GLYPHOSATE INFLUENCE ON SUGARBEET PRODUCTION AND CONTROL OF ABUTILON THEOPHRASTI, CHENOPODIUM ALBUM, AND AMARANTHUS SPECIES USING WEED GROWTH STAGE AND GROWING DEGREE DAYS

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Introduction:

Weed control in sugarbeets has been a challenge since the inception of sugarbeet production. Conventional sugarbeet weed control has seen many modifications to optimize the efficacy of these products. Weed control with conventional products has been managed by growth stage of sugarbeet and weeds and more recently by growing degree days. In 2008 a significant part of the sugarbeet growing regions in the United States seeded some percentage of their sugarbeet production acres to a biotech variety with the Glyphosate tolerant trait. Sugarbeet growers need to be given information to best manage Glyphosate for weed control in sugarbeet. A study was established in 2008 in Southern Minnesota to evaluate application of Glyphosate for control of Abutilon theophrasti, Chenopodium album and Amaranthus species using weed growth stage or growing degree days.

Methods:

Weed control trials were established at three locations; Milan, Sacred Heart and Hector, MN. Experiments were established in a randomized complete block design with 4 replications. Roundup Ready® sugarbeet variety Beta 95RR03 was planted at all locations to seed spacing of 4 inches. Treatments were applied to the center four rows of six row wide, 35 foot long plots with 14 gallon of spray mix per acre using 8001 flat fan nozzles. The criteria for application timing were crop stage, weed stage and Growing Degrees Days (GDD). The GDD was calculated using SMBSC weather station data and applying 34^{o} as base for the calculation. Herbicide treatments were evaluated for sugarbeet injury and weed control efficacy at 14 and 30 days after the last treatment application. Sugarbeets were harvested to determine the treatment and weed control effect on sugarbeet production. Data was analyzed for homogeneity for combinability and was determined that the data could not be combined across locations. The data will be presented and results discussed separately for each location. The Amaranthus species are discussed in this report as a grouped. The Amaranthus species present at all locations researched in 2008 were redroot pigweed, smooth pigweed, tall waterhemp and palmer amaranth.

Table 1. Description of relative application timing

•Planting dates:

Sacred Heart	*5-May*
Milan	*5-May*
Hector	*8-May*

•Application timing by location and dates

	GDD 200 GDD	Weed size first 2 inch	GDD 400 GDD	Weed size second 2 inch	Weed size third 2 inch
S. Heart	22-May	*31-May*	*31-May*	*17-Jun*	*30-Jun*
Milan	*23-May*	*31-May*	*31-May*	*16-Jun*	*1-Jul*
Hector	*2-Jun*	11-Jun	*11-Jun*	*25-Jun*	*8-Jul*

Results and Discussion:

Herbicide treatments will be discussed as conventional and glyphosate (Roundup PowerMax) treatments. Conventional treatments include non-glyphosate containing herbicides. Conventional products included dimethenamid (Outlook), ethofumesate (Nortron), desmedipham + phenmedipham+ethofumeste (Progress) , triflusulfuron (Upbeet) and clopyralid (Stinger). The conventional treatments will be referred by their chemical name or as a conventional treatment. Roundup treatments were applied with Roundup PowerMax which is a 4.5 lb. a.e. glyphosate containing herbicide. In this report weeds will be referred to as their regionally accepted name. The names of weeds evaluated are as follows, Abutilon theophrasti (velvetleaf), Polygonium bungeanum (prickly smartweed[waterweed]), Chenopodium album (lambsquarter), and Amaranthus species (redroot pigweed, smooth pigweed, tall waterhemp and palmer amaranth).

Milan, MN Location

Velvet leaf, water weed and Amaranthus species pressure was heavy in the testing area. Lambsquarter pressure was moderately heavy. Sugarbeet injury tended to be greater with conventional herbicides versus Roundup treatments. Upbeet herbicide was needed with the conventional herbicide treatment to achieve adequate velvetleaf control. Roundup treatments which were initiated at the 2 inch height stage of velvet leaf and applied twice at this timing gave significantly less velvet leaf control than when treatments were applied at the 2 inch height stage and then repeated at the 4 inch height stage of velvet leaf. The application at the 4 inch height stage of the velvet leaf was important in the early control of velvet leaf. Due to the early and rapid growth and continued emergence over time of velvet leaf an application at the 200 GDD and delaying the second application until an additional 400 GDD was achieved gave the best early season control. An important factor in the control of the velvet leaf at the early stage of growth was the timing of the second application, the multiple applications made thereafter or the delay in velvet leaf growth after the initial application. The later was observed when Outlook was applied with Roundup or Nortron was applied preemergence with conventional herbicides. Roundup treatment gave higher velvet leaf control in general or season long when an application was conducted at the canopy sugarbeet stage or multiple application of Roundup were conducted.

