2017
RESEARCH REPORT

Southern Minnesota Beet Sugar Cooperative

Photo credit Clarke Alder-Amalgamated Sugar Company
Depth of root is 47 inches
Sugarbeet was planted on 4/12/17
Picture was taken on 6/21/17

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<u>2017 SMBSC Official Variety Trial Procedures</u>

Cody Groen – Production Agronomist

Four Official Variety Trial locations were planted in 2017. These trials were located near Murdock, Renville, Lake Lillian, and Hector. Trials were planted with a modified 12 row John Deere 7300 vacuum planter. Plots were four 22" rows wide by forty feet long. Each variety was replicated six times across each trial. The experimental design of the trials was a partially balanced lattice design. Emergence counts were taken approximately 28 days after planting, and five foot alleys were cut perpendicular to the rows. After the emergence counts were taken, plots were thinned to a uniform spacing of approximately 190 - 200 sugar beets per 100 foot of row, and all doubles were removed. Quadris was banded over the row at approximately the four to six leaf stage to suppress *Rhizoctonia* root and crown rot.

Weed control was accomplished by applying ethofumesate, Roundup Weathermax/Powermax, Dual Magnum, Stinger, Betamix, and Select Max at the appropriate rates and times. The weeds present at each site dictated the actual weed control products used at each site. All spraying operations were conducted by a tractor sprayer driving perpendicular to the rows down the tilled alleys. SMBSC Research Staff conducted all the spraying operation. Six, seven, or eight *Cercospora* leafspot fungicide applications were made at each Official Variety Trial sites.

In early September, approximately 2.5 feet was tilled under on each end of every plot to eliminate the border effect that develops on the outside of the plots near the tilled alleys. Row lengths are taken on each harvest row to calculate yield at harvest. All plots were defoliated using a 4-row defoliator. The center two rows of each plot were harvested using a 2-row research harvester. All beets harvested from the center two rows were weighed on a scale on the harvester and a sample of beets was taken for quality analysis.

All varieties were entered into various disease nurseries to evaluate the disease tolerance of the varieties. *Cercospora* leafspot nurseries were conducted by SMBSC at a location near Renville and at a Betaseed location near Rosemount, MN. *Aphanomyces* root rot nurseries were conducted at Betaseed's facility in Shakopee, MN and in the SMBSC *Aphanomyces* nursery near Renville. *Rhizoctonia* tolerance was tested at a SMBSC location near Renville as well as the BSDF *Rhizoctonia* nursery in Michigan.

All the data is summarized and merged with the 2015 and 2016 data to evaluate the varieties for approval. SMBSC Seed Policy sets out guidelines for minimum performance standards of the varieties. Varieties that meet all the approval criteria are approved for shareholders to plant their 2018 sugar beet crop.

2017 SMBSC Official Variety Trials Specifications

Trial Location	Cooperator	Entry Designation	Previous Crop	Starter Fertilizer	Planting Date	Disease	Harvest Date
Hector	G.E. Johnson Inc	Official Trial	Field Corn	No	5/11/17	Light to Moderate APH & RHC	10/11/2017-10/12/2017
Lake Lillian	Mike, Brad, and Jeff Schmoll	Official Trial	Soybeans	No	5/8/17	Light CLS	9/21/2017-9/22/2017
Renville	C&P Farms	Official Trial	Field Corn	Yes	5/6/17	Light CLS	9/28/2017-9/29/2017
Murdock	Kyle Petersen	Official Trial	Ensiled Field Corn	Yes	4/29/17	Moderate RHC & APH	10/18/2017-10/19/2017

Trials were sprayed with 1-3 applications of glyphosate. Ethofumesate at full rates was utilized across conventional trials and all of the Hector siteas well as Dual Magnum Lay-by. Hand weeding occurred for escapes. Quadris was band applied to all trials at approximately the 4-8 leaf beet stage for rhizoctonia suppression.
Six CLS fungicide applications were applied to Renville and Lake Lillian. Seven CLS fungicides were applied to Hector. Eight CLS fungicides were applied to Murdock, which inludes a replication of #7 (EBDC alone).

2017 Disease Nursery Trial Specifications

Disease	Cooperator	Location	Ratings Performed By	Use of Ratings in 2017 Variety Approval
Cercospora	Betaseed	Randolph	Betaseed	50% of 2017 CLS Rating
Cercospora	SMBSC	Renville	SMBSC Research Staff	50% of 2017 CLS Rating
Aphanomyces	Betaseed	Shakopee	Betaseed, Mark Bloomquist Cody Groen, Ashok Chanda, Jason Brantner	50% of 2017 Aphanomyces Rating
Aphanomyces	SMBSC	Renville	SMBSC Research Staff	50% of 2017 Aphanomyces Rating
Rhizoctonia	BSDF - USDA/ARS Linda Hanson	Michigan	USDA/ARS	2017 Rhizoctonia Specialty Approval Status
Rhizoctonia	SMBSC	Renville	SMBSC Research Staff	2017 Rhizoctonia Specialty Approval Status

Table 1. Comparison of 2018 Fully Approved Varieties to Test Market and Specialty Approved Varieties - Three Years of Data (2015-2017)

		Rec/T (lbs)		Rec/A (lbs)		Sugar %		Purity (%)		Yield (T/A)		Cercospora Leaf Spot**		Rhizoctonia Root Rating**		Aphanomyces Root Rating**		Emerge-ence (%)		Revenue per Ton*	Revenue per Acre*
	Specialty	3 yr avg	% of mean	3 yr avg	% of mean	3 yr avg	% of mean	3 yr avg	% of mean	3 yr avg	% of mean	3 yr avg	% of mean	3 yr avg	% of mean	3 yr avg	% of mean	3 yr avg	% of mean	% of mean	% of mean
2018 Fully Approved Varieties - Three Years of Data (% of Mean is of Approved Mean)																					
Beta 92RR30	APH	284.5	99.9	9117.8	94.3	16.4	99.7	92.6	100.2	31.9	94.1	4.2	96.5	4.7	100.0	3.3	81.0	70.7	100.1	99.8	93.9
Beta 9475	CLS	281.8	99.0	10074.3	104.2	16.3	98.9	92.6	100.2	35.6	105.3	3.9	88.7	4.4	93.6	4.7	113.6	71.0	100.4	98.0	103.2
Crystal M375		282.7	99.3	9649.9	99.8	16.4	99.7	92.1	99.7	34.0	100.5	4.7	107.7	5.0	106.4	4.8	116.6	70.1	99.1	98.5	99.0
Crystal M380		284.1	99.8	9400.4	97.2	16.4	99.5	92.6	100.2	33.0	97.4	4.7	106.3	4.6	97.9	3.4	82.5	69.1	97.7	99.5	96.9
Crystal M579		290.8	102.1	10118.6	104.6	16.8	102.3	92.2	99.8	34.8	102.7	4.4	100.8	4.8	102.1	4.4	106.3	72.6	102.7	104.2	107.0
Mean		**284.8**	**100.0**	**9672.2**	**100.0**	**16.5**	**100.0**	**92.4**	**100.0**	**33.9**	**100.0**	**4.4**	**100.0**	**4.7**	**100.0**	**4.1**	**100.0**	**70.7**	**100.0**	**100.0**	**100.0**
2018 Test Market Varieties for Limited Sales - Three Years of Data (% of mean is of Approved Mean)																					
SV RR958		274.4	96.3	9473.7	97.9	15.9	96.6	92.4	100.0	34.5	101.7	4.4	101.6	4.3	91.5	4.8	115.7	71.3	100.9	92.8	94.5
2018 Specialty Approved Varieties - Three Years of Data (% of mean is of Approved Mean)																					
Beta 9505	CLS	271.3	95.3	9491.2	98.1	15.8	95.7	92.3	99.8	35.0	103.4	3.8	87.4	4.0	85.1	3.9	94.0	70.8	100.1	90.7	93.8
Crystal RR018	RHC	276.6	97.1	9387.2	97.1	16.1	98.0	91.8	99.4	33.8	100.0	4.2	97.1	3.7	78.7	4.7	113.5	73.1	103.4	94.3	94.3
Hilleshog 9093RR	RHC	262.7	92.3	8703.8	90.0	15.5	93.9	91.4	98.9	33.2	97.9	4.4	99.5	3.3	70.2	4.8	116.2	69.0	97.6	84.6	82.8
Hilleshog 9739	RHC	270.9	95.1	8655.5	89.5	15.7	95.5	92.3	99.9	31.8	93.9	4.0	92.6	3.7	78.7	5.0	121.3	66.6	94.2	90.4	84.9
Maribo MA109RR	RHC	282.2	99.1	9099.5	94.1	16.4	99.4	92.2	99.8	32.3	95.3	4.3	99.3	3.3	70.2	4.6	112.1	69.9	98.8	98.2	93.5

*Revenue per Ton and Revenue per Acre figures were produced using the payment calculation with factors released on Nov. 22, 2017 for the 1st 2017 crop payment estimate.

** Lower numbers are better for all disease nursery ratings.

Table 2. Comparison of 2018 Fully Approved Varieties to Test Market and Specialty Approved Varieties - Two Year Data (2016 & 2017)

		Rec/T (lbs)		Rec/A (lbs)		Sugar %		Purity (%)		Yield (T/A)		Cercospora Leaf Spot		Rhizoctonia Root Rating		Aphanomyces Root Rating		Emerge-ence (%)		Revenue per Ton*	Revenue per Acre*
	Specialty	2 yr avg	% of mean	2 yr avg	% of mean	2 yr avg	% of mean	2 yr avg	% of mean	2 yr avg	% of mean	2 yr avg	% of mean	2 yr avg	% of mean	2 yr avg	% of mean	2 yr avg	% of mean	% of mean	% of mean
2018 Fully Approved Varieties - Two Years of Data (% of Mean is of Approved Mean)																					
Beta 92RR30	APH	276.1	99.7	8352.0	91.5	16.0	99.5	92.6	100.1	30.1	91.7	4.4	99.0	4.6	96.6	3.5	82.9	68.4	99.3	99.3	91.0
Beta 9475	CLS	276.0	99.6	9611.2	105.3	15.9	99.4	92.6	100.2	34.7	105.6	3.9	88.2	4.4	92.4	4.8	114.7	71.8	104.1	99.2	104.8
Crystal M375		273.9	98.9	9208.6	100.9	15.9	99.3	92.2	99.7	33.5	102.0	4.7	107.5	5.1	107.1	4.8	114.1	68.5	99.5	97.6	99.5
Crystal M380		275.8	99.5	8793.0	96.3	15.9	99.3	92.7	100.3	31.8	96.8	4.8	108.2	4.8	100.8	3.5	82.9	66.0	95.8	99.1	95.8
Crystal M579		283.5	102.3	9675.2	106.0	16.4	102.5	92.2	99.7	34.1	103.9	4.3	97.0	4.9	102.9	4.4	105.4	69.9	101.4	104.8	108.8
Mean		**277.1**	**100.0**	**9128.0**	**100.0**	**16.0**	**100.0**	**92.5**	**100.0**	**32.8**	**100.0**	**4.4**	**100.0**	**4.8**	**100.0**	**4.2**	**100.0**	**68.9**	**100.0**	**100.0**	**100.0**
2018 Test Market Varieties for Limited Sales - Two Years of Data (% of mean is of Approved Mean)																					
Beta 9606		270.1	97.5	8844.3	96.9	15.7	97.9	92.2	99.8	32.7	99.6	4.1	93.0	3.3	69.3	4.2	100.4	67.7	98.3	95.0	94.6
Beta 9661		269.4	97.2	9202.7	100.8	15.6	97.2	92.6	100.1	34.1	103.9	4.5	102.1	3.9	81.9	3.8	90.0	68.3	99.1	94.3	97.9
Beta 9666		278.1	100.4	9705.0	106.3	16.2	101.3	91.8	99.3	35.0	106.4	4.0	91.5	5	105.0	4.4	106.5	70.4	102.2	100.9	107.3
Crystal M623		273.0	98.5	8975.1	98.3	15.8	98.5	92.5	100.1	32.8	99.8	4.1	92.9	3.3	69.3	4.6	109.5	68.7	99.7	96.9	96.7
SV RR863	CLS	273.5	98.7	9640.0	105.6	15.8	98.5	92.7	100.3	35.2	107.0	3.7	84.6	4.1	86.1	4.7	112.4	64.6	93.7	97.5	104.3
SV RR958		268.9	97.1	8971.4	98.3	15.6	97.1	92.5	100.1	33.3	101.3	4.6	103.2	4.2	88.2	4.9	118.3	68.5	99.4	94.0	95.2
2018 Specialty Approved Varieties - Two Years of Data (% of mean is of Approved Mean)																					
Beta 9505	CLS	264.6	95.5	8914.2	97.7	15.4	96.0	92.3	99.8	33.8	103.0	4.0	90.1	4	84.0	4.1	97.8	68.8	99.8	90.9	93.6
Crystal RR018	RHC	269.9	97.4	8876.6	97.2	15.8	98.2	92.0	99.5	32.7	99.7	4.3	97.9	3.5	73.5	5.0	119.5	70.7	102.5	94.8	94.4
Hilleshog 9093RR	RHC	255.9	92.4	8088.2	88.6	15.1	94.0	91.4	98.9	31.7	96.6	4.4	98.7	3.3	69.3	4.8	114.9	66.2	96.1	84.4	81.6
Hilleshog 9739	RHC	262.4	94.7	8012.8	87.8	15.3	95.4	92.2	99.7	30.5	92.7	4.1	92.0	3.8	79.8	5.0	120.2	63.6	92.2	89.4	82.8
Maribo MA109RR	RHC	275.1	99.3	8540.4	93.6	16.0	99.6	92.3	99.8	31.1	94.6	4.3	96.9	3.4	71.4	5.0	119.1	67.5	98.0	98.6	93.2
2018 Conventional Test Market Varieties for Limited Sales - Two Years of Data (% of mean is of Approved Mean)* **																					
Hilleshog 3035RZ		261.4	94.4	8852.2	97.0	15.2	94.8	92.4	99.9	33.8	103.0	-	-	-	-	-	-	72.8	105.6	94.8	97.6

