

TIMING OF GLYPHOSATE APPLICATIONS FOR OPTIMUM WEED CONTROL AND SUGARBEET YIELD IN A ROUNDUP READY SUGARBEET PRODUCTION SYSTEM

James F. Stewart*, Corey J. Guza and Lee A. Hubbell
Michigan Sugar Company, Agricultural Research Center, 1459 S. Valley Center Drive,
Bay City, MI 48706

Abstract:

Michigan sugarbeet growers have made a rapid transition to Roundup Ready sugarbeet varieties during the past two years. Over half of the Michigan Sugar Company crop was planted to Roundup Ready varieties in 2008 and we anticipate that over 97 percent of our growers will utilize Roundup Ready varieties this coming season. For the past three years the Research Department has been conducting trials to determine Best Management Practices for producing Roundup Ready Sugarbeets in Michigan. This paper will discuss optimum application timings with glyphosate in a Roundup Ready sugarbeet production system.

Objective:

1. To determine the optimum application timing for glyphosate in a Roundup Ready sugarbeet production system.
2. To determine the optimum number of glyphosate applications required in a Roundup Ready sugarbeet production system.

Materials and Methods:

Small plot replicated trials were conducted in the Michigan sugarbeet growing region in 2006, 2007 and 2008. The treatments included three well timed glyphosate applications, several treatments utilizing two glyphosate application timings, as well as single glyphosate applications timed both early and late. The treatments were applied with a compressed air plot sprayer mounted on a small tractor. The treatments were applied at 3.25 mph at 15 gpa and 30 psi. The plots were 4 rows wide (30 inch rows) and 35 feet long. Each treatment was replicated six times. The glyphosate formulation used was Roundup OriginalMax. The rate was 22 fl oz/A and included AMS at 17 lbs/100 gallons of water. The application timings (sugarbeet leaf stages) are listed below:

2006

- 1) Roundup at Cot-2 lf, 4 lf and 10 lf
- 2) Roundup at 4 lf and at 10 lf
- 3) Roundup at 4 lf
- 4) Roundup at 10 lf
- 5) Untreated

2007

- 1) Roundup at 2 lf, 6 lf and 10 lf
- 2) Roundup at 2 lf and 10 lf
- 3) Roundup at 4 lf and 10 lf
- 4) Roundup at 4 lf
- 5) Roundup at 10 lf
- 6) Untreated

2008

- 1) Roundup at 2 lf, 6 lf and 10 lf
- 2) Roundup at 2 lf and 6 lf
- 3) Roundup at 2 lf and 10 lf
- 4) Roundup at 6 lf and 10 lf
- 5) Roundup at 4 lf
- 6) Roundup at 10 lf
- 7) Untreated

A moderate infestation of common lambsquarters, redroot pigweed and velvetleaf (1-4 weeds/sq ft) existed in the plot area in 2006 and 2007. A very heavy population of wild mustard and common lambsquarters (over 10 weeds/sq ft) were present in the plots in 2008.

Results and Discussion:

Three well timed glyphosate applications provided nearly complete weed control and tended to give somewhat higher yields than the two glyphosate application schemes even though the differences were not always statistically significant (Seed tables 1, 2 and 3). Two applications of glyphosate provided very good weed control and good yields depending upon the timing of the initial application. When weed pressure was heavy it was important to make the initial glyphosate application by the 4 leaf stage of sugarbeets or yields were depressed (Table 1). A single application at the 4 leaf stage provided control of the weeds that were present but later germinating weeds invaded the plots and caused yield loss. The 10 leaf stage application timing provided fairly good weed control but some weeds escaped, possibly because of the large size of the weeds or because they were protected by the canopy of sugarbeets or other weeds. Significant yield loss occurred in this late application, primarily due to early season weed competition. Sugarbeet quality (RWST, calculated from percent sucrose and percent clear juice purity) was not influenced by the treatments (Tables 1, 2 and 3). None of the treatments caused injury to the sugarbeets (Tables 1, 2 and 3).

Table 1. Influence of Roundup Application Timing on Sugarbeet Yield and Weed Control. Deckerville, MI – 2008.