Conventional herbicide control of smartweed was higher at 14 DAT compared to 30 DAT. Smartweed control was greater when Roundup was applied at the 4 inch versus the 2 inch height of smartweed or 400 GDD versus 200 GDD. An application of Roundup at the 4 inch smartweed height whether as a single or as multiple applications was most efficient application stage. An application at the sugarbeet canopy stage or multiple applications at timely smartweed heights solidified the season long control of smartweed. Control of smartweed was significantly increased by Outlook when applied with Roundup at 200 GDD compared to roundup applied at 200 GDD without Outlook.

Conventional herbicide control of Amaranthus species was higher at 14 DAT compared to 30 DAT. Amaranthus species control 14 DAT with Roundup applied two times at 200 GDD or two times at the 2 inch Amaranthus species height was significantly

less than when 4 inch height stage of Amaranthus species or 400 GDD applications were made in the spray program.

Roundup applied at the sugarbeet canopy stage solidified long season control of Amaranthus species. Multiple application of Roundup at various Amaranthus species heights gave good control at 14 DAT and 30 DAT. Application of Roundup multiple times during sugarbeet growing season or at taller weeds heights up to 6 inches gave long season control.

Conventional herbicides gave very good control of lambsquarter at 14 DAT but were significantly lower at 30 DAT. All treatments containing Roundup gave very good control 14 DAT. The only Roundup treatment that gave significantly lower lambsquarter control at 30 DAT compared to 14 DAT was a treatment that did not include an application at sugarbeet canopy stage.

Sugarbeet production (table 7) was maximized when Roundup was applied at timings of 200 GDD and 400 GDD and sugarbeet canopy. The greatest treatment advantage occurred with tons per acre. The change in extractable sugar per acre and revenue per acre was primarily due to the difference in tons per acre for each treatment. Treatment giving poor control early in the sugarbeet growth also gave lower sugarbeet growth and revenue per acre.

Table 2. Herbicide program influence on sugarbeet injury

Exp # 0831

Milan, Mn

Trt #	Herbicide treatments	Rate oz/acre	appl. Criteria	Sugarbeet injury		
				14 DAT	30 DAT	average.
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	20	0	10
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD			
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	9	0	4
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD			
3	Nortron (pre)	120	Sbeet emergence	25	0	13
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD			
4	Nortron (pre)	120	Sbeet emergence	33	0	16
	Progress+Nortron	16+4	200 GDD			
	Progress+Nortron+Outlook	22+4+21	200 GDD			
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	4	0	2
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	20	0	10
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	13	0	6
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	9	0	5
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	4	0	2
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Nortron (pre)	120		6	0	3
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	4	0	2
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	0	0	0
	Roundup PowerMax+AMS	22+2%	canopy			
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	8	0	4
	Roundup PowerMax+AMS	22+2%	canopy			
14	Roundup PowerMax+AMS	22+2%	200 GDD	5	0	3
	Roundup PowerMax+AMS	22+2%	canopy			
15	Roundup PowerMax+AMS	22+2%	200 GDD	3	0	1
	Roundup PowerMax+AMS	22+2%	400 GDD			
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	1	0	1
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	4	0	2
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	4	0	2
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	6	0	3
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	9	0	4
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	8	0	4
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	13	0	6
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	5	0	3
			CV%	29	0	29
			LSD	5	0	3