*Revenue per Ton and Revenue per Acre figures were produced using the payment calculation with factors released on Nov. 22, 2017 for the 1st 2017 crop payment estimate.

** Lower numbers are better for all disease nursery ratings.

***Disease nursery data only available for one year.

Table 3. Comparison of 2018 Fully Approved Varieties to Test Market and Specialty Approved Varieties - 1 Year Data (2017)

		Rec/T (lbs)		Rec/A (lbs)		Sugar %		Purity (%)		Yield (T/A)		Cercospora Leaf Spot**		Rhizoctonia Root Rating**		Aphanomyces Root Rating**		Emerge-ence (%)		Revenue per Ton*	Revenue per Acre*
	Specialty	1 yr avg	% of mean	1 yr avg	% of mean	1 yr avg	% of mean	1 yr avg	% of mean	1 yr avg	% of mean	1 yr avg	% of mean	1 yr avg	% of mean	1 yr avg	% of mean	1 yr avg	% of mean	% of mean	% of mean
2018 Fully Approved Varieties - One Year of Data (% of Mean is of Approved Mean)																					
Beta 92RR30	APH	288.8	99.8	8748.1	88.5	16.5	99.4	93.5	100.3	30.2	91.7	4.5	103.6	4.6	95.8	3.5	82.8	72.3	98.4	99.6	87.9
Beta 9475	CLS	285.7	98.7	10199.9	103.1	16.4	98.9	93.1	99.9	35.7	105.6	3.7	84.9	4.2	87.5	4.5	106.4	76.9	104.6	97.4	101.6
Crystal M375		284.8	98.4	10093.7	102.1	16.4	98.9	92.8	99.6	35.6	102.0	4.6	105.8	5.5	114.6	5.1	120.8	72.6	98.8	96.8	100.6
Crystal M380		292.9	101.2	9896.8	100.1	16.7	100.7	93.5	100.4	34.0	96.8	4.9	112.4	4.9	102.1	3.5	83.4	72.7	98.9	102.4	101.6
Crystal M579		295.2	102.0	10505.9	106.2	16.9	102.1	93.0	99.8	35.7	103.9	4.1	93.3	4.8	100.0	4.5	106.7	73.0	99.3	103.9	108.3
Mean		**289.5**	**100.0**	**9888.9**	**100.0**	**16.6**	**100.0**	**93.2**	**100.0**	**34.2**	**100.0**	**4.4**	**100.0**	**4.8**	**100.0**	**4.2**	**100.0**	**73.5**	**100.0**	**100.0**	**100.0**
2018 Test Market Varieties - One Year of Data (% of mean is of Approved Mean)																					
Beta 9606		284.3	98.2	9574.5	96.8	16.3	98.6	93.0	99.8	33.8	98.7	3.9	88.6	3.0	62.5	4.4	104.6	72.9	99.2	96.7	95.4
Beta 9661		282.0	97.4	9856.5	99.7	16.1	97.4	93.3	100.1	35.1	102.4	4.4	100.0	3.6	75.0	4.1	96.7	71.3	97.0	94.9	97.2
Beta 9666		291.6	100.8	10568.2	106.9	16.8	101.4	92.7	99.5	36.4	106.4	3.9	88.6	4.9	102.1	4.6	109.7	77.1	104.9	101.6	108.2
Crystal M623		290.3	100.3	9806.3	99.2	16.6	99.9	93.5	100.3	33.9	98.9	4.0	90.9	3.2	66.7	4.8	114.8	73.4	99.8	100.4	99.3
SV RR863	CLS	285.1	98.5	10784.6	109.1	16.3	98.2	93.5	100.4	37.9	110.8	3.7	84.1	3.8	79.2	4.8	115.1	69.2	94.1	97.0	107.5
SV RR958		284.7	98.3	9707.0	98.2	16.3	98.3	93.3	100.2	34.1	99.6	4.5	102.3	4.1	85.4	4.4	104.5	75.7	103.0	96.9	96.5
2018 Specialty Approved Varieties - One Year of Data (% of mean is of Approved Mean)																					
Beta 9505	CLS	275.2	95.1	9446.8	95.5	15.9	95.8	92.8	99.6	34.7	101.3	3.9	88.6	3.5	72.9	4.1	97.6	73.3	99.7	90.5	91.7
Crystal RR018	RHC	284.7	98.3	9883.4	99.9	16.4	98.8	92.9	99.7	34.8	101.7	4.2	95.5	3.3	68.8	5.3	125.8	75.2	102.4	96.9	98.6
Hilleshog 9093RR	RHC	269.9	93.2	8673.8	87.7	15.7	94.8	92.1	98.8	32.4	94.7	4.4	100.0	3.3	68.8	4.8	114.1	70.6	96.1	86.7	82.1
Hilleshog 9739	RHC	272.2	94.0	8622.9	87.2	15.7	94.8	92.8	99.6	31.7	92.6	4.0	90.9	3.9	81.3	5.5	129.9	70.6	96.0	88.6	82.0
Maribo MA109RR	RHC	286.2	98.9	8991.0	90.9	16.5	99.4	92.8	99.6	31.5	92.0	4.4	100.0	3.1	64.6	5.3	125.5	73.7	100.3	97.8	90.0
2018 Conventional Test Market Varieties - One Year of Data (% of mean is of Approved Mean)																					
Hilleshog 3035RZ		273.5	94.5	9580.3	96.9	15.7	94.5	93.3	100.1	35.1	102.6	4.3	98.7	3.1	64.6	4.3	102.4	79.3	107.9	94.8	97.6

*Revenue per Ton and Revenue per Acre figures were produced using the payment calculation with factors released on Nov. 22, 2017 for the 1st 2017 crop payment estimate.

** Lower numbers are better for all disease nursery ratings.

** Lower Ratings mean more resistant to disease and are shown in green font.
**Higher Ratings mean more susceptible to disease and are shown in red font.

	Rhizoctonia Root Ratings					**Aphanomyces Root Ratings**					**Cercospora Leafspot Ratings**				
Variety Description	2017 Root Rating	2016 Root Rating	2015 Root Rating	**2016-2017 2 Year Mean** Root Rating	**2015-2017 3 Year Mean** Root Rating	2017 Root Rating	2016 Root Rating	2015 Root Rating	**2014-2015 2 Year Mean** Root Rating	**2015-2017 3 Year Mean** Root Rating	2017 CLS Rating	2016 CLS Rating	2015 CLS Rating	**2016-2017 2 Year Mean** Foliar Rating	**2015-2017 3 Year Mean** Foliar Rating
Fully Approved Varieties															
Beta 92RR30 (Aph)	4.6	4.6	4.8	4.6	4.7	3.5	3.4	3.1	3.4	3.3	4.5	4.2	3.9	4.4	4.2
Beta 9475 (CLS)	4.2	4.5	4.6	4.4	4.4	4.5	5.1	4.5	4.8	4.7	3.7	4.1	3.9	3.9	3.9
Crystal M579 (High Sugar)	4.8	5.0	4.6	4.9	4.8	4.5	4.3	4.4	4.4	4.4	4.1	4.5	4.7	4.3	4.4
Crystal M375	5.5	4.7	4.8	5.1	5.0	5.1	4.5	4.9	4.8	4.8	4.6	4.9	4.7	4.8	4.7
Crystal M380	4.9	4.7	4.1	4.8	4.6	3.5	3.4	3.3	3.5	3.4	4.9	4.6	4.4	4.7	4.6
Test Market Varieties															
Beta 9606	3.0	3.6		3.3		4.4	4.0		4.2		3.9	4.3		4.1	
Beta 9661	3.6	4.2		3.9		4.1	3.5		3.8		4.4	4.6		4.5	
Beta 9666 (High Sugar)	4.9	5.1		5.0		4.6	4.3		4.5		3.9	4.2		4.0	
Crystal M623	3.2	3.4		3.3		4.8	4.3		4.6		4.0	4.2		4.1	
SV RR958	4.1	4.4	4.3	4.2	4.3	4.4	5.5	4.5	4.9	4.8	4.5	4.6	4.2	4.5	4.4
SV RR863 (CLS)	3.8	4.5		4.1		4.8	4.5		4.7		3.7	3.8		3.7	
Specialty Approved															
Crystal RR018 (RHC)	3.3	3.8	3.9	3.5	3.7	5.3	4.7	4.1	5.0	4.7	4.2	4.4	4.1	4.3	4.2
Hilleshog 9093RR (RHC)	3.3	3.3	3.3	3.3	3.3	4.8	4.8	4.8	4.8	4.8	4.4	4.3	4.4	4.3	4.4
Hilleshog 9739 (RHC)	3.9	3.8	3.5	3.8	3.7	5.5	4.6	5.0	5.0	5.0	4.0	4.1	4.0	4.1	4.0
Maribo MA109RR (RHC)	3.1	3.8	2.9	3.4	3.3	5.3	4.7	4.0	5.0	4.7	4.4	4.1	4.5	4.3	4.3
Beta 9505 (CLS)	3.5	4.5	4.1	4.0	4.0	4.1	4.1	3.5	4.1	3.9	3.9	4.1	3.5	4.0	3.8
Conventional Test Market															
Hilleshog 3035	3.1					4.3					4.3				

Rhizoctonia Ratings from SMBSC Nursery at Renville and BSDF Nursery in Michigan
Ratings are on scale of 1 - 7. (1 = Healthy, 7 = Dead)

Aphanomyces Ratings from SMBSC Nursery at Renville and Betaseed Nursery in Shakopee.
Ratings are on scale of 1 - 9. (1 = Healthy, 9 = Dead)

Cercospora Ratings from SMBSC Nursery in Renville and Betaseed Nursery near Randolph MN.
Ratings are on scale of 1-9. 1 = Clean leaves, 9 = Dead Leaves.

