

Incorporating Roundup Ready® Sugarbeets into a Sustainable Weed Control Program at Scottsbluff, NE during the 2007 Growing Season.

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Objective: Determine the best strategies for using Roundup for weed control in sugarbeets.

Determine the most effective traditional herbicides to utilize with Roundup to address Roundup tolerant weeds.

Problem Addressed: Roundup Ready Sugarbeets will soon be available for growers to plant in the Western Sugar Cooperative growing area. Growers have been waiting for this opportunity every since the USDA and EPA approved the first Roundup Ready event in 1998. The use of Roundup for postemergence weed control in sugarbeets should dramatically improve the growers ability to manage weeds. This has been the case for soybean, corn, and cotton growers in other sections of the US. A few soybean growers in Nebraska have been continuously utilizing only Roundup for weed control for the past 11 years. In conjunction, many growers have utilized Roundup in a rotation of corn and soybeans for 8 to 9 years. As we move to western Nebraska the predominant use of Roundup has been in corn with some growers continuously utilizing only Roundup for weed control for 5 years. With 120 million acres of corn and soybeans treated with Roundup in the U.S. in 2006, it is not surprising that weed shifts have occurred and some weed species have developed tolerance to Roundup.

As we begin to introduce Roundup into sugarbeet weed control programs, it would be prudent to examine some of the experiences that corn and soybean growers have had with Roundup so we can sustain Roundup efficacy in sugarbeets. Once growers have switched to a Roundup Ready crop they usually do not want to switch back, but instead want to continue to utilize Roundup, even if tolerant weeds have developed. To address weed tolerance growers have supplemented Roundup by applying a preemergence herbicide at planting followed by Roundup postemergence, tank mixing another postemergence herbicide with Roundup, or rotating a Roundup Ready crop with a non Roundup resistant crop. Many growers in the Western Sugar growing region have

used Roundup Ready crops sparingly, so initially there should be very few problems with Roundup performance. The objective of this experiment is to give growers some backup information so in future years, if Roundup tolerant weeds develop, there will already be control tactics tested and available for growers to utilize.

In 1998, we started an experiment at Scottsbluff to examine the influence of continuous Roundup use on a typical western Nebraska weed population. We observed after 7 years of continuous utilizing Roundup that a population of Roundup tolerant common lambsquarters began to develop. Common lambsquarters seed from this population will be distributed on an adjacent field for the proposed study.

Procedure: A field study was initiated near Scottsbluff, Nebraska to compare the effectiveness of various herbicides for weed control in Roundup Ready sugarbeets. The experimental design was a randomized complete block with four replications. Plots were 11 feet wide by 25 feet long and were located on a sandy loam soil with 1.4% organic matter and a pH of 8.2. Sugarbeet, 'BTS-RZ03RR07', were planted on April 26. The plot area was irrigated on May 10, May 25, June 8, and June 18 for seed germination and early season plant growth. Herbicide application began on April 27, the day after planting. Sugarbeets were in the cotyledon growth stage by May 5 when postemergence herbicide application was initiated. Row closure occurred on June 18 when the last set of postemergence treatments were applied. Herbicides were applied with a tractor-mounted sprayer calibrated to deliver 20 gallons of water per acre at 36-psi pressure with Spraying Systems 11002 VS nozzles. Environmental conditions, including rainfall following herbicide application and weed growth stages at the time of herbicide application are given in Table 1.

Crop injury from herbicides was evaluated on June 3, June 12, and June 20 (Table 2). Crop stand and weed density were determined by counting sugarbeet and weed seedlings in the entire plot on June 26. The weed population consisted of common lambsquarters, redroot pigweed, and kochia at densities of 355, 24, and 2 plants per 92 sq ft, respectively. Sugarbeet injury was greatest and ranged from 14 to 19% in plots treated PRE with Nortron followed by four treatments with the Micro-Rate. There were four treatments that contained Roundup Original Max POST and

Nortron PRE. Adding Nortron PRE at 1.0 lb/acre increased early season sugarbeet injury from 6 to 10%. None of the herbicide treatments reduced sugarbeet stand.