Table 3. Herbicide program influence on velvetleaf control

Exp # 0831

Milan, Mn

Trt #	Herbicide treatments	Rate oz/acre	appl. Criteria	Velvet leaf control		
				14 DAT	30 DAT	average.
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	87	53	70
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD			
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	87	60	74
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD			
3	Nortron (pre)	120	Sbeet emergence	66	23	44
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD			
4	Nortron (pre)	120	Sbeet emergence	59	10	34
	Progress+Nortron	16+4	200 GDD			
	Progress+Nortron+Outlook	22+4+21	200 GDD			
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	50	99	75
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	24	99	61
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	2 inch weeds	64	99	81
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	66	99	83
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	49	99	74
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Nortron (pre)	120		91	99	95
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	90	99	94
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	93	99	96
	Roundup PowerMax+AMS	22+2%	canopy			
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	49	99	74
	Roundup PowerMax+AMS	22+2%	canopy			
14	Roundup PowerMax+AMS	22+2%	200 GDD	26	99	63
	Roundup PowerMax+AMS	22+2%	canopy			
15	Roundup PowerMax+AMS	22+2%	200 GDD	88	54	71
	Roundup PowerMax+AMS	22+2%	400 GDD			
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	89	99	94
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds			
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	88	97	92
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	97	99	98
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	86	99	92
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	93	99	96
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	86	96	91
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	95	99	97
			CV%	8	6	5
			LSD	6	5	4

Table 4. Herbicide program influence on smartweed control

Exp # 0831

Milan, Mn

Trt #	Herbicide treatments	Rate oz/acre	appl. Criteria	Smart weed control		
				14 DAT	30 DAT	average.
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	95	51	73
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD			
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	95	85	90
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD			
3	Nortron (pre)	120	Sbeet emergence	94	80	87
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD			
4	Nortron (pre)	120	Sbeet emergence	95	70	82
	Progress+Nortron	16+4	200 GDD			
	Progress+Nortron+Outlook	22+4+21	200 GDD			
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	83	97	90
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	45	98	72
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	87	99	93
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	85	99	92
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	91	99	95
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Roundup PowerMax+AMS	22+2%	4 inch weeds	97	99	98
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	93	99	96
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	canopy			
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	65	98	82
	Roundup PowerMax+AMS	22+2%	canopy			
14	Roundup PowerMax+AMS	22+2%	200 GDD	30	98	64
	Roundup PowerMax+AMS	22+2%	canopy			
15	Roundup PowerMax+AMS	22+2%	200 GDD	94	69	81
	Roundup PowerMax+AMS	22+2%	400 GDD			
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	96	99	98
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	97	99	98
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	91	91	91
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	95	99	97
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	91	99	95
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	94	99	96
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	93	94	93
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	97	97	97
			CV%	8	8	6
			LSD	7	7	6

Table 5. Herbicide program influence on amaranthus speciecis control

Exp # 0831

Milan, Mn

Trt #	Herbicide treatments	Rate oz/acre	appl. Criteria	Amaranrhus species control		
				14 DAT	30 DAT	average
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	90	41	65
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD			
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	93	75	84
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD			
3	Nortron (pre)	120	Sbeet emergence	99	88	94
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD			
4	Nortron (pre)	120	Sbeet emergence	99	73	86
	Progress+Nortron	16+4	200 GDD			
	Progress+Nortron+Outlook	22+4+21	200 GDD			
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	67	99	83
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	50	99	75
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	98	99	98
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	96	99	97
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	56	99	78
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Nortron (pre)	120		99	99	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	92	99	96
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	canopy			
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	56	99	78
	Roundup PowerMax+AMS	22+2%	canopy			
14	Roundup PowerMax+AMS	22+2%	200 GDD	36	99	68
	Roundup PowerMax+AMS	22+2%	canopy			
15	Roundup PowerMax+AMS	22+2%	200 GDD	92	69	81
	Roundup PowerMax+AMS	22+2%	400 GDD			
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	95	99	97
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	99	99	99
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	91	99	95
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	99	99	99
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	92	99	96
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	99	99	99
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	93	99	96
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	98	99	99
			CV%	8	7	6
			LSD	7	7	5

Table 6. Herbicide program influence on lambsquarters control

Exp # 0831

Milan, Mn

Trt #	Herbicide treatments	Rate oz/acre	appl. Criteria	Lambsquarters control		
				14 DAT	30 DAT	average.
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	98	58	78
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD			
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	98	79	88
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD			
3	Nortron (pre)	120	Sbeet emergence	99	91	95
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD			
4	Nortron (pre)	120	Sbeet emergence	99	87	93
	Progress+Nortron	16+4	200 GDD			
	Progress+Nortron+Outlook	22+4+21	200 GDD			
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	96	99	98
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	99	99	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	99	99	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Roundup PowerMax+AMS	22+2%	4 inch weeds	99	99	99
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	canopy			
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	canopy			
14	Roundup PowerMax+AMS	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	canopy			
15	Roundup PowerMax+AMS	22+2%	200 GDD	99	83	91
	Roundup PowerMax+AMS	22+2%	400 GDD			
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	99	99	99
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	99	99	99
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	99	99	99
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	99	99	99
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	99	99	99
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	99	99	99
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	99	99	99
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	99	99	99
			CV%	5	9	6
			LSD	1	5	3

