

Rush skeletonweed control in no-till winter wheat fallow – LaCrosse and Hay, WA

Mark Thorne, Jacob Fischer, Drew Lyon

Herbicide control of rush skeletonweed (*Chondrilla juncea* L.) in a winter wheat/no-till fallow system is being evaluated near LaCrosse and Hay, WA. Both sites were in winter wheat stubble following the 2018 harvest when fall treatments were applied in October 2018 (Tables 1). Rush skeletonweed has persisted in these fields since they were taken out of the Conservation Reserve Program in 2013. Rush skeletonweed is a problem in this region because few herbicides are effective over the long-term and it depletes soil moisture during the fallow phase of the rotation, which can significantly delay wheat germination and emergence. Rush skeletonweed is a deep-rooted perennial in the Asteraceae family and spreads by rhizome or seed. These trials are second-year replicates of a study initiated in October 2017.

At each site, the fields were in wheat stubble and entering the no-till phase of the rotation. Plots measuring 10 by 30 ft were arranged in a randomized complete block design with four replications per treatment. Herbicides were applied with a hand-held spray boom with six TeeJet® XR11002 nozzles on 20-inch spacing and pressurized with a CO₂ backpack at 3 mph. Spray output was 15 gpa at 25 psi. Fall treatments were applied on October 8, 2018. At the LaCrosse location, a hard frost of 22 °F had occurred on October 3, 2018, five days before treatment. At Hay, the coldest temperature prior to application was 38 °F, also on October 3. Spring treatments were applied on April 18, 2018 to coincide with normal spring fallow aid-to-tillage herbicide applications. Summer treatments were applied June 5, 2018 when rush skeletonweed plants were bolting (Table 1). Herbicide efficacy was assessed by counting all rush skeletonweed plants in a 6.6- by 28-ft strip through the middle of each 10- by 30-ft plot at several times throughout the year.

At the spring census in April 2019, rush skeletonweed density averaged less than 10 plants per plot in the fall-treated plots (Tables 2 and 3), and plots treated with Tordon 22k had no rush skeletonweed. All fall-applied treatments resulted in substantially lower density compared with no fall treatment. At LaCrosse, the Tordon 22k treatment maintained control through summer and averaged only 3 plants per plot by the August 26 census (Table 2). All other fall-applied treatments broke down and were not different from the RT 3 check by August. The spring-applied treatments were also not different from the 24 oz/A RT 3 check at the August census; however, the spring-applied 64 oz/A RT 3 treatment averaged only 16 plants per plot compared with 38 for the RT 3 check, but the two were not different at the 95% probability level.

At the Hay location, Tordon 22k controlled rush skeleton into June, but broke down by August (Table 3). This is a sharp contrast to the LaCrosse site, and to the previous year's trial where Tordon 22k maintained control through the fallow year (see 2018 WSU Weed Control report <http://smallgrains.wsu.edu/weed-resources/weed-publications/weed-control-reports/>) Furthermore, few treatment differences were found between any of the other treatments at the August census. This is also in contrast the previous year's trial.

Table 1. Application and soil data.

Location		LaCrosse, WA		
Application date	October 8, 2018	April 18, 2019	June 5, 2019	
Growth stage	bolted stems and rosettes	rosettes, only	rosettes and bolted stems	
Air temperature	63	73	76	
Relative humidity (%)	39	38	32	
Wind (mph, direction)	0, -	5-8, W	3-7, SW	
Cloud cover (%)	0	0	90	
Soil temperature at 3 inches (F)	60	59	69	
Soil texture	Benge Complex silt loam			
Soil organic matter (%)	2.17			
Soil pH	6.6			
Location		Hay, WA		
Application date	October 8, 2018	April 18, 2019	June 5, 2019	
Growth stage	bolted stems and rosettes	rosettes, only	rosettes and bolted stems	
Air temperature	61	75	80	
Relative humidity (%)	40	35	31	
Wind (mph, direction)	2-4, E	7-8, W	5-8, SW	
Cloud cover (%)	100	1	60	
Soil temperature at 3 inches (F)	60	64	73	
Soil texture	Walla Walla silt loam			
Soil organic matter (%)	3.07			
Soil pH	6.0			