Even though weed populations were severe, all the herbicide treatments provided 88% or greater weed control (Table 2). There was a real benefit in applying three applications of Roundup Original Max compared to two in controlling common lambsquarters and kochia, 96 and 99% versus 89 and 74%, respectively. Adding Nortron PRE at planting increased crop response but would provide growers with a planting time option for introducing a herbicide other than glyphosate into the sugarbeet weed control program. Progress, Upbeet, and Stinger can all be successfully tank-mixed with Roundup Original Max without increasing crop injury and could be utilized to expand the weed control spectrum. Residual weed control can be obtained by adding either Dual Magnum or Outlook to the second application of glyphosate which was applied at the 6 true-leaf growth stage.

The results from the first year of this experiment suggest that with careful assessment of weed populations growers should be able to manage glyphosate tolerant or resistant weeds by combining glyphosate with other herbicides labeled for use in sugarbeets.

Table 1. Environmental Conditions at the Time of Herbicide Application.

Date	Air temperature (F)	Humidity (%)	Wind speed & direction (mph)	Time of day	Crop growth stage	Weed heights		
						Colq	Rrpw	Kocz
April 27	50	65	11 NW	10:00 am	Preemergence	no growth		
May 15	57	45	8 NW	11:00 am	Cotyledon	1.5	1.5	0.75
May 18	72	41	1 SE	10:00 am	2 true-leaves	1.5	1.75	1
May 24	49	58	4 NW	9:00 am	4 true-leaves	2	2	2
May 30	52	70	10 NW	9:00 am	6 true-leaves	5	3	4
June 13	62	74	6 NW	10:00 am	10 true-leaves	7	6	8
June 18	64	46	4 NW	9:00 am	Canopy closure	14	9	9

Rainfall before and after herbicide application:

Date	Amount - (inches) -	Date	Amount - (inches) -	Date	Amount - (inches) -
April 24	0.30	May 21	0.23	June 12	0.08
April 26	0.04	May 22	0.75	June 13	0.85
May 3	0.26	May 29	0.23	June 16	0.05
May 5	0.29	June 7	0.08	June 18	0.85
May 10	0.50	June 8	0.75		

Table 2. Incorporating Roundup Ready Sugarbeets into a Sustainable Weed Control Program at Scottsbluff, NE during the 2007 Growing Season.

Herbicide treatment ¹	Rate (lb/acre)	Time of application ²	Sugarbeet							Weed density 6/26 ⁴			
			Visual injury ³			Stand 6/27 (plants/acre)	Yield 10/5 (tons/acre)	Sucrose (%)	SLM	Weed density 6/26 ⁴			
			6/3	6/12	6/20					Colq	Rrpw	Kocz	Avg
			----- (%) -----							----- (%) -----			
Nontreated	—	—	0	0	0	38400	—	—	—	0	0	0	0
Nortron	1.0	PRE											
Betamix + Upbeet + Stinger + Scoil	0.08 + 0.004 + 0.02	Cot											
Betamix + Upbeet + Stinger + Scoil	0.08 + 0.004 + 0.02	2 TL											
Betamix + Upbeet + Stinger + Scoil	0.08 + 0.004 + 0.02	4TL											
Betamix + Upbeet + Stinger + Scoil	0.08 + 0.004 + 0.02	6 TL	14	20	19	44200	45.2	12.6	2.0	99	99	99	99
Roundup Original Max + AMS	0.75	2 TL											
Roundup Original Max + AMS	0.75	6 TL											
Roundup Original Max + AMS	0.75	Canopy Closure	0	0	0	43600	44.6	12.5	2.0	96	99	99	98
Nortron	1.0	PRE											
Roundup Original Max + AMS	0.75	2 TL											
Roundup Original Max + AMS	0.75	6 TL											
Roundup Original Max + AMS	0.75	Canopy Closure	6	6	3	45500	46.5	12.1	2.2	96	97	87	93
Roundup Original Max + AMS	0.75	2 TL											
Roundup + Progress + AMS	0.75 + 0.25	4 TL											
Roundup + Progress + AMS	0.75 + 0.33	Canopy Closure	0	3	3	50400	40.1	12.5	2.1	91	99	99	96
Roundup + Upbeet + AMS + Scoil	0.75 + 0.016	2 TL											
Roundup + Upbeet + AMS + Scoil	0.75 + 0.016	6 TL											
Roundup Original Max + AMS	0.75	Canopy Closure	3	0	0	52000	49.8	12.7	2.0	98	99	99	99
Roundup + Stinger + AMS	0.75 + 0.02	2 TL											
Roundup + Stinger + AMS	0.75 + 0.02	6 TL											
Roundup Original Max + AMS	0.75	Canopy Closure	0	1	0	45800	46.8	13.1	1.9	97	99	99	98
Nortron	1.0	PRE											
Roundup Original Max + AMS	0.75	Cot											
Roundup + Progress + AMS	0.75 + 0.25	4 TL											
Progress	0.33	6 TL											
Roundup Original Max + AMS	0.75	Canopy Closure	8	8	9	51100	51.0	12.0	2.1	99	99	99	99