SMBSC Agricultural Staff Variety Strip Trial - Summary Analysis

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	189.5	16.9	92.0	31.6	9121.2	97.8%
Beta 9475	206.8	16.6	92.1	32.7	9378.6	100.2%
Beta 9505	195.9	16.1	91.9	34.3	9404.6	95.6%
Crystal M509 Kabina	206.0	16.0	91.9	38.2	10417.6	105.5%
Crystal M509 Systiva	200.4	15.9	91.7	35.4	9578.8	96.3%
Crystal M579	200.0	17.3	92.2	32.5	9729.5	108.4%
Hilleshog 9739	166.5	16.1	91.8	32.1	8860.6	91.3%
SV 863	167.8	16.3	92.3	36.0	10065.9	105.0%
Mean	191.6	16.4	92.0	34.1	9569.6	100.0
%CV	5.4	1.7	0.4	7.7	6.8	6.6
PR>F	<0.0001	<0.0001	0.1168	<0.0001	0.0004	<0.0001
LSD (0.05)	10.4	0.3	0.4	2.7	649.7	6.4
Reps	8	8	8	8	8	8

Combined data from 8 locations with each location considered a replicate.
Locations: Renville, Hector, Redwood, Danube, Belgrade, Murdock, Cosmos, Montevideo.
Revenue is calculated using the 2016 crop payment calculator, utilizing values released Oct. 17, 2017 for the 2016 crop final payment.

SMBSC Variety Strip Trial - Renville

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	188.8	17.1	92.3	29.3	295.8	8671.6	99.4%
Beta 9475	222.5	16.7	91.9	30.8	287.2	8849.7	98.5%
Beta 9505	187.5	16.4	91.6	30.8	280.8	8636.0	93.8%
Crystal M509 Kabina	218.8	16.1	91.9	34.9	275.7	9631.1	102.6%
Crystal M509 Systiva	202.5	15.9	91.7	34.1	270.7	9236.4	96.4%
Crystal M579	235.0	17.5	92.4	32.2	303.9	9770.5	114.8%
Hilleshog 9739	205.0	16.0	92.3	31.5	276.4	8705.9	93.0%
SV RR863	163.8	16.5	92.3	32.3	284.7	9201.7	101.5%
Average	203.0	16.5	92.0	32.0	284.4	9087.9	100.0%

Planted: May 14

Harvested: Sept 29

Agriculturalist: Cody Bakker

SMBSC Variety Strip Trial - Hector

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	190.0	17.4	92.4	27.9	301.5	8408.6	103.3%
Beta 9475	195.0	16.8	92.4	30.1	290.2	8730.2	103.4%
Beta 9505	191.7	15.5	91.8	27.6	265.4	7328.7	78.7%
Crystal M509 Kabina	197.5	16.6	92.6	33.7	287.9	9704.1	114.0%
Crystal M509 Systiva	183.8	15.5	91.9	30.4	265.1	8068.1	86.5%
Crystal M579	183.3	17.6	92.5	31.1	306.6	9544.0	119.1%
Hilleshog 9739	146.7	16.3	92.1	28.6	280.8	8034.5	92.0%
SV RR863	158.3	16.6	92.5	30.5	287.6	8784.3	103.1%
Average	180.8	16.5	92.3	30.0	285.6	8575.3	100.0%
Crystal M380*	195.0	16.4	91.7	25.4	279.9	7117.8	81.2%
SV 958*	198.3	16.2	92.2	29.3	279.4	8173.4	93.1%

Planted: April 25

Harvested: Oct. 26

Agriculturalist: Pete Caspers

*Variety not included in this strip trial average calculation, percent of mean is against the trial mean/average. Variety was not included in summary analysis of combined trials.

SMBSC Variety Strip Trial - Redwood

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	156.3	16.0	91.2	45.7	272.0	12441.8	99.0%
Beta 9475	166.3	16.7	92.0	39.9	287.7	11488.0	97.1%
Beta 9505	163.8	15.4	91.2	53.1	260.9	13860.9	105.0%
Crystal M509 Kabina	166.3	15.3	91.6	54.8	261.0	14299.7	108.3%
Crystal M509 Systiva	158.8	15.5	91.3	47.8	262.4	12545.7	95.7%
Crystal M579	156.3	17.0	91.8	45.7	291.9	13325.0	114.3%
Hilleshog 9739	118.8	16.3	92.0	34.9	280.6	9781.2	80.6%
SV RR863	146.3	15.4	91.0	51.0	260.1	13249.7	99.9%
Average	154.1	16.0	91.5	46.6	272.1	12624.0	100.0%
SV 958*	152.5	16.2	90.7	45.2	273.5	12366.2	99.0%

Planted: April 11
Harvested: Sept 29
Agriculturalist: Chris Dunsmore

*Variety not included in this strip trial average calculation, percent of mean is against the trial mean/average. Variety was not included in summary analysis of combined trials.

SMBSC Variety Strip Trial - Danube

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	176.0	15.8	92.0	33.5	271.1	9073.3	95.9%
Beta 9475	188.0	15.7	92.1	36.5	270.0	9848.3	103.6%
Beta 9505	178.0	15.4	92.5	34.9	264.8	9255.1	95.1%
Crystal M509 Kabina	186.3	15.3	92.6	40.8	263.2	10742.7	109.6%
Crystal M509 Systiva	174.4	15.3	92.1	38.4	262.3	10080.3	102.4%
Crystal M579	184.0	16.2	91.7	32.8	277.8	9097.8	98.8%
Hilleshog 9739	144.0	15.4	91.5	34.0	261.6	8889.8	90.0%
SV RR863	155.0	15.8	92.4	36.2	272.1	9849.6	104.5%
Average	173.2	15.6	92.1	35.9	267.9	9604.6	100.0%

Planted: April 17
Harvested: Sept 14
Agriculturalist: Chris Dunsmore

SMBSC Variety Strip Trial - Belgrade

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	223.8	18.0	91.7	26.1	309.8	8082.1	93.3%
Beta 9475	242.5	17.4	92.0	30.8	299.2	9217.2	103.1%
Beta 9505	243.8	17.3	91.7	29.5	297.5	8773.6	97.6%
Crystal M509 Kabina	248.8	16.9	91.1	35.8	286.4	10250.8	109.9%
Crystal M509 Systiva	256.3	17.1	91.7	30.6	293.3	8981.0	98.5%
Crystal M579	227.5	18.2	92.3	29.4	315.7	9293.1	109.0%
Hilleshog 9739	223.8	17.0	90.7	27.3	288.5	7870.2	85.0%
SV RR863	198.8	17.3	92.4	30.8	300.1	9235.8	103.6%
Average	233.1	17.4	91.7	30.0	298.8	8963.0	100.0%
SV 958*	237.5	17.1	92.1	34.9	295.3	10313.7	113.9%

Planted: April 23

Harvested: Oct 27

Agriculturalist: Jared Kelm

*Variety not included in this strip trial average calculation, percent of mean is against the trial mean/average. Variety was not included in summary analysis of combined trials.

SMBSC Variety Strip Trial - Murdock

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	221.3	17.1	92.6	21.8	296.0	6455.1	95.8%
Beta 9475	227.5	16.3	91.8	24.4	279.4	6827.5	95.6%
Beta 9505	212.5	16.4	91.7	26.9	280.6	8564.3	106.2%
Crystal M509 Kabina	223.8	15.9	92.2	26.5	273.8	7254.3	99.3%
Crystal M509 Systiva	218.8	16.1	91.8	25.6	274.9	7045.0	96.9%
Crystal M579	212.5	17.2	92.2	23.0	297.4	6831.5	101.9%
Hilleshog 9739	167.5	15.8	91.4	27.4	268.9	7377.2	98.9%
SV RR863	185.0	16.2	92.3	27.0	279.3	7534.3	105.4%
Average	208.6	16.4	92.0	25.3	281.3	7236.1	100.0%

Planted: April 24

Harvested: Sept 21

Agriculturalist: Bill Luepke

SMBSC Variety Strip Trial - Maynard

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 9505	206.3	17.5	90.9	30.5	297.6	9085.0	95.8%
Crystal M509 Kabina	207.5	16.9	91.8	33.6	290.4	9752.3	100.4%
Crystal M509 Systiva	213.8	17.0	91.6	32.6	290.3	9453.5	97.3%
Crystal M579	211.3	18.5	92.0	29.2	319.4	9329.6	104.7%
Hilleshog 9739	183.8	17.2	92.5	31.0	297.7	9223.6	97.3%
SV RR863	203.8	17.3	92.4	32.7	300.6	9827.5	104.6%
Average	205.4	17.4	91.9	31.6	299.3	9445.3	100.0%
Crystal 018*	211.3	18.3	92.1	32.7	317.7	10380.3	116.0%

Planted: May 9

Harvested: Oct 17

Agriculturalist: Austin Neubauer

*Trial was not included in the summary analysis because it lacked the full eight required entries to be treated as a replicate.

*Variety not included in this strip trial average calculation, percent of mean is against the trial mean/average. Variety was not included in summary analysis of combined trials.

SMBSC Variety Strip Trial - Cosmos

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	152.5	16.4	91.4	28.7	280.5	8063.6	90.9%
Beta 9475	175.0	16.3	92.0	32.3	280.0	9053.5	101.9%
Beta 9505	170.0	15.8	92.3	30.7	272.7	8364.2	91.4%
Crystal M509 Kabina	175.0	15.7	91.7	35.6	267.9	9541.4	102.2%
Crystal M509 Systiva	190.0	15.5	91.1	36.0	262.7	9464.8	99.0%
Crystal M579	178.8	17.1	91.8	32.0	294.4	9431.3	111.7%
Hilleshog 9739	147.5	15.6	92.2	31.3	267.9	8371.3	89.6%
SV RR863	147.5	16.3	93.0	35.0	283.4	9930.4	113.2%
Average	167.0	16.1	91.9	32.7	276.2	9027.6	100.0%

Planted: May 7

Harvested: Sept 29

Agriculturalist: Les Plumley

SMBSC Variety Strip Trial - Montevideo

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	207.5	17.2	92.2	39.6	297.0	11773.8	105.0%
Beta 9475	237.5	17.1	92.8	37.1	297.0	11014.2	98.2%
Beta 9505	220.0	16.2	92.7	40.7	281.7	11469.5	97.0%
Crystal M509 Kabina	231.3	16.1	91.5	43.2	275.5	11916.5	98.4%
Crystal M509 Systiva	218.8	16.3	92.3	39.8	281.6	11209.1	94.7%
Crystal M579	222.5	17.6	92.9	34.2	308.0	10542.6	97.2%
Hilleshog 9739	178.8	16.5	91.9	41.8	283.9	11854.6	101.0%
SV RR863	187.5	16.4	92.4	44.9	283.6	12741.7	108.5%
Average	213.0	16.7	92.3	40.2	288.5	11565.3	100.0%

Planted: April 24

Harvested: Oct. 23

Agriculturalist: Scott Thaden

SMBSC Variety Strip Trial - Benson

Variety	Stand Count 28 DAP Beets/100' row	Sugar %	Purity %	Tons / Acre	Extractable Sugar per Ton	Extractable Sugar per Acre	Percent of Mean Revenue per Acre
Beta 92RR30	216.3	16.5	92.6	26.9	285.9	7692.0	101.9%
Beta 9475	208.8	16.6	92.2	28.7	286.0	8212.6	108.8%
Beta 9505	206.3	15.4	92.2	27.2	264.9	7211.1	87.7%
Crystal M509 Kabina	211.3	15.6	92.4	31.1	268.8	8371.2	103.6%
Crystal M509 Systiva	218.8	14.8	92.4	29.6	253.5	7492.1	86.2%
Crystal M579	238.8	16.8	92.2	27.4	290.7	7959.1	107.2%
Hilleshog 9739	175.0	15.3	91.5	28.2	260.7	7341.7	87.6%
SV RR863	183.8	15.9	92.6	33.3	275.8	9183.1	117.0%
Average	207.3	15.9	92.3	29.0	273.3	7932.9	100.0%

Planted: April 25

Harvested: Oct 23

Agriculturalist: Scott Thaden

*Strip Trial was not machine harvested. Ten foot of row was harvested from 10 points across the strip trial for each variety and yields calculated. This trial was not included in summary analysis, due to harvest method.

