Winter wheat yield following rush skeletonweed control with Tordon® 22K in no-till fallow.

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Precision sprayer and standard broadcast applications of Tordon 22K in fall and spring were compared for control of rush skeletonweed (*Chondrilla juncea*) in winter wheat/no-till fallow systems in eastern Washington. Precision sprayers can be effective at spot spraying weeds in fallow, thus reducing chemical inputs compared to a complete coverage broadcast application. Tordon is an effective herbicide for controlling rush skeletonweed and is labeled for fallow applications at 16 oz/A. However, Tordon applied in fallow at high rates or too close to planting can result in subsequent crop injury (Figure 1).

Figure 1. Top photo – Tordon damage in growing winter wheat crop. Bottom photo – Tordon damaged winter wheat at harvest.

The fall-applied trial was initiated in October 2020 near LaCrosse, WA, and the spring-applied trials were initiated at field sites near Hay and LaCrosse, WA in May 2021. All three trial sites were in winter wheat stubble undisturbed from the 2020 wheat crop and managed in a winter wheat/no-till fallow cropping system at the time of application. Tordon was applied at 8, 16, and 32 oz/A with both the broadcast applicator and the precision sprayer if set to spray in continuous mode. The broadcast application spray volume was 15 gpa at 3 mph. The spray volume of the precision sprayer, in continuous spray mode, was 29.4 gpa at 5 mph; however, the total output per plot in spot-spray mode depended on the density of rush skeletonweed; therefore, the volume sprayed in each plot was measured to determine the area sprayed per plot and used to calculate the actual Tordon rate applied. All plots measured 10 by 35 ft, but the precision sprayer only covered a width of 6.7 ft through the center of each plot, which was then the area of interest in each plot. Winter wheat was planted in October 2021 at each location, 12 months after the fall applications and 5 months following the spring applications. Herbicide injury was assessed in April and May 2022 as plants were fully

tillered and injury symptoms were apparent. Plots were harvested in late July and early August using a Wintersteiger plot combine cutting a 5-ft swath through the center of each plot. Grain samples were bagged in the field and returned to the Palouse Conservation Field Station, Pullman, WA for cleaning and weighing. Test weights were measured with a DICKEY-john® mini GAC® Plus grain moisture analyzer.

The precision sprayer consistently applied lower amounts of product compared with the broadcast application method (Table 1). The precision sprayer applications in the fall ranged between 24 and 33% of the full Tordon broadcast rate per acre. The spring precision sprayer applications ranged between 6 and 20% of the full broadcast rates; however, the reduced coverage rates also reflected the rush skeletonweed density at the time of application, which was lower in spring than in the fall (data not shown). None of the precision sprayer applications exceeded the maximum labeled Tordon rate of 16 oz/A.

Table 1. Amount of Tordon 22K applied with a precision sprayer compared with a standard broadcast application.

Amount of Tordon applied		
Broadcast	Precision sprayer	Percent of the broadcast rate applied by the precision sprayer
oz/A	oz/A	%
	Fall 2020 applied – LaCrosse, WA	
8	2.6	33
16	3.8	24
32	9.6	30
	Spring 2021 applied – LaCrosse, WA	
8	0.64	8
16	1.9	12
32	1.9	6
	Spring 2021 applied – Hay, WA	
8	1.3	16
16	3.2	20
32	3.8	12

Wheat yields in 2022 were exceptionally high as rainfall in the region was above average. Rainfall recorded near LaCrosse, WA, with a long-term average of 14.3” annually, totaled 15.3” during the period October 1, 2021, through July 31, 2022 (WSU AgWeatherNet). At all three sites, the highest-yielding treatments yielded over 100 bu/A. Yields for the fall Tordon applications were highest for the broadcast Tordon treatments of 8 and 16 oz/A and the precision sprayer treatments of 16 and 32 oz/A, which yielded between 101 and 103 bu/A; however, yields were slightly lower for the two fall nontreated checks, suggesting some yield loss from rush skeletonweed competition (Table 2). At the 32 oz/A Tordon rate, yield associated with the

broadcast application was slightly lower compared with the precision application suggesting potential yield loss resulting from herbicide injury; however, none of the treatments showed any crop injury symptoms during spring growth and heading stages.

