Incorporating Roundup Ready® Sugarbeets into a Sustainable Weed Control Program at Scottsbluff, NE during the 2008 Growing Season.

Robert Wilson, Weed Specialist

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 are 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 130 million acres of corn and soybeans treated with Roundup in the U.S. in 2007, 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 Mitchell, 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 45 feet long and were located on a sandy loam soil with 1.0% organic matter and a pH of 8.0. Sugarbeet, 'BTS66RR50', were planted on April 22. The plot area was irrigated on April 25 for seed germination and early season plant growth. Herbicide application began on April 23, the day after planting. Sugarbeets were in the cotyledon growth stage by May 19 when postemergence herbicide application was initiated. Row closure occurred on July 2 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.

Results: Crop injury from herbicides was evaluated on June 18 and July 9 (Table 2). Crop injury was greatest in areas treated with a conventional weed control program of Nortron applied at planting followed postemergence by four applications of Betamix plus Upbeet plus Stinger plus methylated seed oil (Scoil). Crop injury was also prevalent from three postemergence applications Betamix plus Upbeet plus Stinger plus Scoil combined with two postemergence treatments of Roundup Original Max. Applying Nortron preemergence after sugarbeet planting also caused early season crop injury.

Crop stand and weed density were determined by counting sugarbeet and weed density in a 247 sq ft area in the center of each plot. The weed population consisted of common lambsquarters, redroot pigweed, kochia, toothed spurge, common purslane, hairy nightshade, common sunflower, and wild proso millet at densities of 252, 7, 11, 20, 5, 24, 3, and 5 plants per 247 sq ft, respectively. Two of the more difficult weeds to control in the study site were common lambsquarters and toothed spurge. All the herbicide treatments except the conventional herbicide program of Nortron at planting followed postemergence with four applications of Betamix plus Upbeet plus Stinger plus Scoil provided 98% or greater common lambsquarters control. Two applications of Roundup Original Max at 0.75 lb/acre (22 oz/acre) at the 2 and 6 true-leaf sugarbeet growth stage only controlled 49% of the toothed spurge population. Three applications of Roundup Original Max at 0.75 lb/acre (22 oz/acre) provided 62% toothed spurge control while increasing the Roundup Original Max rate to 1.12 lb/acre (33 oz/acre) resulted in an increase of toothed spurge control to 97%. Combining Roundup Original Max with a preemergence application of Nortron at planting improved toothed spurge control as did a tank mixture of Roundup Original Max in combination with Progress.

Even though weed populations were severe, all the herbicide treatments provided 87% or greater weed control (Table 2). Sugarbeet root yields in nontreated ares averaged 15.9 tons/acre while root yields in herbicide treated areas ranged from 28.6 to 36.7 tons/acre. The results from 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 temp-erature	Humidity	Wind speed & direction	Time of day	Crop growth stage	Weed heights					
						Colq	Hans	Rrpw	Tosp	Vele	Kocz
	(F)	(%)	(mph)			- - - - - - - - - - - - (inches) - - - - - - - - - - - -					
April 23	58	56	6 SE	9:00 am	PRE	no growth					
May 19	72	37	7 W	9:00 am	Cot	1	.5	0	0	1	0
May 29	79	34	3 SE	2:00 pm	2 TL	2	1.5	.5	1	2	2
June 9	63	34	2 W	10:00 am	4 TL	5	3	2	2	3	3
June 17	73	60	1 SE	10:00 am	6 TL	12	4	3	3	4	6
June 23	75	48	2 NE	9:00 am	8 TL	14	6	3	4	5	6
July 2	71	56	5 NW	10:00 am	Canopy closure	26	12	6	10	12	24

Rainfall before and after herbicide application:

Date	Amount	Date	Amount	Date	Amount
	- (inches) -		- (inches) -		- (inches) -
April 24	0.06	May 14	0.10	June 5	0.13
April 30	0.61	May 22	0.27	June 15	0.08
May 1	0.10	May 23	0.33	June 16	0.17
May 7	0.29	May 24	0.08	June 20	0.47
May 9	0.05	May 26	0.15	June 26	0.02
May 10	0.03	June 1	0.06	June 28	0.02
May 12	0.08	June 4	0.52		

Table 2. Incorporating Roundup Ready Sugarbeets into a Sustainable Weed Control Program.