ENTRY	LABEL	Entry Name	% SUGAR		ESP		RECOV. SUG/TON		TONS/ACRE		ESA		% PURITY		NITRATE		EMERGENCE	
			MEAN	PCT	MEAN	PCT	MEAN	PCT	MEAN	PCT	MEAN	PCT	MEAN	PCT	MEAN	PCT	MEAN	PCT
4	D	Beta 92RR30	16.71	102.0	14.73	103.0	294.47	103.0	21.74	66.9	6424.9	69.3	93.82	100.7	22.14	237.4	70.23	95.5
27	AA	Beta 9475	16.40	100.1	14.27	99.8	285.40	99.8	33.87	104.2	9708.6	104.7	92.91	99.7	6.59	70.7	80.50	109.4
28	AB	Beta 9505	15.96	97.5	13.93	97.4	278.65	97.4	31.68	97.4	8452.6	91.2	93.27	100.1	10.50	112.5	70.08	95.3
31	AE	Beta 9606	16.51	100.8	14.36	100.5	287.26	100.5	30.74	94.5	8777.8	94.7	92.88	99.7	6.47	69.4	73.22	99.5
25	Y	Beta 9661	16.41	100.2	14.44	101.0	288.73	101.0	31.45	96.7	9027.5	97.4	93.76	100.6	6.51	69.8	72.36	98.4
32	AF	Beta 9666	17.03	103.9	14.88	104.1	297.57	104.1	35.30	108.5	10322.4	111.3	93.09	99.9	9.01	96.5	77.57	105.5
49	AW	Beta 9742	16.87	103.0	14.75	103.2	295.00	103.2	32.23	99.1	9539.2	102.9	93.20	100.0	10.49	112.5	75.81	103.1
22	V	Beta 9748	16.21	98.9	14.12	98.7	282.30	98.7	32.49	99.9	9170.4	98.9	93.04	99.9	6.19	66.3	74.07	100.7
34	AH	Beta 9764	15.86	96.8	13.79	96.5	275.80	96.4	33.84	104.0	9321.8	100.5	93.02	99.8	25.17	269.9	78.19	106.3
44	AR	Beta 9776	16.05	98.0	13.95	97.6	279.02	97.6	33.42	102.8	9298.2	100.3	92.98	99.8	10.66	114.3	76.14	103.5
35	AI	Beta 9780	16.87	103.0	14.78	103.4	295.60	103.4	37.17	114.3	11000.7	118.6	93.33	100.2	7.15	76.7	76.04	103.4
26	Z	Beta 9788	17.11	104.5	14.99	104.9	299.87	104.9	32.81	100.9	9801.2	105.7	93.29	100.1	6.31	67.6	64.31	87.4
10	J	Beta 9796	16.64	101.6	14.57	101.9	291.44	101.9	35.89	110.3	10406.2	112.2	93.33	100.2	7.82	83.9	75.47	102.6
33	AG	Crystal M375	17.11	104.4	14.96	104.6	299.22	104.6	34.70	106.7	10384.2	112.0	93.14	100.0	7.99	85.7	74.58	101.4
23	W	Crystal M380	17.12	104.5	15.14	105.8	302.67	105.8	31.31	96.3	9373.8	101.1	93.98	100.9	7.67	82.3	74.86	101.8
30	AD	Crystal M509	15.85	96.7	13.84	96.8	276.72	96.8	37.84	116.3	10664.3	115.0	93.37	100.2	13.74	147.3	68.53	93.2
29	AC	Crystal M579	17.05	104.1	14.93	104.4	298.68	104.4	36.43	112.0	10868.3	117.2	93.25	100.1	8.16	87.5	69.70	94.8
6	F	Crystal M623	16.73	102.1	14.72	102.9	294.37	102.9	29.72	91.4	8812.5	95.0	93.68	100.5	7.83	83.9	73.75	100.3
3	C	Crystal M701	16.35	99.8	14.19	99.2	283.79	99.2	34.34	105.6	9797.9	105.7	92.75	99.6	8.35	89.5	79.33	107.9
41	AO	Crystal M715	16.20	98.9	14.25	99.6	284.91	99.6	31.42	96.6	8886.0	95.8	93.80	100.7	11.66	125.0	72.58	98.7
43	AQ	Crystal M729	16.10	98.3	14.05	98.2	280.94	98.2	34.75	106.8	9768.1	105.3	93.22	100.1	10.00	107.2	77.00	104.7
45	AS	Crystal M743	16.16	98.7	14.07	98.4	281.30	98.4	29.83	91.7	8406.8	90.7	93.01	99.8	5.84	62.6	74.16	100.8
20	T	Crystal M760	16.14	98.5	14.19	99.2	283.73	99.2	31.49	96.8	8635.6	93.1	93.77	100.6	7.27	78.0	74.95	101.9
46	AT	Crystal M783	16.42	100.3	14.28	99.9	285.66	99.9	28.18	86.7	8054.0	86.9	92.87	99.7	5.02	53.8	73.60	100.1
16	P	Crystal M787	16.69	101.9	14.61	102.2	292.13	102.2	36.74	112.9	10768.9	116.1	93.28	100.1	6.17	66.1	70.29	95.6
9	I	Crystal RR018	16.38	100.0	14.40	100.7	287.88	100.7	34.05	104.7	9788.9	105.6	93.67	100.5	15.33	164.4	73.43	99.8
8	H	Hilleshog 9093RR	16.07	98.1	13.90	97.2	277.92	97.2	29.14	89.6	8073.1	87.1	92.55	99.3	10.17	109.0	75.37	102.5
15	O	Hilleshog 9739	16.06	98.1	14.01	97.9	280.08	97.9	28.59	87.9	8029.9	86.6	93.17	100.0	8.33	89.3	72.43	98.5
1	A	Hilleshog 9904	15.32	93.5	13.11	91.7	262.22	91.7	36.51	112.2	9385.3	101.2	91.97	98.7	9.07	97.3	71.53	97.2
36	AJ	Hilleshog 9905	15.73	96.0	13.58	94.9	271.56	95.0	35.59	109.4	9701.3	104.6	92.53	99.3	13.34	143.0	77.31	105.1
7	G	Hilleshog 9906	16.49	100.7	14.03	98.1	280.56	98.1	26.92	82.8	7624.7	82.2	91.25	97.9	8.99	96.4	53.35	72.5
12	L	Hilleshog 9907	16.64	101.6	14.57	101.9	291.42	101.9	23.67	72.8	6786.2	73.2	93.37	100.2	6.83	73.2	69.17	94.0
37	AK	Maribo MA109	16.70	102.0	14.64	102.4	292.84	102.4	28.69	88.2	8396.2	90.5	93.44	100.3	7.84	84.0	76.46	103.9
5	E	Maribo MA703	16.30	99.5	14.00	97.9	280.10	97.9	29.16	89.7	8158.3	88.0	92.04	98.8	8.17	87.6	74.67	101.5
21	U	Maribo MA704	16.06	98.0	13.92	97.3	278.37	97.3	28.98	89.1	8054.2	86.9	92.72	99.5	5.17	55.4	70.34	95.6
11	K	Maribo MA705	16.79	102.5	14.68	102.7	293.59	102.7	31.50	96.9	9210.0	99.3	93.18	100.0	8.34	89.4	73.84	100.4
38	AL	Maribo MA706	16.53	100.9	14.58	101.9	291.52	101.9	28.91	88.9	8396.9	90.6	93.94	100.8	10.02	107.4	75.06	102.0
48	AV	SV RR862	16.30	99.5	14.32	100.1	286.37	100.1	37.71	115.9	10675.0	115.1	93.67	100.5	10.96	117.5	70.54	95.9
13	M	SV RR863	16.58	101.2	14.56	101.8	291.18	101.8	37.69	115.9	10935.3	117.9	93.55	100.4	5.18	55.5	72.39	98.4
40	AN	SV RR874	16.20	98.9	14.12	98.7	282.42	98.8	35.37	108.8	9988.4	107.7	93.11	99.9	9.18	98.4	65.97	89.7
39	AM	SV RR875	16.43	100.3	14.39	100.6	287.75	100.6	34.76	106.9	10104.9	109.0	93.39	100.2	7.34	78.7	80.87	109.9
14	N	SV RR876	16.60	101.3	14.65	102.5	293.01	102.5	35.60	109.5	10464.7	112.9	93.96	100.8	7.01	75.2	79.44	108.0
19	S	SV RR877	15.80	96.4	13.71	95.9	274.21	95.9	37.23	114.5	10164.4	109.6	92.91	99.7	11.84	126.9	76.05	103.4
47	AU	SV RR878	16.17	98.7	14.16	99.0	283.11	99.0	30.74	94.5	8664.3	93.4	93.44	100.3	3.95	42.3	72.21	98.2
2	B	SV RR958	16.32	99.6	14.38	100.5	287.47	100.5	32.17	98.9	9261.1	99.9	93.86	100.7	9.84	105.5	77.96	106.0
24	X	Baseline 5 Beta 95RR03	15.84	96.7	13.63	95.3	272.59	95.3	33.41	102.7	9152.5	98.7	92.27	99.0	12.82	137.4	74.44	101.2
42	AP	Baseline 6 Crytal RR265	16.11	98.3	14.09	98.5	281.75	98.5	34.17	105.1	9703.2	104.6	93.40	100.2	8.34	89.4	73.68	100.2
18	R	Baseline 7 Hilleshog 4017RR	16.45	100.4	14.27	99.8	285.47	99.8	31.30	96.2	8952.7	96.5	92.69	99.5	14.82	158.9	75.58	102.8
17	Q	Baseline 8 Hilleshog 9093RR	16.24	99.1	14.19	99.3	283.88	99.3	32.42	99.7	9025.3	97.3	93.30	100.1	9.49	101.7	74.66	101.5
		GRAND MEAN	16.38		14.30		285.97		32.52		9272.8		93.17		9.33		73.55	
		CV	2.32		3.02		3.02		10.74		11.1		1.03		92.32		8.80	
		LSD	0.36		0.41		8.24		3.35		995.5		0.92		8.22		6.44	
		MSE	0.15		0.19		74.61		12.29		1087278.6		0.93		74.24		45.59	
		SED	0.22		0.25		4.99		2.02		602.0		0.56		4.97		3.90	
		ALPHA	0.05		0.05		0.05		0.05		0.1		0.05		0.05		0.05	
		REPS	6.00		6.00		6.00		6.00		6.0		6.00		6.00		6.00	