Table 7. Herbicide program influence on sugarbeet production

Exp # 0831

Milan, Mn

Trt #	Herbicide treatments	Rate oz/acre	appl. Criteria	Tons per acre	Ext. Suc. per ton	Ext. Suc. per acre	Revenue per acre
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	19.2	238	4570	482.24
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD				
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	27.3	235	6413	664.73
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD				
3	Nortron (pre)	120	Sbeet emergence	25.9	235	6089	632.44
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD				
4	Nortron (pre)	120	Sbeet emergence	19.1	229	4362	439.16
	Progress+Nortron	16+4	200 GDD				
	Progress+Nortron+Outlook	22+4+21	200 GDD				
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	28.5	242	6888	738.55
	Roundup PowerMax+AMS	22+2%	canopy				
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	28.1	245	6894	749.53
	Roundup PowerMax+AMS	22+2%	canopy				
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	25.6	240	6137	650.73
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	27.9	237	6605	691.60
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	24.9	248	6165	676.50
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
10	Nortron (pre)	120		23.5	237	5578	585.71
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
11	Roundup PowerMax+AMS	22+2%	200 GDD	31.6	250	7900	874.92
	Roundup PowerMax+AMS	22+2%	400 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	24	248	5952	654.01
	Roundup PowerMax+AMS	22+2%	canopy				
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	23.8	247	5879	643.36
	Roundup PowerMax+AMS	22+2%	canopy				
14	Roundup PowerMax+AMS	22+2%	200 GDD	24.9	256	6374	722.29
	Roundup PowerMax+AMS	22+2%	canopy				
15	Roundup PowerMax+AMS	22+2%	200 GDD	24.6	251	6175	686.48
	Roundup PowerMax+AMS	22+2%	400 GDD				
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	25.9	245	6343	687.55
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	25.0	246	6150	670.33
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	24.8	237	5864	613.60
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	25.0	240	6000	638.37
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	26.3	243	6390	686.57
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	25.4	293	7441	941.66
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	28.4	238	6766	712.89
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	26.6	247	6580	720.60
			CV%	14	5	14	16
			LSD	3.4	11	865	106.60

Sacred Heart, MN Location

Sugarbeet injury was low regardless of the treatment at this location. Conventional herbicides either did or tended to give significantly higher sugarbeet injury than the Roundup treatments at 14 DAT. However, at 30 DAT the sugarbeet injury was statistically similar regardless of the herbicide treatment. Multiple applications of Roundup at various heights of lambsquarter, gave the highest lambsquarter control at 14 DAT. All Roundup treatments gave lambsquarter control of 90% percent or greater at 30 DAT, except when Roundup was applied two times when lambsquarter was 2 inches tall or at the 200 GDD timing and at the sugarbeet canopy stage. Outlook added to Roundup treatment applied two times when lambsquarter was 2 inches tall or at the 200 GDD timing significantly increased lambsquarter control. Outlook applied with Roundup or Nortron applied preemergence gave significantly greater lambsquarter control compare to similar treatments without Outlook or Nortron in the spray program.

Conventional herbicides gave 88% Amaranthus species control or greater at 14 DAT. Amaranthus species control lowered significantly when Nortron applied preemergence was not part of the spray program. Outlook applied postemergence with Roundup or Nortron applied preemergence to Roundup applications significantly increased control of Amaranthus species at 14 DAT.

Roundup applied multiple times to 4 or 6 inch tall Amaranthus species gave higher control than when Roundup was applied to Amaranthus species at 1 or 2 inch height. Later application increased control of Amaranthus species was probably due to emergence of Amaranthus species not emerged when the 1 and 2 inch height application were conducted. Application of Roundup at the sugarbeet canopy stage gave significantly greater Amaranthus control than when there was no sugarbeet canopy application.

