

## Effect of surfactants on the efficacy of RT<sup>®</sup> 3 for control of smooth scouringrush.

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The efficacy of glyphosate in controlling smooth scouringrush (*Equisetum laevigatum*), when applied in chemical fallow, is best evaluated the year after application. Reduced stem density in crops for up to two years following application has been observed when an organosilicone surfactant is added to RT 3 glyphosate applied at 96 oz/A (Figure 1). Organosilicone surfactants reduce the surface tension of spray droplets on the leaves or stems, which facilitates the movement of the herbicide across the leaf/stem surface and into open stomates where the herbicide can be more easily absorbed. However, the reduction of spray droplet surface tension also leaves the herbicide solution susceptible to rapid evaporation. If the spray solution evaporates before it can reach an open stomate and be taken in by the plant, or if the stomates are closed, control is lost.



Figure 1. Spring wheat in the foreground has very little smooth scouringrush two years after an application of RT 3 plus Silwet<sup>™</sup> L77 in fallow compared with the nontreated area in the background.

In general, stomates in modern plants open during the day to obtain CO<sub>2</sub> from the atmosphere but remain mostly closed at night. If stomates are closed at night and open during the day, control from RT 3 should be greater when applied during the day. However, our previous studies were all conducted during years with relatively average precipitation and in contrast, 2021 was a severe drought year for the entire region. Drought and high temperatures can stress plants and cause normal physiological processes like photosynthesis and gas exchange to shut down. Furthermore, the genus *Equisetum* originated 350-400 million years ago, and it is not clear if the physiology of smooth scouringrush is similar to modern plants that evolved more recently between 145-23 million years ago.

In July and August 2021, we applied herbicide treatments containing RT 3 and four different surfactants in field trials near Rock Lake and Reardan, WA, respectively. All sites were in no-till fallow at the time of application and were planted to winter wheat in October 2021. The Rock Lake site was a slight northwest-facing slope on Uhlig silt loam soil with a pH of 5.5 and 3.75% organic matter in the top 6 inches. The Reardan site was on a northwest-facing slope on Athena silt loam soil with a pH of 4.9 and 2.4% organic matter in the top 6 inches. Plots measured 10 by 30 ft and were arranged in a randomized complete block design with four replications per

treatment. Day herbicide treatments were applied at 9:30 am on July 12, 2021, at Rock Lake, with 81 °F air temperature and relative humidity was 31%. Night treatments were applied at 11:30 pm with 74 °F air temperature, and 32% relative humidity. Night treatments were applied at Reardan at 8:40 pm on August 9, 2021. The air temperature was 65 °F and the relative humidity was 45%. Day treatments at Reardan at were applied at 10:40 am August 10, 2021; the air temperature was 77 °F and the relative humidity was 31%. Night-time applications were initiated in the evenings after all surrounding WSU Ag WeatherNet stations reported 0 watts/meter<sup>2</sup> solar radiation. All treatments were applied with a hand-held spray boom with six TeeJet® AIXR110015 nozzles on 20-inch spacing and pressurized with a CO<sub>2</sub> backpack at 3 mph. Spray output was 15 GPA at 40 psi. All RT 3 applications were applied at 96 oz/A. Organosilicone surfactants compared were Silwet™ L77, and Kinetic®, applied at 0.5% v/v, and Syl-Coat® applied at 0.375% v/v. Wetcit®, a non-organosilicone surfactant, was 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 at Rock Lake averaged 271 stems/yd<sup>2</sup>. Initial density at the Reardan site averaged 213 stems/yd<sup>2</sup>.

In July 2022, smooth scouringrush stem density was evaluated in winter wheat at both Rock Lake and Reardan, one year after treatments were applied in fallow (Figure 2). At Rock Lake the only treatments affected by the application timing were ones containing Wetcit® or Syl-Coat®. These were the treatments with the greatest stem count difference between daytime and nighttime applications (Figure 3). All remaining treatments were not significantly different from the nontreated check nor affected by the application timing. At Reardan day/night differences were observed in both organosilicone surfactants Silwet™ L77 and Syl-Coat®. Both treatments, when applied at night, were the most effective. The increased efficacy at night compared to daytime applications may have been due to the hot, dry conditions in August that may have caused rapid droplet drying and/or daytime stomatal closure, reducing herbicide entry into the plants.



Figure 2. Smooth scouringrush stems in winter wheat near Rock Lake, WA.

Figure 3. Smooth scouringrush stem density in winter wheat one year after treatments were applied in fallow near Rock Lake, WA, and Reardan, WA. All treatments, except nontreated and Finesse, were applied during the day and at night with RT 3 at 96 oz/A with no added surfactant, Silwet™ L77, Kinetic®, Syl-Coat®, or Wetcit® surfactants. Columns for each surfactant with the same letter are not statistically different at the 95% probability level.