ENTRY	LABEL	Entry Name	% SUGAR MEAN	% SUGAR PCT	ESP MEAN	ESP PCT	ECOV. SUG/TO MEAN	ECOV. SUG/TO PCT	TONS/ACRE MEAN	TONS/ACRE PCT	ESA MEAN	ESA PCT	% PURITY MEAN	% PURITY PCT	NITRATE MEAN	NITRATE PCT	EMERGENCE MEAN	EMERGENCE PCT
4	D	Beta 92RR30	15.51	100.8	13.33	101.0	266.84	101.1	34.63	92.6	9249.6	93.6	92.32	100.1	12.96	73.0	68.33	96.6
27	AA	Beta 9475	15.73	102.2	13.59	103.0	271.82	102.9	38.77	103.6	10548.8	106.8	92.63	100.5	13.44	75.7	73.10	103.3
28	AB	Beta 9505	15.12	98.3	12.91	97.8	258.41	97.9	36.85	98.5	9532.4	96.5	91.97	99.8	15.20	85.6	72.60	102.6
31	AE	Beta 9606	15.76	102.4	13.62	103.2	272.55	103.2	37.03	99.0	10107.2	102.3	92.85	100.7	29.75	167.5	70.47	99.6
25	Y	Beta 9661	15.43	100.3	13.33	101.0	266.31	100.9	37.40	100.0	9965.4	100.9	92.60	100.5	13.25	74.7	72.15	102.0
32	AF	Beta 9666	16.08	104.5	13.87	105.1	276.96	104.9	38.87	103.9	10754.9	108.9	92.35	100.2	16.83	94.8	74.05	104.7
49	AW	Beta 9742	15.35	99.8	13.12	99.4	262.19	99.3	37.62	100.6	9857.7	99.8	91.87	99.7	20.35	114.6	73.57	104.0
22	V	Beta 9748	14.98	97.4	12.85	97.4	257.15	97.4	36.33	97.1	9335.6	94.5	92.33	100.2	16.72	94.2	69.52	98.3
34	AH	Beta 9764	15.14	98.4	12.80	97.0	256.22	97.0	36.61	97.9	9370.6	94.8	91.37	99.1	17.81	100.3	74.28	105.0
44	AR	Beta 9776	15.03	97.6	13.02	98.7	260.39	98.6	41.67	111.4	10857.7	109.9	92.82	100.7	18.71	105.4	77.62	109.7
35	AI	Beta 9780	15.83	102.8	13.67	103.6	273.69	103.7	38.67	103.4	10570.2	107.0	92.68	100.5	11.88	66.9	71.43	101.0
26	Z	Beta 9788	16.22	105.4	13.95	105.7	279.30	105.8	36.38	97.2	10209.4	103.3	92.22	100.0	13.79	77.7	68.57	96.9
10	J	Beta 9796	15.73	102.2	13.58	102.9	271.75	102.9	38.71	103.5	10512.8	106.4	92.61	100.5	17.37	97.8	74.52	105.3
33	AG	Crystal M375	15.39	100.0	13.18	99.9	263.94	100.0	39.31	105.1	10378.4	105.0	92.23	100.1	19.52	110.0	71.92	101.7
23	W	Crystal M380	15.72	102.1	13.58	102.9	271.85	103.0	35.89	95.9	9742.5	98.6	92.76	100.6	17.14	96.5	69.77	98.6
30	AD	Crystal M509	14.83	96.4	12.75	96.6	254.44	96.4	41.14	110.0	10452.3	105.8	92.36	100.2	15.60	87.9	71.20	100.7
29	AC	Crystal M579	16.10	104.6	13.94	105.7	278.58	105.5	37.47	100.2	10421.0	105.5	92.60	100.5	15.20	85.6	71.42	101.0
6	F	Crystal M623	15.79	102.6	13.74	104.1	274.92	104.1	37.68	100.7	10369.1	105.0	93.08	101.0	16.39	92.3	75.97	107.4
3	C	Crystal M701	15.40	100.1	13.12	99.4	263.17	99.7	37.90	101.3	9982.2	101.0	91.87	99.7	17.09	96.2	76.40	108.0
41	AO	Crystal M715	15.18	98.6	13.11	99.3	262.30	99.3	39.13	104.6	10280.8	104.1	92.62	100.5	32.24	181.6	61.20	86.5
43	AQ	Crystal M729	15.03	97.7	12.86	97.4	257.11	97.4	37.03	99.0	9507.8	96.2	91.98	99.8	21.55	121.4	78.32	110.7
45	AS	Crystal M743	15.29	99.3	13.00	98.5	259.97	98.5	37.62	100.5	9785.0	99.0	91.75	99.5	17.23	97.0	74.53	105.4
20	T	Crystal M760	15.42	100.2	13.32	100.9	266.70	101.0	37.80	101.0	10103.8	102.3	92.78	100.7	12.84	72.3	71.43	101.0
46	AT	Crystal M783	15.47	100.6	13.37	101.3	267.67	101.4	37.19	99.4	9967.2	100.9	92.70	100.6	11.58	65.2	69.05	97.6
16	P	Crystal M787	15.51	100.8	13.35	101.2	267.04	101.1	40.67	108.7	10853.2	109.9	92.27	100.1	16.18	91.1	74.75	105.7
9	I	Crystal RR018	15.65	101.7	13.39	101.5	267.95	101.5	37.22	99.5	9965.9	100.9	92.05	99.9	20.69	116.5	75.48	106.7
8	H	Hilleshog 9093RR	14.80	96.1	12.49	94.6	249.69	94.6	36.78	98.3	9175.3	92.9	91.17	98.9	19.59	110.4	64.07	90.6
15	O	Hilleshog 9739	15.05	97.8	12.90	97.7	257.91	97.7	35.52	95.0	9189.3	93.0	92.22	100.0	12.13	68.3	69.28	97.9
1	A	Hilleshog 9904	15.03	97.7	12.74	96.5	255.34	96.7	38.91	104.0	9948.8	100.7	91.48	99.2	32.53	183.2	70.00	99.0
36	AJ	Hilleshog 9905	15.18	98.6	12.84	97.3	256.49	97.1	39.84	106.5	10229.9	103.5	91.06	98.8	24.42	137.5	72.38	102.3
7	G	Hilleshog 9906	15.47	100.5	13.05	98.9	261.03	98.9	34.64	92.6	9040.5	91.5	91.05	98.8	16.36	92.2	52.63	74.4
12	L	Hilleshog 9907	15.49	100.6	13.26	100.5	265.39	100.5	34.27	91.6	9094.6	92.1	92.07	99.9	29.10	163.9	63.82	90.2
37	AK	Maribo MA109	15.84	102.9	13.62	103.2	272.78	103.3	36.06	96.4	9831.6	99.5	92.35	100.2	12.79	72.0	74.77	105.7
5	E	Maribo MA703	15.45	100.4	13.16	99.7	263.20	99.7	33.33	89.1	8785.0	88.9	91.67	99.4	11.66	65.6	67.15	94.9
21	U	Maribo MA704	15.16	98.5	12.81	97.1	256.02	97.0	34.10	91.1	8715.5	88.2	91.00	98.7	13.38	75.4	65.70	92.9
11	K	Maribo MA705	15.58	101.2	13.34	101.1	267.08	101.2	36.70	98.1	9822.7	99.4	92.01	99.8	15.89	89.5	71.90	101.6
38	AL	Maribo MA706	15.44	100.4	13.22	100.2	264.31	100.1	35.16	94.0	9284.9	94.0	91.95	99.7	23.74	133.7	75.02	106.1
48	AV	SV RR862	15.31	99.5	13.14	99.5	262.69	99.5	38.59	103.2	10132.6	102.6	92.33	100.2	17.13	96.5	63.10	89.2
13	M	SV RR863	15.39	100.0	13.34	101.1	267.26	101.2	39.10	104.5	10439.3	105.7	93.10	101.0	14.07	79.3	68.33	96.6
40	AN	SV RR874	15.00	97.5	12.87	97.5	257.85	97.7	38.00	101.6	9807.5	99.3	92.43	100.3	20.38	114.8	61.20	86.5
39	AM	SV RR875	15.52	100.9	13.42	101.7	268.37	101.6	37.82	101.1	10143.1	102.7	92.68	100.5	13.96	78.6	72.38	102.3
14	N	SV RR876	15.44	100.3	13.36	101.2	267.43	101.3	39.89	106.6	10656.6	107.9	92.75	100.6	15.19	85.6	73.35	103.7
19	S	SV RR877	15.04	97.7	12.81	97.0	256.35	97.1	39.97	106.8	10253.7	103.8	91.75	99.5	23.61	133.0	72.13	102.0
47	AU	SV RR878	15.28	99.3	13.10	99.2	261.83	99.2	37.40	100.0	9774.2	98.9	92.18	100.0	15.57	87.7	69.05	97.6
2	B	SV RR958	15.60	101.3	13.56	102.8	271.31	102.8	37.86	101.2	10269.5	103.9	93.15	101.1	13.52	76.2	71.67	101.3
24	X	Baseline 5 Beta 95RR03	14.68	95.4	12.49	94.7	250.09	94.7	35.95	96.1	9002.6	91.1	91.85	99.6	16.37	92.2	71.67	101.3
42	AP	Baseline 6 Crytal RR265	14.93	97.0	12.64	95.8	252.79	95.7	36.84	98.5	9315.7	94.3	91.45	99.2	21.09	118.8	70.47	99.6
18	R	Baseline 7 Hilleshog 4017RR	15.70	102.0	13.48	102.2	270.29	102.4	34.56	92.4	9347.1	94.6	92.30	100.1	19.60	110.4	74.75	105.7
17	Q	Baseline 8 Hilleshog 9093RR	15.02	97.6	12.66	96.0	253.15	95.9	36.24	96.9	9167.2	92.8	91.11	98.8	16.56	93.3	69.53	98.3
	GRAND MEAN		15.39		13.20		264.04		37.41		9879.8		92.18		17.75		70.73	
	CV		2.11		2.86		2.84		3.77		4.7		0.91		37.94		9.13	
	LSD		0.32		0.37		7.40		1.39		464.2		0.80		6.67		6.16	
	MSE		0.11		0.15		60.21		2.12		236721.1		0.71		48.85		41.72	
	SED		0.20		0.23		4.48		0.84		280.9		0.49		4.04		3.73	
	ALPHA		0.05		0.05		0.05		0.05		0.05		0.05		0.05		0.05	
	REPS		6.00		6.00		6.00		6.00		6.0		6.00		6.00		6.00	