Sugarbeet production was relative to weed control at the various evaluation timings. Outlook applied postemergence with Roundup increased weed control compared to similar treatments applied without Outlook. All roundup treatments with applications at the sugarbeet canopy gave high weed control and there was a low variability at 30 DAT, but tons per acre was variable between treatments and the variability related into variable revenue per acre.

Table 8. Herbicide program influence on sugarbeet injury
Exp # 0833
Sacred Heart, Mn

				Sugarbeet injury		
Trt #	**Herbicide treatments**	**Rate oz/acre**	**appl. Criteria**	14 DAT	30 DAT	average.
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	5	1	3.1
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD			
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	8	0	3.8
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD			
3	Nortron (pre)	120	Sbeet emergence	1	0	0.6
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD			
4	Nortron (pre)	120	Sbeet emergence	0	1	0.6
	Progress+Nortron	16+4	200 GDD			
	Progress+Nortron+Outlook	22+4+21	200 GDD			
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	0	1	0.6
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	0	0	0.0
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	0	1	0.6
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	0	3	1.3
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	0	2	0.9
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Nortron (pre)	120		0	0	0.0
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	0	3	1.5
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	0	0	0.0
	Roundup PowerMax+AMS	22+2%	canopy			
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	0	1	0.6
	Roundup PowerMax+AMS	22+2%	canopy			
14	Roundup PowerMax+AMS	22+2%	200 GDD	0	3	1.3
	Roundup PowerMax+AMS	22+2%	canopy			
15	Roundup PowerMax+AMS	22+2%	200 GDD	0	1	0.6
	Roundup PowerMax+AMS	22+2%	400 GDD			
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	0	3	1.3
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	0	0	0.0
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	0	2	0.9
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	0	1	0.6
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	0	3	1.3
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	0	3	1.3
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	0	0	0.0
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	0	3	1.3
			C.V. %	31	19	15
			LSD	3	4	2

Table 9. Herbicide program influence on lambsquarters control
Exp # 0833
Sacred Heart, Mn

				Lambsquarter control		
Trt #	**Herbicide treatments**	**Rate oz/acre**	**appl. Criteria**	14 DAT	30 DAT	average.
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	95	86	90
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD			
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	98	69	84
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD			
3	Nortron (pre)	120	Sbeet emergence	85	82	83
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD			
4	Nortron (pre)	120	Sbeet emergence	89	84	87
	Progress+Nortron	16+4	200 GDD			
	Progress+Nortron+Outlook	22+4+21	200 GDD			
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	92	79	86
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	91	94	93
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	95	99	97
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	98	98	98
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	94	99	96
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Nortron (pre)	120		97	98	97
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	87	98	92
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	85	98	92
	Roundup PowerMax+AMS	22+2%	canopy			
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	88	98	93
	Roundup PowerMax+AMS	22+2%	canopy			
14	Roundup PowerMax+AMS	22+2%	200 GDD	83	98	90
	Roundup PowerMax+AMS	22+2%	canopy			
15	Roundup PowerMax+AMS	22+2%	200 GDD	98	91	94
	Roundup PowerMax+AMS	22+2%	400 GDD			
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	96	98	97
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	88	98	93
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	99	95	97
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	97	98	97
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	99	98	98
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	91	98	94
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	99	97	98
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	99	96	98
			C.V. %	5	12	7
			LSD	7	16	9

Table 10. Herbicide program influence on amaranthus speciecis control
Exp # 0833
Sacred Heart, Mn

				amaranthus species control		
Trt #	**Herbicide treatments**	**Rate oz/acre**	**appl. Criteria**	14 DAT	30 DAT	average.
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	89	68	78
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD			
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	95	62	78
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD			
3	Nortron (pre)	120	Sbeet emergence	88	92	90
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD			
4	Nortron (pre)	120	Sbeet emergence	96	95	95
	Progress+Nortron	16+4	200 GDD			
	Progress+Nortron+Outlook	22+4+21	200 GDD			
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	80	95	87
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	83	91	87
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	93	99	96
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	98	99	99
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	79	98	89
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Nortron (pre)	120		95	97	96
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	83	99	91
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	80	99	89
	Roundup PowerMax+AMS	22+2%	canopy			
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	76	98	87
	Roundup PowerMax+AMS	22+2%	canopy			
14	Roundup PowerMax+AMS	22+2%	200 GDD	59	98	78
	Roundup PowerMax+AMS	22+2%	canopy			
15	Roundup PowerMax+AMS	22+2%	200 GDD	87	77	82
	Roundup PowerMax+AMS	22+2%	400 GDD			
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	89	97	93
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	74	95	85
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	93	95	94
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	99	99	99
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	90	97	94
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	78	99	88
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	91	99	95
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	99	93	96
			C.V. %	7	7	5
			LSD	9	9	7