Frost prior to fall applications may have influenced efficacy, especially with the synthetic auxin herbicides, e.g. Tordon 22k, Stinger, and Milestone. Previous research has shown that frost changes carbohydrate structure to improve cold tolerance, and a frost a few days before application is associated with greater synthetic auxin herbicide efficacy. At the LaCrosse site, a hard frost of 22 °F occurred 5 days before the application that caused obvious stem damage. This extreme cold event may have actually reduced the movement of herbicides into the roots. In contrast, no frost occurred before the applications at Hay. In the previous year's trial, a frost of 26 °F occurred 5 days prior to application and herbicide efficacy was overall better. However, frost is not a factor for the spring- and summer-applied treatments. The spring tank mix applications of either Stinger or Milestone with RT 3 had no effect on rush skeletonweed density (Tables 2 and 3). Spring-applied RT 3 at 64 oz/A was trending more effective than other spring applications; however, differences did not reach the 95% probability level. The summer application of 2,4-D when rush skeletonweed began to bolt was also not effective. Herbicide control in fallow is clearly difficult and may be a function of the timing of fall applications in relation to a frost, and the physiological condition of the plant. An optimal scenario may be a

light frost a few days prior to application and plants that are actively growing and not suffering from drought or a hard freeze. Rosettes that emerge or are present in late fall or winter may be good targets, as well.

Table 2. Rush skeletonweed density in no-till winter wheat fallow in relation to fall, spring, and summer-applied herbicides near LaCrosse, WA.

Trt	Herbicide*	Rate (oz/A)	Time**	Spring*** 4/18/19 -----(plants per 6.6 by 28 ft plot)****	Early Summer 6/5/19	Summer pre-seeding 8/22/19
1	Stinger RT 3	10.7 24	Fall Spring	4 cd	21 cd	24 ab
2	Milestone RT 3	1.2 24	Fall Spring	9 b	38 bc	78 a
3	Stinger RT 3 2,4-D	10.7 24 43	Fall Spring Summer	6 bc	38 bc	33 ab
4	Milestone RT 3 2,4-D	1.2 24 43	Fall Spring Summer	1 cd	11 d	41 ab
5	Curtail RT 3	64 24	Fall Spring	5 bc	39 bc	60 a
6	Curtail + Finesse RT 3	32 + 0.4 24	Fall Spring	6 bc	36 bc	39 ab
7	Tordon RT 3	16 24	Fall Spring	0 d	0 e	3 c
8	RT 3 + 2,4-D 2,4-D	64 + 43 43	Fall Summer	11 b	124 a	54 ab
9	Stinger + RT 3	10.7 + 24	Spring	109 a	29 bcd	50 ab
10	Milestone + RT 3	1.2 + 24	Spring	111 a	36 bc	34 ab
11	RT 3 2,4-D	64 43	Spring Summer	99 a	58 abc	16 b
12	RT 3 check	24	Spring	83 a	74 ab	38 ab

See Table 3 for footnotes.

Table 3. Rush skeletonweed density in no-till winter wheat fallow in relation to fall, spring, and summer-applied herbicides near Hay, WA.

Trt	Herbicide*	Rate (oz/A)	Time**	Spring*** 4/18/19	Early Summer 6/5/19	Summer pre-seeding 8/22/19
				-----(plants per 6.6 by 28 ft plot)**** ----		
1	Stinger RT 3	10.7 24	Fall Spring	3 bc	77 ab	42 ab
2	Milestone RT 3	1.2 24	Fall Spring	2 bc	30 b	36 ab
3	Stinger RT 3 2,4-D	10.7 24 43	Fall Spring Summer	3 bc	77 ab	61 ab
4	Milestone RT 3 2,4-D	1.2 24 43	Fall Spring Summer	4 b	76 ab	76 a
5	Curtail RT 3	64 24	Fall Spring	2 bc	60 ab	51 ab
6	Curtail + Finesse RT 3	32 + 0.4 24	Fall Spring	4 bc	70 ab	47 ab
7	Tordon RT 3	16 24	Fall Spring	0 c	0 c	46 ab
8	RT 3 + 2,4-D 2,4-D	64 + 43 43	Fall Summer	1 bc	82 ab	39 ab
9	Stinger + RT 3	10.7 + 24	Spring	76 a	93 ab	54 ab
10	Milestone + RT 3	1.2 + 24	Spring	56 a	111 ab	39 ab
11	RT 3 2,4-D	64 43	Spring Summer	58 a	123 a	27 b
12	RT 3 check	24	Spring	36 a	94 ab	31 b

*Milestone and Curtail + Finesse treatments included M-90 non-ionic surfactant at 0.25% v/v; all RT 3 treatments included ammonium sulfate at 17 lb/100 gal. All plots were sprayed with RT 3 in spring for control of winter annual weeds and volunteer crop.

**Fall treatments (F) applied October 17, 2018; Spring treatments (Sp) applied April 18, 2019; Summer treatments (Su) applied June 5, 2019. Summer burn-down treatments (64 oz/A RT 3 + 2 oz/A Sharpen) were applied June 28 and September 5, 2019.

***Shaded counts were for treatments that had not yet been applied.

****Numbers in each column followed by the same letter are not statistically different ($\alpha=0.05$)

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