ENTRY	LABEL	Entry Name	% SUGAR MEAN	% SUGAR PCT	ESP MEAN	ESP PCT	ECOV. SUG/TON MEAN	ECOV. SUG/TON PCT	TONS/ACRE MEAN	TONS/ACRE PCT	ESA MEAN	ESA PCT	% PURITY MEAN	% PURITY PCT	NITRATE MEAN	NITRATE PCT	EMERGENCE MEAN	EMERGENCE PCT
4	D	Beta 92RR30	16.62	102.4	14.46	103.0	289.89	103.2	32.84	95.8	9711.3	100.8	93.02	100.5	16.86	85.5	71.25	104.7
27	AA	Beta 9475	16.46	101.4	14.28	101.7	285.83	101.8	34.28	100.0	9795.8	101.7	92.83	100.3	17.40	88.3	71.50	105.1
28	AB	Beta 9505	15.87	97.8	13.75	98.0	275.43	98.1	35.84	104.6	9875.8	102.5	92.92	100.4	18.21	92.4	70.40	103.4
31	AE	Beta 9606	16.42	101.2	14.28	101.7	285.29	101.6	33.36	97.3	9533.6	99.0	92.90	100.4	16.44	83.4	71.95	105.7
25	Y	Beta 9661	16.17	99.6	14.01	99.8	280.78	100.0	35.61	103.9	9992.4	103.8	92.92	100.4	16.82	85.3	64.56	94.9
32	AF	Beta 9666	16.89	104.1	14.69	104.6	293.34	104.5	35.85	104.6	10513.0	109.2	92.65	100.1	15.79	80.1	72.34	106.3
49	AW	Beta 9742	16.69	102.8	14.43	102.8	288.50	102.7	33.39	97.4	9633.5	100.0	92.40	99.8	20.90	106.0	68.93	101.3
22	V	Beta 9748	15.94	98.2	13.78	98.1	275.49	98.1	36.50	106.5	10051.7	104.4	92.70	100.1	16.48	83.6	75.75	111.3
34	AH	Beta 9764	16.24	100.1	13.96	99.4	279.12	99.4	34.77	101.5	9668.1	100.4	92.08	99.5	20.52	104.1	67.74	99.5
44	AR	Beta 9776	15.92	98.1	13.85	98.7	277.23	98.7	39.53	115.3	10951.6	113.7	93.12	100.6	24.59	124.7	77.83	114.4
35	AI	Beta 9780	16.63	102.5	14.50	103.3	289.99	103.3	36.18	105.6	10500.7	109.0	93.07	100.5	17.07	86.6	70.70	103.9
26	Z	Beta 9788	16.43	101.3	14.21	101.2	284.24	101.2	35.84	104.6	10201.8	105.9	92.55	100.0	19.09	96.8	66.59	97.8
10	J	Beta 9796	16.83	103.7	14.65	104.3	293.15	104.4	34.82	101.6	10207.4	106.0	92.87	100.3	12.95	65.7	62.90	92.4
33	AG	Crystal M375	16.60	102.3	14.53	103.5	291.06	103.7	35.76	104.3	10398.4	108.0	93.32	100.8	25.90	131.4	66.66	97.9
23	W	Crystal M380	16.85	103.8	14.77	105.2	295.24	105.1	35.93	104.8	10585.8	109.9	93.32	100.8	18.02	91.4	69.28	101.8
30	AD	Crystal M509	15.91	98.1	13.76	98.0	274.73	97.8	39.37	114.9	10821.4	112.4	92.52	99.9	16.03	81.3	66.06	97.1
29	AC	Crystal M579	16.90	104.1	14.75	105.0	294.59	104.9	34.64	101.1	10184.6	105.8	92.97	100.4	17.56	89.1	69.03	101.4
6	F	Crystal M623	16.39	101.0	14.25	101.5	284.85	101.4	32.88	95.9	9357.4	97.2	92.92	100.4	18.84	95.6	65.65	96.5
3	C	Crystal M701	16.67	102.7	14.48	103.1	289.75	103.2	32.90	96.0	9525.4	98.9	92.82	100.3	16.26	82.5	71.42	104.9
41	AO	Crystal M715	16.06	99.0	13.94	99.3	278.74	99.3	36.10	105.3	10113.8	105.0	92.87	100.3	26.01	132.0	64.77	95.2
43	AQ	Crystal M729	15.91	98.0	13.80	98.3	276.39	98.4	36.76	107.2	10157.7	105.5	93.08	100.6	19.18	97.3	73.38	107.8
45	AS	Crystal M743	16.31	100.5	14.18	101.0	283.45	100.9	35.81	104.5	10156.3	105.5	92.78	100.2	24.24	123.0	67.51	99.2
20	T	Crystal M760	16.22	99.9	14.07	100.2	281.14	100.1	35.66	104.0	9999.7	103.8	92.83	100.3	15.77	80.0	68.77	101.0
46	AT	Crystal M783	16.32	100.6	14.17	100.9	283.64	101.0	35.27	102.9	10026.5	104.1	93.03	100.5	17.35	88.0	63.64	93.5
16	P	Crystal M787	16.34	100.7	14.16	100.8	283.01	100.8	35.11	102.4	9939.0	103.2	92.53	100.0	15.62	79.3	68.84	101.1
9	I	Crystal RR018	16.44	101.3	14.29	101.8	285.26	101.6	33.19	96.8	9468.0	98.3	92.78	100.2	18.36	93.1	70.81	104.0
8	H	Hilleshog 9093RR	15.92	98.1	13.63	97.1	272.78	97.1	31.43	91.7	8525.0	88.5	91.92	99.3	22.74	115.4	71.86	105.6
15	O	Hilleshog 9739	15.79	97.3	13.64	97.2	272.19	96.9	31.34	91.4	8518.9	88.5	92.55	100.0	18.79	95.3	65.05	95.6
1	A	Hilleshog 9904	15.17	93.5	12.84	91.5	256.59	91.4	35.92	104.8	9202.3	95.6	91.18	98.5	26.28	133.3	64.36	94.6
36	AJ	Hilleshog 9905	15.68	96.6	13.42	95.6	268.38	95.6	34.93	101.9	9379.3	97.4	91.90	99.3	27.35	138.8	64.05	94.1
7	G	Hilleshog 9906	16.11	99.3	13.75	98.0	275.24	98.0	31.46	91.8	8661.2	89.9	91.68	99.0	19.42	98.5	56.81	83.5
12	L	Hilleshog 9907	16.32	100.6	14.13	100.6	282.54	100.6	28.05	81.8	7938.6	82.4	92.62	100.0	25.87	131.2	64.93	95.4
37	AK	Maribo MA109	16.79	103.5	14.58	103.8	291.63	103.9	28.92	84.4	8458.7	87.8	92.63	100.1	16.77	85.1	67.27	98.8
5	E	Maribo MA703	16.04	98.8	13.68	97.4	273.40	97.4	29.60	86.4	8119.4	84.3	91.45	98.8	16.93	85.9	63.60	93.5
21	U	Maribo MA704	15.88	97.9	13.54	96.4	270.78	96.4	28.34	82.7	7709.3	80.1	91.57	98.9	20.54	104.2	60.83	89.4
11	K	Maribo MA705	16.02	98.7	13.73	97.8	274.17	97.6	32.71	95.4	9012.7	93.6	91.75	99.1	25.22	127.9	68.03	100.0
38	AL	Maribo MA706	16.34	100.7	14.18	101.0	284.02	101.2	33.41	97.5	9484.4	98.5	92.67	100.1	20.66	104.8	70.28	103.3
48	AV	SV RR862	16.18	99.7	14.06	100.1	280.56	99.9	35.20	102.7	9862.1	102.4	92.85	100.3	20.45	103.8	63.34	93.1
13	M	SV RR863	16.33	100.7	14.30	101.8	286.02	101.9	38.07	111.1	10867.0	112.8	93.40	100.9	16.15	81.9	64.94	95.4
40	AN	SV RR874	16.39	101.0	14.16	100.8	282.83	100.7	35.32	103.0	9999.0	103.8	92.25	99.7	16.90	85.7	60.24	88.5
39	AM	SV RR875	16.34	100.7	14.13	100.7	282.39	100.6	35.17	102.6	9953.0	103.4	92.42	99.8	21.05	106.8	70.58	103.7
14	N	SV RR876	16.19	99.8	14.06	100.1	281.33	100.2	36.50	106.5	10251.8	106.5	92.78	100.2	24.20	122.8	72.54	106.6
19	S	SV RR877	15.65	96.4	13.41	95.5	268.09	95.5	36.13	105.4	9683.6	100.6	92.02	99.4	28.28	143.5	66.24	97.3
47	AU	SV RR878	15.92	98.1	13.81	98.4	276.67	98.5	34.83	101.6	9674.0	100.5	92.93	100.4	19.04	96.6	69.63	102.3
2	B	SV RR958	16.23	100.0	14.07	100.2	281.15	100.1	33.80	98.6	9483.3	98.5	92.77	100.2	17.61	89.3	72.46	106.5
24	X	Baseline 5 Beta 95RR03	15.79	97.3	13.57	96.7	272.46	97.0	33.93	99.0	9222.3	95.8	92.40	99.8	17.15	87.0	69.72	102.5
42	AP	Baseline 6 Crytal RR265	15.91	98.0	13.71	97.6	273.81	97.5	33.10	96.6	9072.0	94.2	92.27	99.7	18.18	92.2	70.53	103.6
18	R	Baseline 7 Hilleshog 4017RR	15.96	98.4	13.66	97.3	273.14	97.3	31.33	91.4	8548.1	88.8	91.80	99.2	26.12	132.5	70.36	103.4
17	Q	Baseline 8 Hilleshog 9093RR	16.11	99.3	13.95	99.3	278.22	99.1	31.89	93.0	8882.6	92.2	92.52	99.9	17.85	90.6	68.86	101.2
	GRAND MEAN		16.23		14.04		280.79		34.28		9630.2		92.57		19.71		68.06	
	CV		2.49		3.01		3.02		6.01		6.8		0.71		38.8		9.01	
	LSD		0.39		0.41		8.23		2.04		649.0		0.62		7.45		6.05	
	MSE		0.17		0.18		74.44		4.57		462670.3		0.43		61.01		40.18	
	SED		0.24		0.25		4.98		1.23		392.7		0.38		4.51		3.66	
	ALPHA		0.05		0.05		0.05		0.05		0.1		0.05		0.05		0.05	
	REPS		6.00		6.00		6.00		6.00		6.0		6.00		6.00		6.00	