Herbicide treatment ¹	Rate (lb/acre)	Time of application ²	Sugarbeet							Weed density 6/26 ⁴				
			Visual injury ³			Stand 6/27 (plants/acre)	Yield 10/5 (tons/acre)	Sucrose (%)	SLM	Colq	Rrpw	Kocz	Avg	
			6/3	6/12	6/20									----- (%) -----
Roundup Original Max + AMS	1.12	2 TL												
Roundup Original Max + AMS	1.12	6 TL												
Roundup Original Max + AMS	1.12	10 TL	2	0	0	49400	46.6	12.7	1.9	99	99	99	99	
Nortron	1.0	PRE												
Roundup Original Max + AMS	0.75	2 TL												
Roundup + Dual Magnum + AMS	0.75 + 1.0	4 TL												
Roundup Original Max + AMS	1.12	10 TL	8	9	8	50200	44.8	12.6	2.1	99	99	99	99	
Roundup Original Max + AMS	0.75	2 TL												
Roundup Original Max + AMS	0.75	6 TL	1	0	0	50700	40.4	12.4	2.2	89	99	74	88	
Nortron	1.0	PRE												
Roundup Original Max + AMS	0.75	2 TL												
Roundup + Outlook + AMS	0.75 + 0.66	4 TL												
Roundup Original Max + AMS	1.12	10 TL	10	13	13	45100	38.7	12.9	2.0	99	99	99	99	
Betamix + Upbeet + Stinger + Scoil	0.08 + 0.004 + 0.02	Cot												
Roundup Original Max + AMS	0.75	2 TL												
Betamix + Upbeet + Stinger + Scoil	0.16 + 0.008 + 0.04	4 TL												
Betamix + Upbeet + Stinger + Scoil	0.16 + 0.008 + 0.04	6 TL												
Roundup Original Max + AMS	1.12	10 TL	8	15	12	45100	41	13.1	1.9	99	99	99	99	
Roundup Original Max + AMS	0.75	2 TL												
Roundup + Dual Magnum + AMS	0.75 + 1.0	4 TL												
Roundup + Dual Magnum + AMS	0.75 + 1.0	Canopy Closure	0	4	2	54200	44.1	13.1	1.9	97	99	87	94	
LSD at 5%	—	—	5	6	6	NS	8.9	1.1	0.2	8	1	22	8	

¹ Spray additives were combined with the spray solution at the following rate: ammonium sulfate (AMS) at 2% and methylated seed oil (Scoil) at 1.5% v/v.

² Time of application: preemergence (PRE), sugarbeet growth stage cotyledon (Cot), 2 true-leaves (2 TL), 4 true-leaves (4 TL), 6 true-leaves (6 TL), 10 true-leaves (10 TL), and canopy closure of sugarbeet.

³ Visual crop injury evaluated on a scale from 0 to 100 with 0 equal to no injury and 100 equal to death of the plant.

⁴ Percent weed control calculated from weed counts taken on June 26. Weed abbreviations: common lambsquarters (Colq), redroot pigweed (Rrpw), and kochia (Kocz).