Soybean PRE Herbicide Effectiveness with Limited Water

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The most important piece to combatting glyphosate-resistant weeds in soybeans is an effective pre-emergent (PRE) herbicide program. Predicting when an activating rainfall will occur is as difficult as ever even though we know that the amount of rain will impact the success of PRE herbicides. The question then becomes, “how will the herbicide be affected if we don’t get enough rain to activate the product?” Herbicide labels will sometimes mention that tillage is an option for activating herbicides when rain does not occur. A field trial was established in 2016 to evaluate weed control using three soybean herbicides affected by delayed rain and to evaluate rotary hoeing as a substitute for rain activation. These treatments were tested in both tilled and no-till (direct seeded) situations.

The three herbicides chosen, Spartan (sulfentrazone), Fierce (flumioxazin + pyroxasulfone), and metribuzin, represent the chemistries of a large portion of the rain-activated PRE herbicides for soybeans. Metribuzin is a generic product sold under many names but was formerly sold as Sencor. Each herbicide was compared in corn stubble that was either tilled or left un-tilled. A center pivot irrigation system was used to simulate rainfall (0.5” of water) for the herbicide activation treatments. The herbicides were activated within one day of application, seven days after application, rotary hoed seven days after application, or received no activation treatment. The first natural activating rainfall occurred 16 days after treatment so the non-activated treatment was actually activated a little over 2 weeks following herbicide applications. The weeds in the study area were common lambsquarters and redroot pigweed. All existing weeds received glyphosate treatment immediately after planting so that only the pre-emerge component of the herbicides was evaluated.

The best way to review the results will be to look at each main component of the trial. In general, no-till plots had less weed control than tilled plots (~10% less overall). The most likely cause for the difference is that the tilled treatments created more soil to herbicide contact while more herbicide may have gotten bound to residue in the no-till treatments. This was largely related to performance of a single product (metribuzin) as it tested much worse in no-till than with tilled treatments (Table 1). Spartan and Fierce were largely the same across tillage strategies, though Spartan under tillage actually performed worse than no-till on common lambsquarters when there was no activation. It is not immediately clear why this occurred.

Table 1. Comparison of herbicide activation strategies one and seven days after herbicide treatment (DAT) with different herbicide and tillage strategies

Activation	Tillage	Herbicide		Pigweed	Lambsquarters	Control Rating[1]
				% control	% control	
1 DAT	Till	metribuzin	1	88.8	95.8	G-E
7 DAT	Till	metribuzin	2	78.8	91.3	F-E
Rotary Hoe[2]	Till	metribuzin	3	45.0	47.5	P
No Water	Till	metribuzin	4	89.5	93.8	G-E
1 DAT	Till	Fierce	5	97.0	82.5	G-E
7 DAT	Till	Fierce	6	93.8	87.5	G-E
Rotary Hoe	Till	Fierce	7	96.0	88.8	G-E
No Water	Till	Fierce	8	93.8	81.3	G-E
1 DAT	Till	Spartan	9	93.8	99.0	E
7 DAT	Till	Spartan	10	95.0	96.0	E
Rotary Hoe	Till	Spartan	11	86.0	92.3	G-E
No Water	Till	Spartan	12	87.5	75.0	F-G
1 DAT	no-till	metribuzin	13	78.8	88.8	F-G
7 DAT	no-till	metribuzin	14	52.5	76.3	P-F
Rotary Hoe	no-till	metribuzin	15	21.3	25.0	N
No Water	no-till	metribuzin	16	7.5	17.5	N
1 DAT	no-till	Fierce	17	92.3	92.5	E
7 DAT	no-till	Fierce	18	90.0	90.0	E
Rotary Hoe	no-till	Fierce	19	88.8	87.5	G
No Water	no-till	Fierce	20	93.8	87.5	G-E
1 DAT	no-till	Spartan	21	91.3	97.0	E
7 DAT	no-till	Spartan	22	93.8	95.0	E
Rotary Hoe	no-till	Spartan	23	90.0	93.8	E
No Water	no-till	Spartan	24	90.0	95.0	E
LSD (0.05)				8.4	9.7	

[1]As per the North Dakota Weed Control Guide rating scale

[2]The rotary hoe treatment received no water activation and but occurred 7 DAT

Fierce was the most resilient product of the three. There was never a decline in performance across the tillage and activation strategies. Spartan was also resilient except for the one instance under tilled conditions where receiving no activation reduced control by nearly 20%. Metribuzin was affected the most by tillage and activation. For individual species; metribuzin was better on lambsquarters than pigweed (~10% difference). Fierce was better on pigweed under tillage but provided equal control to both under no-till. Spartan provided statistically similar control to both species, though it often trended toward higher control of lambsquarters than pigweed.

A one-week delay in rain activation only caused reduced control with metribuzin. With metribuzin the control dropped off dramatically under no-till when no activating rain occurred. Rotary hoeing did not increase control in no-till and actually reduced weed control under tilled conditions. In this case the rotary hoeing may have planted more seeds than it terminated, while not activating the product. Rotary

hoeing did increase the weed control from Spartan under tilled conditions. Rotary hoeing had no effect on no-till Spartan nor either tillage strategy with Fierce but control was already very high with those treatments. Based on these results, rotary hoeing would not be recommended with metribuzin.
It was surprising to see Fierce so stable across treatments. One of its components, pyroxasulfone (sold alone as Zidua), needs multiple rainfall events totaling at least 0.5” or more for activation. Yet there was no apparent negative response due to activation strategy. In 2016 the activating rain came 16 days after the herbicides were applied. That is still a relatively short period of time. Spartan and Fierce would likely see a dramatic drop in efficacy between 21 and 28 days after application if not activated properly, though it is not clear which one would drop first. This study will continue in 2017 at the CREC.