Table 11. Herbicide program influence on sugarbeet production

Exp # 0833

Sacred Heart, Mn

Trt #	Herbicide treatments	Rate oz/acre	appl. Criteria	Tons per acre	Ext. Suc. per ton	Ext. Suc. per acre	Revenue per acre
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	33.5	245	8209	890.53
	Progress+Upbeet+Stinger+MSO	11.5+0.125+1.3+1.5%:	200 GDD				
	Progress+Upbeet+Stinger+MSO	11.5+0.125+1.3+1.5%:	200 GDD				
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	39.6	216	8561	804.71
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD				
3	Nortron (pre)	120	Sbeet emergence	35.2	241	8491	907.41
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD				
4	Nortron (pre)	120	Sbeet emergence	27.5	203	5581	480.07
	Progress+Nortron	16+4	200 GDD				
	Progress+Nortron+Outlook	22+4+21	200 GDD				
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	37.9	252	9567	1069.90
	Roundup PowerMax+AMS	22+2%	canopy				
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	42.0	246	10305	1121.21
	Roundup PowerMax+AMS	22+2%	canopy				
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	47.1	245	11539	1253.43
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	46.1	246	11372	1242.15
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	39.0	243	9456	1015.84
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
10	Nortron (pre)	120		40.8	252	10264	1144.97
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
11	Roundup PowerMax+AMS	22+2%	200 GDD	39.4	243	9589	10.33.24
	Roundup PowerMax+AMS	22+2%	400 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	41.0	240	9856	1047.00
	Roundup PowerMax+AMS	22+2%	canopy				
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	44.5	225	9984	983.59
	Roundup PowerMax+AMS	22+2%	canopy				
14	Roundup PowerMax+AMS	22+2%	200 GDD	46.6	248	11549	12.66.91
	Roundup PowerMax+AMS	22+2%	canopy				
15	Roundup PowerMax+AMS	22+2%	200 GDD	36.3	202	7330	625.27
	Roundup PowerMax+AMS	22+2%	400 GDD				
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	35.7	248	8861	974.49
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	42.1	243	10242	1104.37
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	36.6	235	8605	891.76
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	41.8	242	10085	1078.89
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	32.5	251	8152	904.49
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	32.9	252	8287	923.74
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	42.3	246	10414	1135.28
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	37.8	241	9124	974.98
			C.V. %	7	9	12	14
			LSD	4.1	32	1525	206.71

Hector, MN Location:

Weed pressure at the Hector location was low to medium and weed control rating was reflective of that factor. Weed control was high regardless of the treatment. Most treatments gave very good revenue per acre. Outlook in the Roundup spray program applied twice at 200 GDD and at sugarbeet canopy gave higher sugarbeet revenue per acre than a similar treatment without Outlook in the spray program. The highest revenue was achieved with Roundup applied at 200 GDD, 400 GDD and sugarbeet canopy.

Table 12. Herbicide program influence on weed control in sugarbeet

Experiment 0835

Hector, Mn

Trt #	Herbicide treatments	Rate oz/acre	appl. Criteria	Lambs Quarters control	Amaranthus control	Yellow Foxtail control
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	71	62	27
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD			
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	99	64	26
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD			
3	Nortron (pre)	120	Sbeet emergence	99	95	85
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD			
4	Nortron (pre)	120	Sbeet emergence	99	80	85
	Progress+Nortron	16+4	200 GDD			
	Progress+Nortron+Outlook	22+4+21	200 GDD			
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	99	99	98
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	99	99	96
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	99	99	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	99	99	98
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	99	99	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Nortron (pre)	120		99	99	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	canopy			
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	canopy			
14	Roundup PowerMax+AMS	22+2%	200 GDD	99	98	99
	Roundup PowerMax+AMS	22+2%	canopy			
15	Roundup PowerMax+AMS	22+2%	200 GDD	99	71	49
	Roundup PowerMax+AMS	22+2%	400 GDD			
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	99	99	99
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	99	99	99
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	99	95	98
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	85	79	98
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	99	99	98
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	99	76	79
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	99	99	98
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	99	99	99
			C.V. %	2	10	5
			LSD	13	7	3

