

EFFICACY AND SAFETY OF RESIDUAL HERBICIDES (SEQUENCE[®] AND NORTRON[®]) RELATIVE TO ACTIVATION TIMING IN SUGAR BEET

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Introduction

Prior to the commercialization of Roundup Ready[®] sugar beet, weed management was a challenge in all sugar beet production areas. The adoption of glyphosate resistant sugar beet hybrids was nearly 100% the year after introduction. However, as more weeds develop resistance to glyphosate, the value of this trait to growers would begin to erode. Within the Amalgamated sugar beet growing region, populations of kochia resistant to glyphosate have been identified and confirmed. Also, there are reports of increased tolerance to glyphosate by common lambsquarters and Russian thistle. To slow down the rate of weed resistance to glyphosate, there is a need to diversify weed management programs to include other effective herbicide sites of action. This would preserve the value of glyphosate in Roundup Ready sugar beet for increased productivity and profitability.

The objectives of this study were 1) to evaluate the effect of irrigation timing on residual weed control with Sequence (s-metolachlor + glyphosate) and Sequence + Nortron (ethofumesate) tankmixes in sugar beet; 2) Assess the effect of irrigation timing on sugar beet response to Sequence and Sequence + Nortron tankmixes.

Materials and Methods

The experiment was established on April 8, 2022 at the Malheur Experiment Station, Ontario, OR in a field previously planted to wheat. The study was a split block design comprised of timing of first irrigation (main-plot) either 1, 4, or 8 days after herbicide application (Table 1) and herbicides (sub-plot); standalone Sequence at 3 pt/acre at 2-leaf stage, Sequential Sequence at 3 pt/acre at 2-leaf and 8- to 10-leaf stages, and Sequence at 3 pt/acre + Nortron at 2 pt/acre at 2-leaf followed by Sequence at 3 pt/acre at 8- to 10-leaf stage (Figure 1). Study details are presented in Table 1. All herbicide treatments included AMS 2.5% v/v. The study was furrow irrigated and all other operations followed local production practices. Plants were evaluated for visible injury and weed control and harvested for yield and sugar quality variables on September 20, 2022.

Table 1. Design and methodology quick facts

Design and Methodology	
Experiment design	Split-Block (main = irrigation; sub = herbicide)
Replications	4
Hybrid	BTS 251N
Planting date	8 April 2022
Plot size	Main = 22' wide x 27'; Sub-plot = 7.33' wide x 27'
First irrigation	1 day after herbicide application (5/13/22)
	4 days after herbicide application (5/16/22)
	8 days after herbicide application (5/20/22)
Herbicide treatments ^a	Sequence at 3 pt/acre
	Sequence 3 at pt/acre followed by Sequence at 3 pt/acre
	Sequence at 3 pt/acre + Nortron at 2 pt/acre followed by Sequence at 3 pt/acre
	Roundup at 32 fl oz/acre
	Untreated control
Harvest date	20 September 2022
Irrigation	Furrow

^a Sequence 3 pt/acre = glyphosate 0.84 lb ai/acre + s-metolachlor 1.12 lb ai/acre; Nortron 32 fl oz/acre (ethofumesate 0.375 lb ai/acre).

Results and Conclusions

Visible injury. Visible injury to sugar beet plants was only affected by the timing of first irrigation (Figure 2). Evaluations on June 7 (7 days after the last application) indicated injury at 23, 14, or 13% for standalone Sequence at 3 pt/acre with activation at 1, 4, or 8 days after herbicide application, respectively. When Sequence at 3 pt/acre was applied sequentially at 2- and 8- to 10-leaf, the injury was 24% with 1-day activation, 13% when activation was 4 days after herbicide application, and 50% with first irrigation at 8 days after application (Figure 3). Injury for plants treated with a tank-mixture comprised of Sequence at 3 pt/acre + Nortron at 2 pt/acre at the 2-leaf stage followed by Sequence at 3 pt/acre at 8- to 10-leaf stage averaged 52% across irrigation timings. It appeared that Nortron herbicide tended to accentuate the activity of Sequence (glyphosate plus s-metolachlor), which resulted in increased injury. The injury was largely transient and did not affect plant growth, root yield and sugar quality variables.

Weed Control. Evaluations on May 25, 2022 indicated $\geq 99\%$ control for common lambsquarters, hairy nightshade, and complete control for pigweed species across herbicide treatments and the timing of first irrigation compared to 95% for standalone Roundup at 32 fl oz/acre (data not shown). Control for kochia ranged from 38% to complete control for Sequence treatments compared to 66% for Roundup at 32 fl oz/acre. Control for common purslane was affected by timing of first irrigation but not herbicide treatments. Initiating irrigation 1 day after spray resulted in 0 to 50% control, with standalone Sequence proving 0% control. Irrigation at 4 or 8 days after herbicide application provided $\geq 91\%$ across herbicide treatments.

Yield and Sugar Quality. Early plant injury did not affect root yield or sugar quality variables. Averaged across herbicide treatments, the tared yield was 51.2, 51.3, or 54.8 tons/acre when the first irrigation was 1, 4, or 8 days after herbicide application (Figure 3). Similarly, when averaged across the timing of first irrigation the yield was 51.6 tons/acre for standalone Sequence at 3 pt/acre, 53.9 tons/acre for sequentially applied Sequence at 3 pt/acre at 2-leaf and 8- to 10-leaf, or 51.8 tons/acre for Sequence at 3 pt/acre + Nortron 2 pt/acre at 2-leaf followed by Sequence 3 pt/acre at 8- to 10-leaf stage.