Herbicide treatment [1]	Rate	Time of application [2]	Sugarbeet						Percent weed control 7/16 [4]								
			Visual injury [3]		Stand	Yield											
			6/18	7/9	7/16	10/16	Sucrose	SLM	Colq	Rrpw	Kocz	Tosp	Copu	Hans	Cosf	Wipr	Avg
	(lb/acre)		----(%)----		(plants/acre)	(tons/acre)	(%)	(%)	----------(%)----------								
Nontreated	__	__	0	0	21846	15.9	14.7	1.7	0	0	0	0	0	0	0	0	0
Nortron	1.0	Pre	19	0	21846	29.8	15.2	1.7	91	99	90	87	99	95	99	99	95
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	0.16 + 0.008 + 0.04	4 TL															
Betamix + Upbeet + Stinger + Scoil	0.16 + 0.008 + 0.04	6 TL															
Roundup Original Max + AMS	0.75	2 TL	0	0	21120	31.5	14.6	1.7	99	95	99	62	89	99	99	99	93
Roundup Original Max + AMS	0.75	6 TL															
Roundup Original Max + AMS	0.75	Canopy Close															
Nortron	1.0	Pre	7	1	22506	30.9	16.3	1.5	99	92	99	99	99	99	99	99	98
Roundup Original Max + AMS	0.75	2 TL															
Roundup Original Max + AMS	0.75	6 TL															
Roundup Original Max + AMS	0.75	Canopy Close															
Roundup Original Max + AMS	0.75	2 TL	10	2	23760	30.3	15.8	1.6	98	80	97	96	94	99	99	99	96
Roundup Original Max + Progress + AMS	0.75 + 0.25	4 TL															
Roundup Original Max + Progress + AMS	0.75 + 0.33	8 TL															
Roundup Original Max +	0.75	2 TL	5	0	18546	29.7	16.2	1.5	99	84	99	82	99	99	99	99	95
Upbeet + AMS + Scoil	0.016	2 TL															
Roundup Original Max +	0.75	6 TL															
Upbeet + AMS + Scoil	0.016	6 TL															
Roundup Original Max + AMS	0.75	Canopy Close															
Roundup Original Max + Stinger + AMS	0.75 + 0.02	2 TL	5	3	27588	35.8	15.4	1.7	99	99	99	88	99	99	99	99	98
Roundup Original Max + Stinger + AMS	0.75 + 0.04	6 TL															
Roundup Original Max + AMS	0.75	Canopy Close															
Nortron	1.0	Pre	8	1	20460	28.6	16.5	1.7	98	99	99	73	99	99	99	99	96
Roundup Original Max + AMS	0.75	Cot															
Roundup Original Max + Progress + AMS	0.75 + 0.25	4 TL															
Progress	0.33	6 TL															
Roundup Original Max + AMS	0.75	Canopy Close															
Roundup Original Max + AMS	1.12	2 TL	0	0	22572	32.2	15.6	1.6	99	99	99	97	99	98	99	99	99
Roundup Original Max + AMS	1.12	6 TL															
Roundup Original Max + AMS	1.12	10 TL															
Nortron	1.0	Pre	4	0	23100	33.5	15.4	1.7	99	99	92	88	99	99	89	99	96
Roundup Original Max + AMS	0.75	2 TL															
Roundup Original Max + Dual Magnum + AMS	0.75 + 1.0	4 TL															
Roundup Original Max + AMS	1.12	10 TL															

			Sugarbeet														
			Visual injury [3]		Stand	Yield			Percent weed control 7/16 [4]								
Herbicide treatment [1]	Rate	Time of application [2]	6/18	7/9	7/16	10/16	Sucrose	SLM	Colq	Rrpw	Kocz	Tosp	Copu	Hans	Cosf	Wipr	Avg
	(lb/acre)		- - - - (%) - - - -		(plants/acre)	(tons/acre)	(%)	(%)	- (%) -								
Roundup Original Max + AMS	0.75	2 TL	0	0	23826	36.7	15.6	1.6	98	50	99	49	94	99	99	99	87
Roundup Original Max + AMS	0.75	6 TL															
Nortron	1.0	Pre	11	1	20988	30.4	16.6	1.7	99	99	99	78	99	99	99	99	97
Roundup Original Max + AMS	0.75	2 TL															
Roundup Original Max + Outlook + AMS	0.75 + 0.66	4 TL															
Roundup Original Max + AMS	1.12	10 TL															
Betamix + Upbeet + Stinger + Scoil	0.08 + 0.004 +0.02	Cot	18	1	26664	32.6	15.9	1.6	99	99	99	91	99	99	99	99	98
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															
Roundup Original Max + AMS	0.75	2 TL	2	1	20724	32.4	15.7	1.6	99	99	99	83	99	98	99	99	97
Roundup Original Max + Dual Magnum + AMS	0.75 + 1.0	4 TL															
Roundup Original Max + Dual Magnum + AMS	0.75	8 TL															
LSD at 5%	__	__	5	3	NS	5.5	2	NS	4	21	9	31	9	2	7	0	5

[1] Spray additives were combined with the spray solution at the following rate: ammonium sulfate (AMS) at 17.5 lbs/100 gal and methylated seed oil (Scoil) at 1.5%.

[2] Time of application: preemergence of crop (Pre), cotyledon (cot), 2 true-leaves (2 TL), 4 true-leaves (4 TL), 6 true-leaves (6 TL), 8 true-leaves (8 TL), 10 true-leaves (10 TL), and at canopy close.

[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 July 16. Weed abbreviations: common lambsquarters (Colq), redroot pigweed (Rrpw), kochia (Kocz), toothed spurge (Tosp), common purslane (Copu), hairy nightshade (Hans), common sunflower (Cosf), and wild proso millet (Wipr).