In contrast, Tordon applications substantially reduced winter wheat yield in both spring-applied trials, particularly from the broadcast applications (Table 2). Winter wheat injury symptoms, including stunting and twisted leaves (Figure 1), were observed with each broadcast rate at both locations and increased in severity with each increase in rate of Tordon applied. At LaCrosse, wheat yields were greatest for both nontreated checks and all precision application treatments. Wheat yields associated with each broadcast rate were lower than their corresponding precision application rate. The broadcast 32 oz/A Tordon rate yielded the lowest overall at 36 bu/A. At the Hay site, herbicide injury was not observed with the 8 oz/A broadcast rate, but yield was lower compared with the nontreated check. The 32 oz/A precision application rate did result in 3% injury and reduced yield compared with the nontreated check but had higher yield than the 8 oz/A broadcast application. Like the spring LaCrosse applications, all broadcast rates at Hay resulted in lower yields compared with their respective precision application rate. The 32 oz/A broadcast Tordon rate was most injurious as the wheat only yielded 8 bu/A. The precision application rates of 16 and 32 oz/A also reduced yields compared with the nontreated checks.

Tordon applications to rush skeletonweed not exceeding the maximum labeled rate of 16 oz/A do not appear to reduce yield when applied in fallow during the fall following harvest with either application method; however, the precision application method substantially reduces the total amount of herbicide applied. Fall applications in a wheat/fallow system allow an 11 to 12-mo interval between spraying and planting, which appears to be an adequate period for herbicide breakdown in this region. Waiting to apply Tordon in the following spring shortens the plant back interval and appears to increase crop injury risk. The labeled planting interval for Washington state is 90 days and this may not be adequate in some situations. For example, the 2020-21 fallow period coincided with one of the top-ten worst drought periods on record for the region, therefore, the lack of rainfall may have increased the risk of crop injury in these trials.

Table 2. Winter wheat yield in response to Tordon 22K applications with precision sprayer and broadcast applications for control of rush skeletonweed in no-till summer fallow.

Application method*	Rate	Crop injury rating**	2022 Wheat Yield
	oz/A	% of check***	bu/A***
fall-applied 2020 – LaCrosse, WA			
nontreated check – 1	0	0 a	91 c
nontreated check - 2	0	0 a	94 bc
precision sprayer	8	0 a	94 bc
broadcast	8	0 a	101 ab
precision sprayer	16	0 a	102 a
broadcast	16	0 a	102 a
precision sprayer	32	0 a	103 a
broadcast	32	0 a	95 bc
spring-applied 2021 – LaCrosse, WA			
nontreated check – 1	0	0 d	100 ab
nontreated check - 2	0	0 d	99 ab
precision sprayer	8	0 d	105 a
broadcast	8	7 c	95 b
precision sprayer	16	0 d	107 a
broadcast	16	40 b	78 c
precision sprayer	32	0 d	104 a
broadcast	32	70 a	36 d
spring-applied 2021 – Hay,WA			
nontreated check – 1	0	0 d	100 a
nontreated check - 2	0	0 d	100 ab
precision sprayer	8	0 d	96 abc
broadcast	8	0 d	71 d
precision sprayer	16	0 d	94 bc
broadcast	16	16 b	25 e
precision sprayer	32	3 c	91 c
broadcast	32	68 a	8 f

*Nontreated checks 1 and 2 are in relation to the precision and broadcast applications, respectively.

**Crop injury as percent of nontreated checks was visually rated April 28, 2022, at LaCrosse, and May 23, 2022, at Hay.

***Means are based on four replicates per treatment. Means for each location with the same letter are not significantly different at the 95% probability level, which may result from similar treatment effects, but can also result from experimental or random error associated with the trial

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