

ROEHL*, STEVE R., MARK BREDEHOEFT, and JOHN FISCHER, Southern Minnesota BeetSugar Cooperative, P.O. Box 500, Renville, MN 56284. **Efficacy and economic viability of current and potential weed control options at Southern Minnesota Beet Sugar Cooperative.**

The Micro-rate herbicide program received a label in 1998 allowing low rates of Betamix, Betanex, or Progress specifically, to be applied with a methylated seed oil (MSO) adjuvant. Increases in sulfonylurea herbicide efficacy such as with Upbeet, to MSO adjuvants have been well documented. Thus, the label allowed for the tank mix of what has since been labeled the Micro-rate, (Betanex, Betamix, or Progress with Upbeet, Stinger, and MSO at 0.5 pt/A + 0.13 oz/A + 1.3 oz/A + 1.5% v/v, respectively).

Initially spray tank precipitation problems required grower consideration. In addition, there were instances where the Micro-rate program was not recommended at all. Nevertheless, Micro-rate use at Southern Minnesota Beet Sugar Cooperative (SMBSC) increased until it represented a majority of the herbicide-treated acres by 1999. In 2000 however, reports from SMBSC growers and through personal conversation with Alan Dexter - Extension Sugar Beet Weed Specialist, regarding his annual grower survey indicated that SMBSC growers were not satisfied with Micro-rate performance.

Some objectives of SMBSC weed control research in 1999 and 2000 have included investigation into. 1) Modifying currently registered herbicide programs in order to identify a most efficacious and cost effective program and 2) Investigating programs and products that are not currently registered but may become available; such that best management practices can be established in the event of the product becoming available for use in sugar beet.

An experiment was established in 1999 in an existing sugar beet field known to have an infestation of Tall Waterhemp (*Amaranthus tuberculatus*) near Comfrey, MN. All treatments were applied three times and included Betanex alone and combined with Dual II Magnum or Frontier herbicides as a lay-by in the first application and the Micro-rate with varying rates of Betanex. The application dates were May 21, June 2, and June 17. Treatments were replicated four times in a RCBD with herbicides being applied to the center four rows of six-row by 30 ft experimental units with a bicycle wheel-type sprayer delivering 8.5 gpa at 40 p.s.i. through 8001 nozzles. The experiment was not harvested, thus only herbicide efficacy and beet injury data is presented (Table 1).

Table 1. Influence of herbicide rate and combinations on postemergence weed control and sugar beet injury at Comfrey, MN.

Treatment	Rate/A	TW ^a	Gift	EBN	Inj.
		-----% control	-----	-----	- % -
Betamix (3X)	16oz/16oz/20oz	70	72	79	5
Betanex (3X)	16oz/16oz/20oz	77	69	86	9
Standard Micro-rate					
Betanex + Upbeet + Stinger + MSO	0.5 pt + 0.13 oz + 1.3 oz + 1.5% v/v	83	69	96	6
Micro-rate (3X)					
Betanex + Upbeet + Stinger + MSO	0.75 pt + 0.13 oz + 1.3 oz + 1.5% v/v	88	63	99	8
Micro-rate (3X)					3
Betanex + Upbeet + Stinger + MSO	1.0 pt + 0.13 oz + 1.3 oz + 1.5% v/v	99	61	99	
Betanex + Frontier/ Betanex (2X)	16 oz + 1 qt / 16 oz / 16 oz	99	78	99	13
Betanex + Dual II / Betanex (2X)	16 oz + 1 qt / 16 oz / 16 oz	99	77	99	16
LSD (0.05)		5	12	6	8

^a Abbreviations: TW, Tall Waterhemp; Gift, Giant Foxtail (*Setaria faberii*); EBN, Eastern Black Nightshade (*Solanum nigrum*)

In 2000 an experiment was conducted at Buffalo Lake and Gleuk, MN. Sugar beet were seeded into six 22"-row by 30 ft experimental units. The plot was arranged in a RCBD with four replicates. The treatments included the

Micro-rate alone and combined with Dual II Magnum or Frontier with varying Betamix rates and treatment timings within the Micro-rate treatments. Treatments were applied to the center four rows of the experimental units with a bicycle wheel type sprayer delivering 8.5 gpa at 40 p.s.i. through 8001 nozzles. The planting, application, and harvest dates along with the weed and sugar beet stages can be found in Table 2. Selected treatments, weed control, RSA, and herbicide program costs are listed in Table 3.

Table 2. Dates, sugar beet stage, and weed stages of herbicide applications in 2000.

Procedure	Buffalo Lake, MN			Gluek, MN		
	Date	Beet Stage	Weed Stage	Date	Beet Stage	Weed Stage
PPI Dual treatments	4/25	PPI	PPI	4/25	PPI	PPI
Planting Date	5/1	N/A	N/A	4/25	N/A	N/A
POST treatment # 1	5/11	Cotyledon	Cotyledon	5/9	Cotyledon	Cotyledon
POST treatment # 2	5/18	Ctyl - 2-lf	Cotyl - 2-lf	5/16	Ctyl - 2-lf	Cotyl - 2-lf
POST treatment # 3	5/25	2 to 4-leaf	Cotyl - 2-lf	5/23	2 to 4-leaf	Cotyl - 2-lf
POST treatment # 4	6/1	4-leaf	Cotyl - 4-lf	5/30	4-leaf	Cotyl - 4-lf
Hand harvest date	9/26	N/A	N/A	9/25	N/A	N/A

Table 3. Comparison of acetanilides PPI or lay-by or Betamix concentration in the Micro-rate to the Standard Micro-rate applied four times for weed control, RSA, and cost..

