

## Comparison of surfactants aiding glyphosate uptake in smooth scouringrush

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Control of smooth scouringrush (*Equisetum laevigatum*) with glyphosate has not been successful, especially at rates applied for general weed control in no-till fallow management (Figure 1). Smooth scouringrush has expanded its range in eastern Washington through the past two decades, especially where no-till cropping systems are practiced. It has long been known that chlorsulfuron, one of the active ingredients in Finesse<sup>®</sup> (chlorsulfuron + metsulfuron), will control smooth scouringrush for several years after application, but chlorsulfuron cannot be used in cropping systems where sulfonyleurea-sensitive crops are grown, such as pulses and most canola cultivars. We have recently found that the addition of Silwet<sup>®</sup> L77 organosilicone surfactant with RT<sup>®</sup> 3 (glyphosate) applied at 96 oz/A in fallow has substantially reduced smooth scouringrush density in the following winter wheat crop. In other research, it has been shown that Silwet L77 aids the uptake of glyphosate through open stomates as opposed to through the plant epidermis layer. This may explain how Silwet L77 is facilitating the efficacy of RT 3 in smooth scouringrush in our research. However, there is



Figure 1. Smooth scouringrush on a NW-facing slope in no-till fallow near Rosalia, WA.

some uncertainty as to the future availability of Silwet L77 in the Pacific Northwest. Kinetic<sup>®</sup> organosilicone surfactant has been presented as a replacement, but it is uncertain if Kinetic will be as effective as Silwet L77 for smooth scouringrush control. Wetcit<sup>®</sup>, a citrus acid alcohol-based surfactant has also been effective in facilitating uptake of RT 3 in smooth scouringrush. This study compares the efficacy of Kinetic and Wetcit with Silwet L77 surfactants applied with RT 3 at 96 oz/A for control of smooth scouringrush. Furthermore, these treatments are applied both during the day when stomates are open, and at night when they are mostly closed. Better efficacy with daytime applications may suggest that uptake is occurring through the open stomates.

The study site is on a northwest-facing slope on the Seagle farm near Rosalia, WA. The site was in no-till fallow at the time of application and was planted to winter wheat in October 2020. Soil

type is a Neff-Garfield complex with 15-25% slope and a silt loam texture and has a pH of 5.9 and organic matter of 2.7%. Plots measured 10 by 30 ft and were arranged in a randomized complete block design with four replications per treatment. All herbicide treatments were applied on July 6, 2020 with a hand-held spray boom with six TeeJet® XR11002 nozzles on 20-inch spacing and pressurized with a CO<sub>2</sub> backpack at 3 mph. Spray output was 15 gpa at 25 psi. The RT 3 applications were applied at 96 oz/A, Finesse was applied at 0.5 oz/A, Silwet L77 and Kinetic were applied at 0.5% v/v, and Wetcit was applied at 0.78% v/v. Initial smooth scouringrush density averaged 282 stems/yard<sup>2</sup>. Daytime treatments were applied between 12:00 and 12:30 p.m. Nighttime applications were between 9:40 and 10:00 p.m. Nighttime applications were initiated after all surrounding WSU Ag WeatherNet stations reported 0 watts/meter<sup>2</sup> solar radiation. Visibility during nighttime applications was aided by the use of a small light attached to a hat brim. Soil temperature at 2 inch depth was 67° F during the daytime applications, and 72° during the nighttime applications.

Visual ratings of herbicide control were made 30 and 60 days after treatment (DAT). At 30 DAT, very little stem discoloration or height difference could be seen between treated plots and the nontreated check plots. (Table 1). This is not uncommon for applications on north-facing slopes (personal observations) where temperatures may be cooler and solar radiation less direct than on flats or southern exposures. At 30 DAT, rating for the daytime application of RT 3 with Silwet L77 was statistically greater than all other treatments, but only averaged 17% injury compared with the nontreated check (Table 1). Both the nighttime application of RT 3 with Silwet L77 and the daytime application of RT 3 with Kinetic averaged 11% control; however the nighttime application with Kinetic average only 6% control and was statistically less effective than the daytime application. By 60 DAT, control symptoms were more visible and included stem yellowing and stunted growth (Figure 2). There was no statistical difference between daytime applications with Silwet L77, Kinetic, or Wetcit. Both nighttime applications of RT 3 with Silwet L77 or Kinetic were less effective than their corresponding daytime applications; however, there was no statistical difference between the day or night applications of Wetcit (Table 1). Very little symptoms were seen with either day or night applications of RT 3 alone or with Finesse. Finesse was included as a reference treatment for comparison during the 2021 crop year because of its known effectiveness in controlling smooth scouringrush; however, it does not cause considerable stem injury symptoms during the year of application.

Visual assessments indicate that Kinetic may be as effective as Silwet L77 in aiding uptake of RT 3, and that applications of these two treatments during the day are more effective than during night when stomates are closed. However, the lack of difference between day and night applications of RT 3 with Wetcit suggests it may be facilitating a different mechanism of RT 3 uptake than through open stomates. Stem density measurements in the 2021 wheat crop will fully demonstrate the efficacy of these applications.

See next page for Table 1.

Table 1. Visual control rating of smooth scouringrush following herbicides applications comparing three surfactants in no-till fallow.

#	Herbicide	Surfactant	Timing	Visual control ratings*	
				30 DAT	60 DAT
				percent of check	
1	Nontreated check	---	---	0	0
2	RT 3	none	day	5 c	23 de
3	RT 3	none	night	5 c	20 de
4	RT 3	Silwet L77	day	17 a	47 a
5	RT 3	Silwet L77	night	11 b	27 cd
6	RT 3	Kinetic	day	11 b	40 ab
7	RT 3	Kinetic	night	6 c	22 de
8	RT 3	Wetcit	day	9 bc	40 ab
9	RT 3	Wetcit	night	7 bc	32 bc
10	Finesse	Silwet L77	day	5 c	18 e

\*Means are based on four replicates per treatment. Means within each column followed by the same letter are not significantly different at the 95% probability level, which means that we are not confident that the difference is the result of treatment rather than experimental error or random variation associated with the experiment.



Figure 2. Smooth scouringrush stem yellowing from application of RT 3 plus Silwet L77.