ENTRY	LABEL	Entry Name	% SUGAR MEAN	% SUGAR PCT	ESP MEAN	ESP PCT	ECOV. SUG/TC MEAN	ECOV. SUG/TC PCT	TONS/ACRE MEAN	TONS/ACRE PCT	ESA MEAN	ESA PCT	% PURITY MEAN	% PURITY PCT	NITRATE MEAN	NITRATE PCT	EMERGENCE MEAN	EMERGENCE PCT
4	D	Beta 92RR30	17.06	102.5	15.19	104.3	304.01	104.3	31.68	92.2	9606.7	96.1	94.69	101.5	10.84	83.7	79.38	102.9
27	AA	Beta 9475	16.98	102.0	14.99	102.9	299.71	102.8	35.79	104.2	10746.5	107.5	93.88	100.6	9.39	72.5	82.38	106.7
28	AB	Beta 9505	16.56	99.4	14.41	98.9	288.13	98.9	34.40	100.2	9926.4	99.3	92.99	99.7	11.44	88.3	79.98	103.6
31	AE	Beta 9606	16.66	100.1	14.60	100.2	291.95	100.2	33.94	98.8	9879.5	98.8	93.41	100.1	21.51	166.1	75.95	98.4
25	Y	Beta 9661	16.56	99.5	14.56	99.9	292.19	100.3	35.77	104.2	10440.5	104.4	93.83	100.6	8.96	69.1	76.10	98.6
32	AF	Beta 9666	17.18	103.2	14.93	102.5	298.70	102.5	35.70	103.9	10682.4	106.8	92.77	99.4	16.94	130.8	84.28	109.2
49	AW	Beta 9742	16.85	101.2	14.54	99.8	290.50	99.7	36.40	106.0	10561.3	105.6	92.29	98.9	17.27	133.3	77.38	100.3
22	V	Beta 9748	16.70	100.3	14.72	101.0	294.85	101.2	32.84	95.6	9689.8	96.9	93.92	100.7	8.43	65.1	81.45	105.5
34	AH	Beta 9764	16.49	99.0	14.27	97.9	284.75	97.7	36.21	105.5	10273.6	102.7	92.35	99.0	14.50	111.9	86.43	112.0
44	AR	Beta 9776	16.46	98.9	14.32	98.3	286.86	98.4	37.76	110.0	10822.0	108.2	93.03	99.7	10.01	77.3	83.82	108.6
35	AI	Beta 9780	17.37	104.4	15.31	105.1	306.32	105.1	35.66	103.8	10927.4	109.3	93.83	100.6	11.07	85.4	79.03	102.4
26	Z	Beta 9788	17.15	103.0	15.05	103.3	301.05	103.3	33.19	96.6	9985.6	99.9	93.39	100.1	15.78	121.8	70.23	91.0
10	J	Beta 9796	17.23	103.5	15.20	104.3	303.73	104.2	37.42	109.0	11374.3	113.7	93.71	100.4	15.54	120.0	84.35	109.3
33	AG	Crystal M375	16.47	99.0	14.24	97.7	284.80	97.7	32.60	94.9	9213.7	92.1	92.52	99.2	12.93	99.8	77.37	100.3
23	W	Crystal M380	17.06	102.5	15.07	103.4	301.82	103.6	32.76	95.4	9885.2	98.8	94.04	100.8	9.69	74.8	76.92	99.7
30	AD	Crystal M509	16.57	99.5	14.58	100.1	291.96	100.2	36.61	106.6	10697.6	107.0	93.87	100.6	10.24	79.0	77.62	100.6
29	AC	Crystal M579	17.64	105.9	15.45	106.0	308.87	106.0	34.27	99.8	10549.6	105.5	93.21	99.9	6.57	50.7	81.65	105.8
6	F	Crystal M623	17.30	103.9	15.34	105.3	307.04	105.4	35.14	102.3	10686.2	106.9	94.11	100.9	12.70	98.0	78.10	101.2
3	C	Crystal M701	17.04	102.4	14.88	102.1	297.73	102.2	34.57	100.7	10289.0	102.9	93.01	99.7	15.62	120.6	78.82	102.1
41	AO	Crystal M715	16.41	98.6	14.53	99.7	290.83	99.8	36.75	107.0	10679.5	106.8	94.20	101.0	25.89	199.8	68.57	88.8
43	AQ	Crystal M729	16.28	97.8	14.20	97.5	283.51	97.3	36.14	105.2	10233.8	102.3	92.94	99.6	13.18	101.8	81.20	105.2
45	AS	Crystal M743	16.89	101.4	14.91	102.3	297.69	102.2	33.60	97.8	9987.3	99.9	93.78	100.5	9.98	77.1	77.37	100.3
20	T	Crystal M760	16.78	100.8	14.77	101.3	295.67	101.5	32.93	95.9	9738.4	97.4	93.76	100.5	11.61	89.6	81.18	105.2
46	AT	Crystal M783	16.84	101.2	14.81	101.6	296.52	101.8	35.54	103.5	10569.1	105.7	93.70	100.4	6.96	53.7	82.17	106.5
16	P	Crystal M787	16.70	100.3	14.76	101.3	295.74	101.5	36.95	107.6	10900.6	109.0	94.13	100.9	10.64	82.2	77.13	99.9
9	I	Crystal RR018	17.03	102.3	14.87	102.0	297.53	102.1	34.82	101.4	10310.9	103.1	93.07	99.7	22.58	174.3	81.18	105.2
8	H	Hilleshog 9093RR	16.10	96.7	13.94	95.7	279.19	95.8	32.28	94.0	8921.9	89.2	92.68	99.3	14.01	108.2	71.20	92.3
15	O	Hilleshog 9739	15.98	96.0	13.93	95.6	278.76	95.7	31.37	91.4	8753.3	87.5	93.33	100.0	7.65	59.0	75.48	97.8
1	A	Hilleshog 9904	16.11	96.7	13.91	95.4	277.98	95.4	31.54	91.8	8785.0	87.8	92.46	99.1	22.36	172.6	73.08	94.7
36	AJ	Hilleshog 9905	15.85	95.2	13.59	93.3	272.06	93.4	36.24	105.5	9504.7	95.0	92.10	98.7	16.99	131.2	80.70	104.6
7	G	Hilleshog 9906	16.83	101.1	14.76	101.3	294.69	101.1	31.02	90.3	9131.2	91.3	93.26	99.9	6.34	49.0	60.22	78.0
12	L	Hilleshog 9907	16.96	101.9	14.93	102.4	298.60	102.5	34.21	99.6	10355.3	103.6	93.64	100.4	14.00	108.0	72.15	93.5
37	AK	Maribo MA109	16.57	99.5	14.36	98.6	287.40	98.6	32.29	94.0	9277.5	92.8	92.71	99.4	14.46	111.6	76.22	98.8
5	E	Maribo MA703	15.79	94.8	13.36	91.7	266.75	91.5	27.95	81.4	7393.3	73.9	90.75	97.3	16.76	129.3	75.23	97.5
21	U	Maribo MA704	16.02	96.2	13.70	94.0	273.94	94.0	31.40	91.4	8621.9	86.2	91.74	98.3	12.36	95.4	69.75	90.4
11	K	Maribo MA705	16.50	99.1	14.35	98.5	286.51	98.3	30.17	87.8	8662.4	86.6	92.71	99.4	9.79	75.5	77.15	100.0
38	AL	Maribo MA706	16.64	100.0	14.59	100.1	291.27	100.0	32.43	94.5	9422.8	94.2	93.35	100.0	17.14	132.3	74.27	96.2
48	AV	SV RR862	16.91	101.6	14.91	102.3	298.78	102.5	37.07	108.0	11040.0	110.4	93.85	100.6	16.46	127.0	75.00	97.2
13	M	SV RR863	16.79	100.8	14.81	101.7	295.90	101.5	36.80	107.2	10896.6	109.0	93.95	100.7	5.32	41.1	70.97	92.0
40	AN	SV RR874	16.47	98.9	14.48	99.3	289.70	99.4	36.26	105.6	10477.9	104.8	93.71	100.4	13.37	103.2	69.28	89.8
39	AM	SV RR875	16.96	101.9	14.95	102.6	298.42	102.4	35.88	104.5	10732.2	107.3	93.70	100.4	8.16	63.0	80.42	104.2
14	N	SV RR876	16.30	97.9	14.16	97.2	283.77	97.4	39.26	114.3	11151.8	111.5	93.04	99.7	12.93	99.8	82.63	107.1
19	S	SV RR877	16.25	97.6	14.29	98.1	285.94	98.1	37.26	108.5	10642.8	106.4	94.01	100.7	15.73	121.4	74.85	97.0
47	AU	SV RR878	16.25	97.6	14.40	98.8	288.29	98.9	35.20	102.5	10167.1	101.7	94.43	101.2	8.21	63.4	76.90	99.6
2	B	SV RR958	17.00	102.1	14.93	102.5	298.76	102.5	32.58	94.9	9814.1	98.1	93.57	100.3	9.78	75.5	80.72	104.6
24	X	Baseline 5 Beta 95RR03	16.01	96.2	13.82	94.9	276.65	94.9	34.15	99.5	9596.3	96.0	92.43	99.1	13.68	105.6	76.92	99.7
42	AP	Baseline 6 Crytal RR265	16.57	99.5	14.66	100.6	292.82	100.5	33.52	97.6	9829.1	98.3	94.14	100.9	11.13	85.9	74.50	96.5
18	R	Baseline 7 Hilleshog 4017RR	16.38	98.4	14.27	98.0	285.94	98.1	31.07	90.5	8908.3	89.1	93.19	99.9	18.96	146.3	77.85	100.9
17	Q	Baseline 8 Hilleshog 9093RR	16.31	98.0	14.22	97.6	284.27	97.6	33.27	96.9	9269.4	92.7	92.98	99.6	8.91	68.8	75.98	98.5
	GRAND MEAN		16.65		14.57		291.41		34.34		10000.24		93.31		12.95		77.17	
	CV		2.92		3.54		3.56		7.57		7.7		0.92		61.76		6.69	
	LSD		0.49		0.51		10.31		2.58		760.9		0.83		7.78		4.92	
	MSE		0.26		0.29		116.81		7.34		635640.4		0.76		66.50		26.63	
	SED		0.29		0.31		6.24		1.56		460.3		0.50		4.71		2.98	
	ALPHA		0.05		0.05		0.05		0.05		0.1		0.05		0.05		0.05	
	REPS		6.00		6.00		6.00		6.00		6.0		6.00		6.00		6.00	

Date of Harvest Trials
Lake Lillian and Murdock, MN - 2017

Cody Groen

Introduction: Sugar beets are a biennial crop and will continue to increase in yield and sugar content during the first year of growth until the beets are harvested. This rate of growth and sugar accumulation can vary based on the environmental conditions present in any given year and the health of the sugar beet foliage.

Objectives: In 2011, SMBSC began to perform trials to measure the rate of growth of the sugar beets during the period from mid-August through early-October. These trials provided rate of growth data for each season for sugar content, tons per acre (TPA), purity, and extractable sugar per acre (ESA). The weekly harvest information could also be used to look at the SMBSC prepile premium and how effectively it compensates shareholders for early harvesting of a portion of their sugar beet crop.

Methods: Trials were established at 2-4 locations across the Cooperative each season since 2011. These trials were often conducted on the same locations as the SMBSC Official Variety Trials. In 2017, the two Date of Harvest Trials were conducted at a location near Murdock and at a location near Lake Lillian. Trial maintenance was performed similar to the nearby Official Variety Trial. Each week during the mid-August to early-October period approximately 180' of row was harvested from each trial location. Harvest was accomplished with a tractor mounted one-row defoliator and one-row sugar beet harvester. The beets harvested each week were placed in tare bags and brought to the SMBSC Tare Lab for weights and quality analysis. Sample analysis included tare, sugar content, purity, and brie nitrate. Row lengths were measured each week prior to harvest and these lengths were used to accurately calculate the area harvested. The calculated harvested area for each week was used to determine yield on a per acre basis.

Results and discussion: The first harvest date for the trial was August 24, 2017. Harvesting continued on a weekly basis until October 12, 2017. Despite difficult harvest conditions due to the frequent rains and wet soils, we were able to harvest during each of the weeks in that period.

The heavy rains that saturated the soil throughout the pre-pile period in 2017 (August through September) appeared to have detrimental effects on the sugarbeet crop when compared to long-term average rates of yield increases. Table 1 shows the average pounds extractable sugar per acre (ESA) increase per day for each of the past seven years, between mid-August to early-October. From 2011-2015, the daily average rate of increase in ESA was 94.9 pounds extractable sugar per acre per day. If the 2016 crop is included in this average, the value is drawn down to 86.7 lbs ESA per day by the poor production rate for 2016 of 45.7 pounds of extractable sugar per acre per day. While Cercospora infection lowered the 2016 crop to a rate less than 50% of the prior five years, the rate of increase of extractable sugar per acre for 2017 was 63% of the historic trend, with 60.0 pounds of extractable sugar per acre per day. Despite the low production rate, Figure 1 illustrates the upward trend in ESA by harvest date during the pre-pile period in the 2017 Date of Harvest Trials.

The trends of generally positive yield gain with lower than average rate of gains are seen in percent sugar increases per day and tons per acre increases per day as well. Table 2 shows that the yield increase for 2017 on percent sugar per day or per week was 74%, of the average percent sugar gain per day between 2011 and 2015. A more significant deviation from the historic average is seen when looking at tons per acre gain for the 2017 pre-pile period. Table 3 indicates that the 2017 increase in tons per acre was 51% of the long-term average.

A possible reason for this drastic reduction in growth rate of the 2017 crop could be the continuous rains that occurred in the last half of the summer and across the growing period. Saturated soil conditions could have resulted in the soil being a poor environment for root growth. While rainfall may be a contributing factor, it is less likely that temperature played a role in the growth rate reduction of 2017. Figure 3 depicts the 2017 Growing Degree Day (GDD) accumulation using the sugarbeet GDD model for calculating heat units. The sugarbeet GDD model accumulates GDD more quickly than the corn GDD model, and Figure 3 shows near normal heat units and appropriate accumulation for August to October 2017.

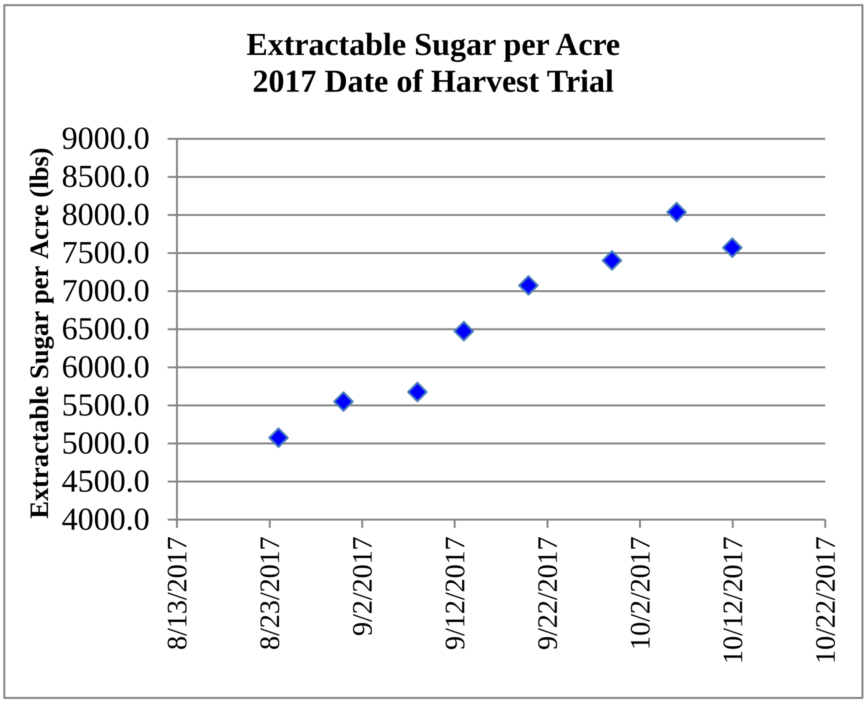

Figure 1. Extractable sugar per acre (ESA) data collected during the 2017 Date of Harvest trials, plotted across the harvest period. Gain was linear, though at a rate less than in prior years.