Treatment	Buffalo Lake, MN			Gluek, MN			Cost
	Amar sp. ^a	Colq	RSA	Amar sp.	Colq	RSA	
	- % control -	- lbs -	- lbs -	- % control -	- lbs -	- lbs -	
Standard Micro-rate (4X)	80	92	9221	75	83	7928	\$79.00
B'mix 8 oz/ 8oz/ 8 oz/ 8oz							
Micro-rate							
B'mix 12 oz/ 12 oz/ 12 oz	76	85	7348	78	76	7686	\$69.00
Micro-rate							
B'mix 8 oz/ 12 oz/ 16 oz	81	84	8188	76	76	8412	\$69.00
Micro-rate							
B'mix 8 oz/ 16 oz/ 24 oz	89	95	9530	76	75	8310	\$79.00
Dual 1 qt. PPI/							
Standard Micro-rate (3X)	88	91	8588	91	92	9383	\$80.00
Dual 1 qt. + Stand. Micro/							
Standard Micro-rate (2X)	74	80	9019	76	85	7048	\$80.00
Frontier 25 oz + St. Micro/							
Standard Micro-rate (2X)	81	86	9818	94	99	8582	\$71.00
LSD (0.05)	15	15	1720	20	22	1219	

^a Abbreviations: Amar sp., *Amaranthus* species; Colq, common lambsquarters (*Chenopodium album*); RSA, recoverable sugar per acre.

Results and Discussion:

Data collected from 1999 indicate that the standard Micro-rate (Betanex + Upbeet + Stinger + MSO at 0.5 pt/A + 0.13 oz/A + 1.3 oz/A + 1.5% v/v) provided greater TW and EBN control than Betanex alone at 16/ 16/ 20 oz/A

when each were applied three times, Table 1. When Betanex in the Micro-rate was increased to 12 oz/A in each of three applications, TW control increased compared to the standard Micro-rate applied three times. Further control of EBN could not be achieved because of the high level of control from the standard Micro-rate. TW control was further enhanced when Betanex in the Micro-rate was increased to 16 oz/A in each of three applications. When either Dual or Frontier were added to Betanex in the first application followed by two more applications of Betanex; control of TW and EBN were equal to the Micro-rate applied three times with Betanex at 16 oz/A. However, beet injury from Dual applied lay-by in the first of three applications of Betanex was greater than injury from the Micro-rate regardless of Betanex rate. Injury from Frontier applied as lay-by tended to be higher but was not significant.

Selected treatments from the Buffalo Lake and Gluek locations are listed in Table 3. Data from this experiment support data from Dexter, et.al. in previous Sugar beet Research and Extension Reports, which indicate that the Micro-rate program is most effective when it is initiated early and sprayed at least three times. SMBSC research data specifically found the Micro-rate most effective when initiated at the cotyledon weed stage and applied four times at a seven day interval (data not presented). Thus, the Micro-rate applied four times was used as a basis for comparison in the data below. At the Buffalo Lake location, Frontier at 25 oz/A as a lay-by in the first of three standard Micro-rate treatments tended to give weed control that provided for the greatest RSA. This treatment was followed by the Micro-rate applied three times with Betamix at 8, 16, and 24 oz/A, the standard Micro-rate applied four times, and Dual II Magnum at 1 qt/A as a lay-by in the first of three standard Micro-rate treatments, respectively. Each of these program's product costs were approximately \$80.00 except the Frontier lay-by program which cost \$71.00.

At Gluek, Dual II Magnum at 1qt/A applied PPI and followed with three standard Micro-rates tended to provide for the greatest RSA followed by Frontier at 25 oz/A as a lay by in the first of three standard Micro-rates, the Micro-rate applied three times with Betamix at 8, 12, and 16 oz/A, and the Micro-rate applied three times with Betamix at 8, 16, and 24 oz/A.

Conclusions:

- Increasing Betanex rate in the Micro-rate, increased tall waterhemp control over the standard Micro-rate with Betanex when each program was applied three times.
- Incremental increases of Betamix in the Micro-rate in each of these applications may provide equal weed control with similar product costs as the standard Micro-rate with Betamix applied four times.
- Dual used PPI followed by three standard Micro-rate applications or Frontier or Dual used as a lay-by in the first of three Micro-rate applications may have potential to provide equal weed control and RSA with similar or slightly lower product costs as the Micro-rate applied four times.

REFERENCES

- Dexter, A.G., Luecke, J.L. 1998. Special Survey on Micro-Rate, 1998. Sugarbeet Res. Ext. Rep. 29: 64-70.
- Dexter, A.G., Luecke, J.L., Bredehoeft, M.W. 1997. Micro Rates of Postemergence Herbicides, 1997. Sugarbeet Res. Ext. Rep. 28: 103-108.
- Dexter, A.G., Luecke, J.L., Bredehoeft, M.W. 1996. Micro Rates of Postemergence Herbicides in Sugarbeets. Sugarbeet Res. Ext. Rep. 27: 62-66.
- Warner, J.D., Dexter, A.G. 1995. Adjuvant Effect on Weed Control in Sugar Beet From Upbeet, and Upbeet Plus Other Adjuvants. Sugarbeet Res. Ext. Rep. 26: 77-82.