Comparison of RT® 3 and surfactants for control of smooth scouringrush – one year after treatment

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Applications of RT 3 (glyphosate) to smooth scouringrush (*Equisetum laevigatum*) in chemical fallow have resulted in inconsistent control, especially at rates used for general weed control in no-till fallow management (Figure 1). We have recently found that the addition of Silwet® L77 organosilicone surfactant with RT 3 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. This may explain how Silwet L77 is facilitating the efficacy of RT 3 in smooth scouringrush in our research. In general, stomates are closed at night and open periodically during the day to obtain CO_2 from the surrounding air. We hypothesized that if stomatal uptake is the primary route of RT 3 uptake in smooth scouringrush, and Silwet L77 facilitates this uptake, then control should be greater if RT 3 plus Silwet L77 is applied during the day rather than at night.

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

In 2020, we applied RT 3 during the day and at night to smooth scouringrush growing 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 content 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_2 backpack at 3 mph. Spray output was 15 gpa at 25 psi. All RT 3 applications were applied at 96 oz/A. Surfactants compared were Silwet L77 and Kinetic, both organosilicone surfactants applied at 0.5% v/v, and Wetcit, a non-organosilicone surfactant applied at 0.78% v/v. Finesse was applied at 0.5 oz/A as a positive control because it has been shown to be very effective for smooth scouringrush

control. Initial smooth scouringrush density in 2020 averaged 282 stems/yd^2. Daytime treatments were applied between 12:00 and 12:30 p.m. Nighttime applications were between 9:40 and 10:00 p.m. Nightime applications were initiated after all surrounding WSU Ag WeatherNet stations reported 0 watts/meter^2 solar radiation. Soil temperature at 2 inch depth was 67° F during the daytime applications, and 72° during the nightime applications.

In July 2021, one year after treatments were applied, stem densities were counted in two 1-meter quadrats per plot to assess treatment efficacy. Overal, control from the 2020 mid-day applications was less than expected and may have been due to moisture stress, which would have caused stomates to close, and/or an increased rate of spray droplet evaporation from the stems. However, the daytime application of RT 3 plus Kinetic resulted in a 55% reduction in stem density compared with the same treatment applied at night (Table 1). In contrast, day and night applications of RT 3 plus Silwet L77 were not statistically different. Silwet L77 is a straight organosilicone surfactant that substantially reduces spray droplet surface tension on the stems, thus may increase evaporation rate. Kinetic is a blend of an organosilicone and nonionoic surfactants and may result in a slower evaporation rate. Applications of RT 3 alone and with Wetcit were not affected by the day or night timing. Results of this trial suggest that there is a relationship between uptake, and subsequent control of smooth scouringrush with RT 3, with stomatal opening; however, plant stress and weather conditions at the time of application may influence herbicide efficacy.

Table 1. Smooth scouringrush stem density in winter wheat one year after herbicide applications.

#	Herbicide	Surfactant	Timing	Smooth scouringrush
				stems/yd^2
1	Nontreated check	---	---	115 a
2	RT 3	none	day	109 ab
3	RT 3	none	night	104 ab
4	RT 3	Silwet L77	day	59 bcd
5	RT 3	Silwet L77	night	82 abc
6	RT 3	Kinetic	day	49 cd
7	RT 3	Kinetic	night	110 a
8	RT 3	Wetcit	day	73 abc
9	RT 3	Wetcit	night	78 abc
10	Finesse	Silwet L77	day	38 d

*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.