Preliminary Results and Conclusions. Application of Sequence at 3 pt/acre plus Nortron at 2 pt/acre at the 2-leaf stage followed by Sequence at 3 pt/acre resulted in sugar beet injury that was characterized by leaf deformation (drawstring) and temporary stunting. All herbicide treatments exhibited more injury when the first irrigation was at 8 days after spraying. Control for kochia and common purslane was reduced when the first irrigation was at 1 day after spraying. Sugar beet injury and stunting was transient and did not affect root yield or sugar quality variables. The study will be repeated to confirm these results.

Acknowledgements

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Figure 1. Timing of first irrigation after application of Sequence and Nortron to control weeds in sugar beet at the Malheur Experiment Station, Ontario, OR 2022. Photograph courtesy of Joel Felix, taken on May 19, 2022 for plots irrigated 8 days after herbicide application.



Figure 2. Depiction of sugar beet injury and stunting across one block treated with Sequence and Nortron to control weeds in sugar beet at the Malheur Experiment Station, Ontario, OR 2022. Photo courtesy of Joel Felix and taken May 26, 2022.

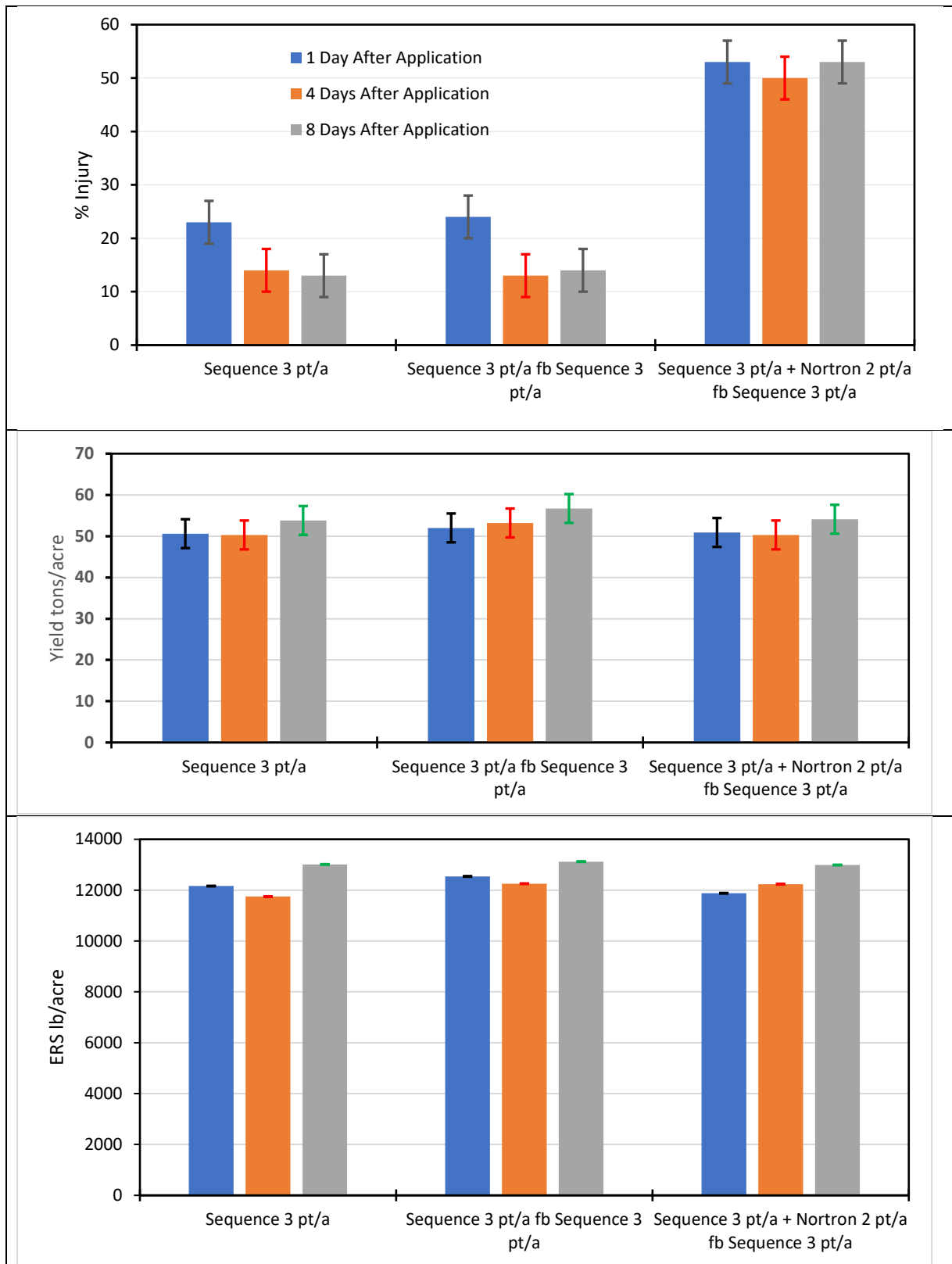


Figure 3. Percent sugar beet injury (top) – LSD (0.05) = 4, root yield (middle) – LSD (0.05) = 4.7, and ERS – LSD (0.05) = 8.8 in response to timing of the first irrigation at the Malheur Experiment Station, Ontario, OR 2022. Means compared using LSD (P = 0.05).