Table 13. Herbicide program influence on sugarbeet production
Experiment 0835
Hector, Mn

Trt #	Herbicide treatments	Rate oz/acre	appl. Criteria	TONS	Extractable Sucrose per ton	Extractable Sucrose per acre	Revenue per acre
1	Progress+Upbeet+Stinger+MSO	8.5+0.125+1.3+1.5%:	cotyledon weed	27.9	255	7109	802.14
	Progress+Upbeet+Stinger+MSO (2X)	11.5+0.125+1.3+1.5%:	200 GDD				
2	Progress+Upbeet+Stinger+Nortron+MSO	8.5+0.125+1.3+4+1.5%:	cotyledon weed	27.0	263	7126	827.34
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	11.5+0.125+1.3+4+1.5%:	200 GDD				
3	Nortron (pre)	120	Sbeet emergence	29.8	255	7600	859.28
	Progress+Upbeet+Stinger+Nortron+MSO (2X)	5.7+0.125+1.3+4+1.5%:	200 GDD				
4	Nortron (pre)	120	Sbeet emergence	24.8	254	6315	708.09
	Progress+Nortron	16+4	200 GDD				
	Progress+Nortron+Outlook	22+4+21	200 GDD				
5	Roundup PowerMax+AMS (2X)	22+2%	2 inch weeds	29.7	259	7695	881.35
	Roundup PowerMax+AMS	22+2%	canopy				
6	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	29.3	259	7592	868.91
	Roundup PowerMax+AMS	22+2%	canopy				
7	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	27.2	265	7216	843.08
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
8	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	31.8	260	8282	952.42
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
9	Roundup PowerMax+AMS	22+2%+	2 inch weeds	31.0	262	8147	943.95
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
10	Nortron (pre)	120		30.8	255	7854	886.76
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
11	Roundup PowerMax+AMS	22+2%	200 GDD	30.4	270	8206	973.40
	Roundup PowerMax+AMS	22+2%	400 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
12	Roundup PowerMax+AMS (2X)	22+2%	400 GDD	30.3	258	7823	893.19
	Roundup PowerMax+AMS	22+2%	canopy				
13	Roundup PowerMax+AMS (2X)	22+2%	200 GDD	28.8	269	7734	914.67
	Roundup PowerMax+AMS	22+2%	canopy				
14	Roundup PowerMax+AMS	22+2%	200 GDD	30.7	269	8249	976.13
	Roundup PowerMax+AMS	22+2%	canopy				
15	Roundup PowerMax+AMS	22+2%	200 GDD	30.6	260	7944	911.62
	Roundup PowerMax+AMS	22+2%	400 GDD				
16	Roundup PowerMax+AMS (3X)	22+2%	1 inch weeds	31.1	262	8152	942.48
17	Roundup PowerMax+AMS (3X)	22+2%	2 inch weeds	31.4	259	8142	931.97
18	Roundup PowerMax+AMS (2X)	22+2%	4 inch weeds	31.3	229	7178	724.81
19	Roundup PowerMax+AMS (2X)	22+2%	6 inch weeds	30.4	261	7962	919.44
20	Roundup PowerMax+AMS (3X)	32+2%	1 inch weeds	29.8	253	7541	845.77
21	Roundup PowerMax+AMS (3X)	32+2%	2 inch weeds	29.6	262	7767	899.15
22	Roundup PowerMax+AMS (2X)	32+2%	4 inch weeds	32.2	261	8411	969.55
23	Roundup PowerMax+AMS (2X)	32+2%	6 inch weeds	30.5	266	8130	954.46
			C.V. %	7	5	8	10
			LSD	0.8	845	129	129.09

General Observation:

Weed control and revenue per acre trended to be better when Roundup was applied at 200 GDD and 200 GDD and sugarbeet canopy or 200 GDD and 400 GDD and sugarbeet canopy. The addition of Outlook with Roundup applied postemergence or Nortron applied preemergence followed by Roundup postemergence generally significantly increased weed control and sugarbeet production. Further research will be conducted to evaluate weed control efficacy and crop influence of treatments in reference to criteria for timing of application.