Treatment	RWSA	RWST	Tons/ Acre	% SB Injury	% Weed Control		
					Avg 2	W. Must	Lambsq
Roundup 2 lf, 6 lf, 10 lf	8370	244.9	34.18	0	99.7	99.3	100.0
Roundup 2 lf, 6 lf	8114	247.5	32.78	0	99.3	98.7	100.0
Roundup 2 lf, 10 lf	8217	243.1	33.80	0	92.7	90.3	95.0
Roundup 6 lf, 10 lf	4916	237.6	20.69	0	94.1	89.2	99.0
Roundup 4 lf	4638	244.2	18.99	0	69.2	86.7	51.7
Roundup 10 lf	4326	231.7	18.67	0	76.7	79.2	74.2
Untreated Check	649	230.8	2.81	0	3.7	5.8	1.5
LSD 5%	1575	20.03	5.8	0	8.3	6.6	13.6
CV	23.6	7.1	21.4	0	9.2	7.1	15.4
Treatment Mean*	6430.2	241.5	26.52	0	88.6	90.6	86.8

Notes for Table 1: Planted: April 30, 2008, Harvested: October 7, 2008. Variety: HM 28RR
Spray Dates: 2 lf: May 24, 4 lf: Jun 7, 6 lf: Jun 17, 10 lf: Jun 27

Evaluation dates for injury and weed control: July 25. Yield CV's were high in this trial primarily due to extreme variation in the untreated check plots and the poor weed control treated plots. *Treatment Mean values do not include untreated check data. Weeds were approximately 2 inches tall, depending upon species, at the first application timing (2 leaf stage of sugarbeets).

Table 2. Influence of Roundup Application Timing on Sugarbeet Yield and Weed Control. Blumfield, MI – 2007.

Treatment	RWSA	RWST	Tons/ Acre	% SB Injury	% Weed Control		
					Avg 2	Lambsq	R Pigw
Roundup 2 lf, 6 lf, 10 lf	4735	197.8	23.94	0	99.0	99.4	98.6
Roundup 2 lf, 10 lf	4706	200.1	23.52	0	98.1	97.1	99.1
Roundup 4 lf, 10 lf	4583	202.7	22.61	0	98.3	98.5	98.0
Roundup 4 lf	4115	194.3	21.18	0	92.3	91.8	92.8
Roundup 10 lf	4090	188.4	21.71	0	87.1	87.1	98.1
Untreated Check	2568	205.6	12.49	0	0.0	0.0	0.0
LSD 5%	541.9	ns	1.79	0	3.9	4.3	3.7
CV	11.01	6.3	7.2	0	4.1	4.6	4.0
Treatment Mean*	4445.8	196.7	22.59	0	95.0	94.8	97.3

Notes for Table 2: Planted: May 24, 2007, Harvested: October 4, 2007. Variety: HM 28RR
Spray Dates: 2 lf: Jun 7, 4 lf: Jun 15 6 lf: Jun 21, 10 lf: Jul 6

Evaluation dates for injury and weed control: July 28. *Treatment Mean values do not include untreated check data. This was a replanted field. Weeds were approximately 2 inches tall, depending upon species, at the first application timing (2 leaf stage of sugarbeets).

Table 3. Influence of Roundup Application Timing on Sugarbeet Yield and Weed Control. Blumfield, MI – 2006.

Treatment	RWSA	RWST	Tons/ Acre	% SB Injury	% Weed Control			
					Avg 3	Lambsq	R Pigw	Velvetl
Roundup Cot-2 lf, 4 lf, 10 lf	8352	215.2	38.81	0	97.5	98.8	96.3	97.5
Roundup 4 lf, 10 lf	8255	210.9	39.14	0	95.8	98.8	93.8	95.0
Roundup 4 lf	6667	213.2	31.27	0	80.0	90.0	67.5	82.5
Roundup 10 lf	7437	212.0	34.35	0	90.8	95.0	93.8	83.5
Untreated	3347	216.5	15.46	0	0.0	0.0	0.0	0.0
LSD 5%	1240	ns	5.63	0	4.8	5.3	10	5.5
CV	11.9	4.9	11.5	0	4.3	3.6	9.3	5
Treatment Mean*	7677.8	212.8	35.89	0	91.0	95.7	87.9	89.6

Notes for Table 3: Planted: May 4, 2006, Harvested: October 2, 2006. Variety: HM 28RR
Spray Dates: Cot-2 lf: Jun 9, 4 lf: Jun 17 6 lf: Jun 23, 10 lf: Jul 10

Evaluation dates for injury and weed control: July 24. *Treatment Mean values do not include untreated check data. Weeds were approximately 2 inches tall, depending upon species, at the first application timing (Cot-2 leaf stage of sugarbeets).

Conclusions:

Three well timed glyphosate applications beginning at the two leaf stage of sugarbeets were required to provide excellent weed control under all conditions during this three year study. Two well timed glyphosate applications provided very good weed control under most conditions, however, when the first application was delayed beyond the four leaf stage of sugarbeets yields

suffered under heavy weed pressure. A few weed escapes were more likely to occur in the two application timing treatments as compared to the three application timing treatments. Single glyphosate applications, regardless of the application timing, did not provide adequate weed control or produce acceptable yields. None of the glyphosate treatments caused sugarbeet injury. Recoverable white sugar per ton (RWST) was not affected by the treatments.