMARY

All treatment methods gave significant control of lesser celandine, and timing of treatment did not appear to impact the level of control. After two years, lesser celandine was able to reinvade plots regardless of what treatment was used.


## ACKNOWLEDGEMENTS

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**Appendix 1. Additional plot photos.**

**Figure 6.** Plot 2-20 (0.5% ecomazapyr + 2% glyphosate before flowering) pretreatment (4-12-2021 and 3-21-2022), post-treatment 1 year after treatment (3-28-2023), post-treatment 1 year after treatment (4-11-2023), and post-treatment 2 years after treatment (4-9-2024)

4-12-2021 3-21-2022 3-28-2023 4-11-2023 4-9-2024

**Figure 7.** Plot 1-16 (control) pretreatment (4-12-2021), one year after treatment (4-11-2023) and two years after treatment (4-9-2024)

4-12-2021 4-11-2023 4-9-2024

**Figure 8.** Plot 1-17 (0.5% ecomazapyr+2% triclopyr during flowering) pretreatment (4-12-2021), 1 year after treatment (4-11-2023), and 2 years after treatment (4-9-2024)

4-12-2021 4-11-2023 4-9-2024