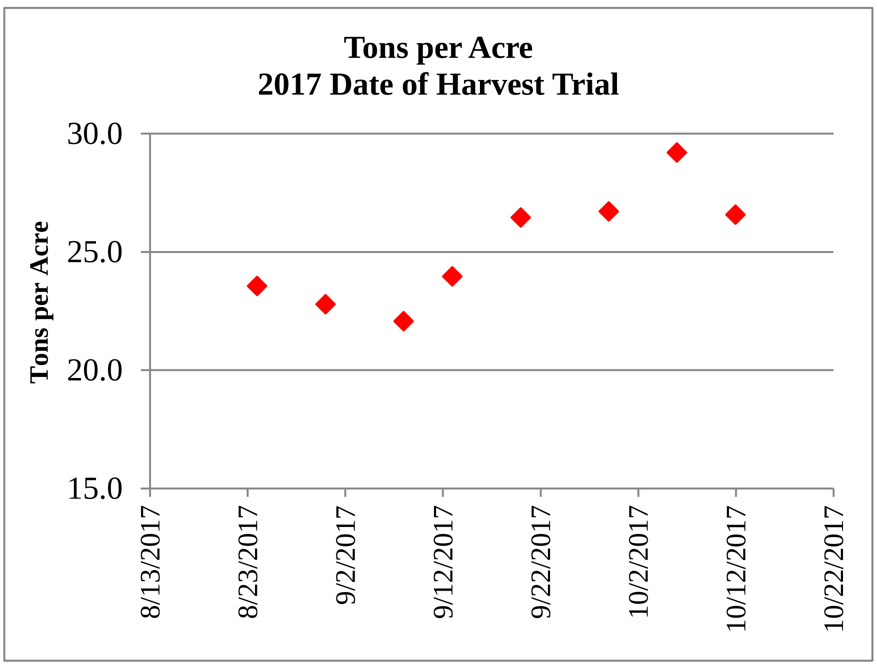

Figure 2. Tons per acre data collected during the 2017 Date of Harvest Trials, plotted across the harvest period, depicting a general positive trend. Rate of gain was substantially lower than in prior years.

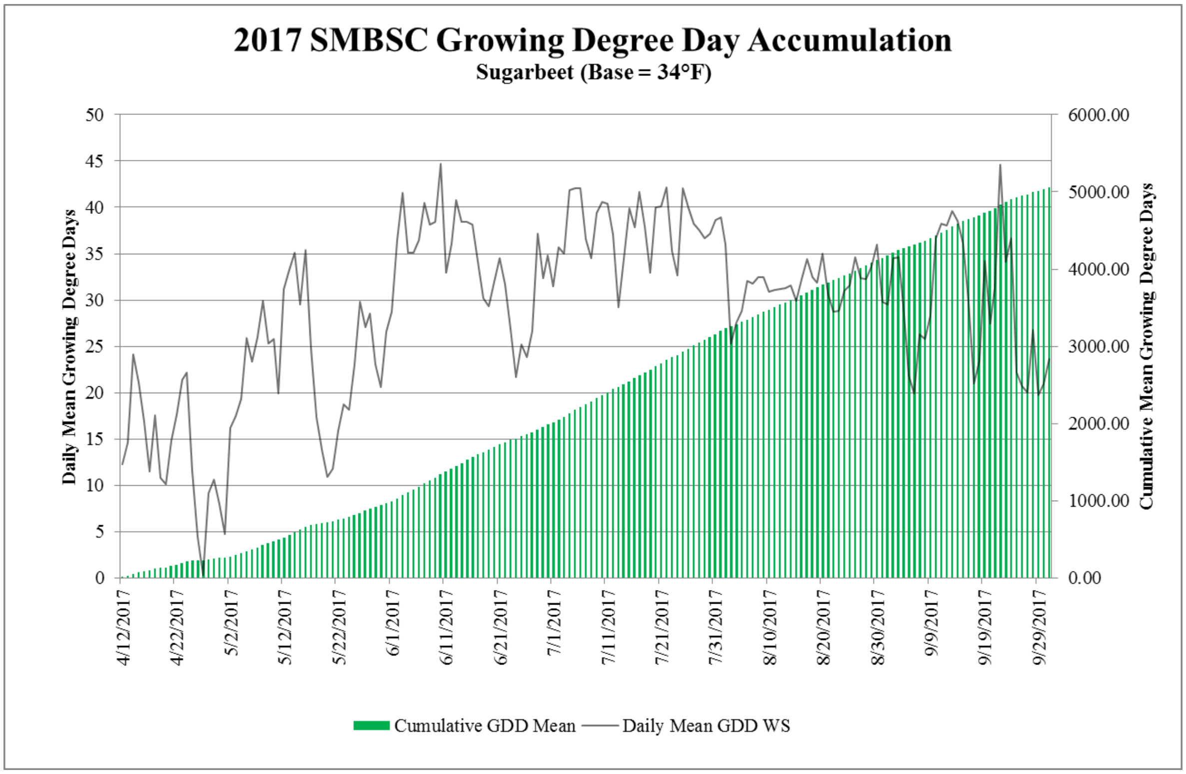

Figure 3. Accumulated Growing Degree Days (GDD) calculated using weather data from six SMBSC weather stations across the cooperative. Individual days are plotted as the black line according to the left axis, green bars show the total accumulated GDD for the growing season at given date.

Table 1.

2011-2017 Regression Analysis of Extractable Sugar per Acre Increase per Day

Year	Extractable Sugar per Acre Increase per Day (lbs.)
2011	100.73
2012	89.02
2013	91.62
2014	93.40
2015	99.77
2016	45.70
Average (2011-2015)	94.91
Average (2011-2016)	86.71
2017	60.04

Table 2.

2011-2017 Regression Analysis of Percent Sugar Increase per Day

Year	Percent Sugar Increase per Day (%)	Percent Sugar Increase per Week (%)
2011	0.10	0.68
2012	0.09	0.61
2013	0.05	0.38
2014	0.09	0.60
2015	0.06	0.44
2016	0.03	0.18
Average (2011-2015)	0.08	0.54
Average (2011-2016)	0.07	0.48
2017	0.06	0.40

Table 3.

2011-2017 Regression Analysis of Ton per Acre Increase per Day

Year	Ton per Acre Increase per Day (tons)	Ton per Acre Increase per Week (tons)
2011	0.25	1.74
2012	0.15	1.06
2013	0.29	2.01
2014	0.23	1.59
2015	0.24	1.67
2016	0.14	0.99
Average (2011-2015)	0.23	1.62
Average (2011-2016)	0.22	1.51
2017	0.12	0.82

Fall Cover Crop Establishment

David Mettler and Cody Groen

Introduction: Nurse/companion crops have been widely adopted in the SMBSC growing area to prevent wind erosion and damage to sugar beet seedlings in the spring. However, after harvest these fields are prone to wind erosion because of the small amount of residue and smooth surfaces left after harvest. Wind erosion in the late fall and winter have become a growing concern to growers losing their valuable, nutrient rich topsoil, but also to the rest of the community as concerns about water quality grow. The ability to establish a fall cover crop after sugar beets may help address this issue.

Objective: The objective of this study was to evaluate the effects of planting date and cover crop species on the ability to establish an acceptable ground cover over multiple years and to document other benefits such as nitrogen scavenging and retention. Establishing a cover crop in the fall is greatly dependent on environmental conditions. This makes the time of planting and species used for a fall cover crop important factors contributing to the successful establishment of a cover crop.

Fall Establishment Materials and Methods: This trial was conducted in collaboration with local growers on fields following sugar beet production. The small plot research was set up as a randomized complete block design with 4 replications of 10 treatments. These treatments consisted of three different cover crop species planted at three separate times in addition to an unplanted control. Cover crop species included winter wheat (90 lbs/acre), winter rye (100 lbs/acre), and an oat (50 lbs/acre) and oilseed radish (15 lbs/acre) mixture. These cover crop species were planted on September 12th, September 26th /22nd, and October 10th in 2016 and 2017. Treatments were planted in plots 11 feet wide and 30 feet long. Cover crop seed was broadcast by hand and incorporated using a small S-tine field cultivator. Visual ratings of percent cover were taken multiple times each fall, along with computer analysis of one square meter photographs to estimate the amount of green cover through the use of free, open-source software called “Easy Leaf Area” (ELA). Total above ground biomass was collected from a square meter for each plot and analyzed for nutrient content. Soil samples were also taken for each plot in the spring to evaluate nutrient uptake and retention in the top two feet of the soil profile. The 2017 fall seeded cover crop trial will be evaluated in the spring of 2018.

Fall Establishment Results: Visual ratings of percent ground cover were taken four times in the fall both years that this trial was conducted (Table 1.) There was a large difference in the amount of ground cover provided by the same cover crop species established at different times in the fall (Figure 1). While there was not much difference in the percent ground cover between the two September seeding dates, the late planting in October had very little growth. The amount of growth and the differences between the seeding dates varied depending on the environmental conditions of a given year. Warm temperatures in November resulted in more growth during the fall of 2016 compared to the same cover crop species and seeding date in 2017 when the temperatures were much cooler in November (Figure 2). These ratings also show some differences in the percent ground cover of the different cover crop species (Figure 3).

	Visual Rating of Percent Ground Cover							
Treatment	9/26/16	10/10/16	10/25/16	11/16/16	10/5/17	10/18/17	10/26/17	11/9/17
Control	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W. Rye Early	21.3	68.8	77.5	88.1	14.2	38.1	52.5	54.4
W. Wheat Early	10.6	58.8	69.4	77.5	8.3	17.5	36.3	35.6
Oat+Radish Early	6.9	66.3	79.4	93.1	16.7	45.0	55.0	56.3
W. Rye Mid	0.0	21.3	44.4	65.0	10.4	29.4	46.3	46.9
W. Wheat Mid	0.0	22.5	38.8	63.8	17.1	36.9	53.8	58.8
Oat+Radish Mid	0.0	17.5	43.1	79.4	13.4	40.6	57.5	58.1
W. Rye Late	0.0	0.0	5.6	35.6	0.0	0.0	5.5	4.4
W. Wheat Late	0.0	0.0	2.6	23.8	0.0	0.0	6.5	5.7
Oat+Radish Late	0.0	0.0	1.8	31.3	0.0	0.0	5.5	3.6
Mean	4.3	28.3	40.3	61.9	8.0	20.8	31.9	32.4
CV%	41.7	17.1	14.2	12.6	18.9	13.6	12.9	14.7
Pr>F	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
lsd (0.05)	2.6	7.1	8.3	11.4	2.2	4.1	6.0	6.9

Table 1. Visual ratings of percent ground cover were taken by mutiple people with an average of the individual ratings for all four reps of the experiment presented in this table. Data from both years presented independently in the above table.

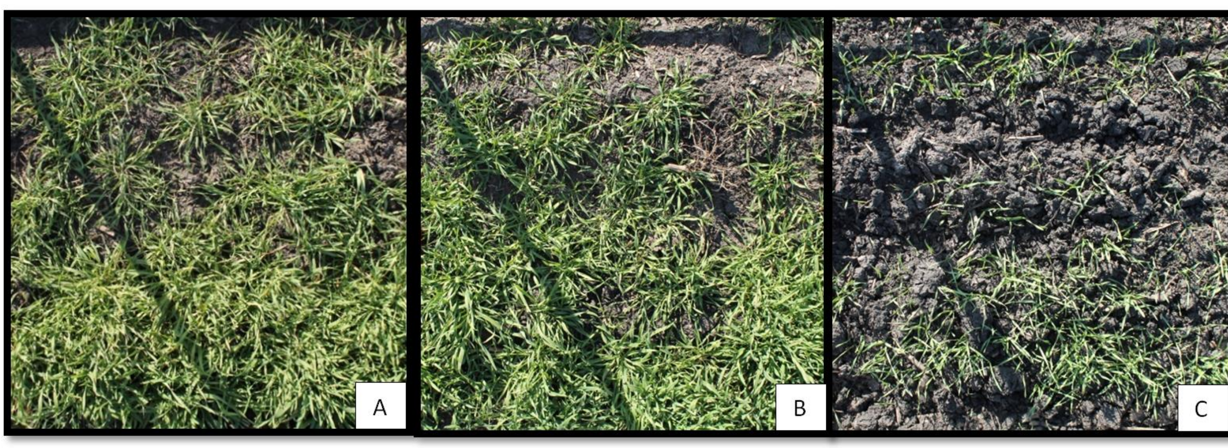

Fig. 1: Three planting times for winter rye seeded at 100 lbs/acre. A) September 12th B) September 26th and C) October 10th. Pictures were taken November 16th, 2016.

Fig. 2: Cover crop establishment will vary greatly depending on the environmental conditions of a given year. A) Oat & Oilseed Radish 2016, B) Oat & Oilseed Radish 2017.

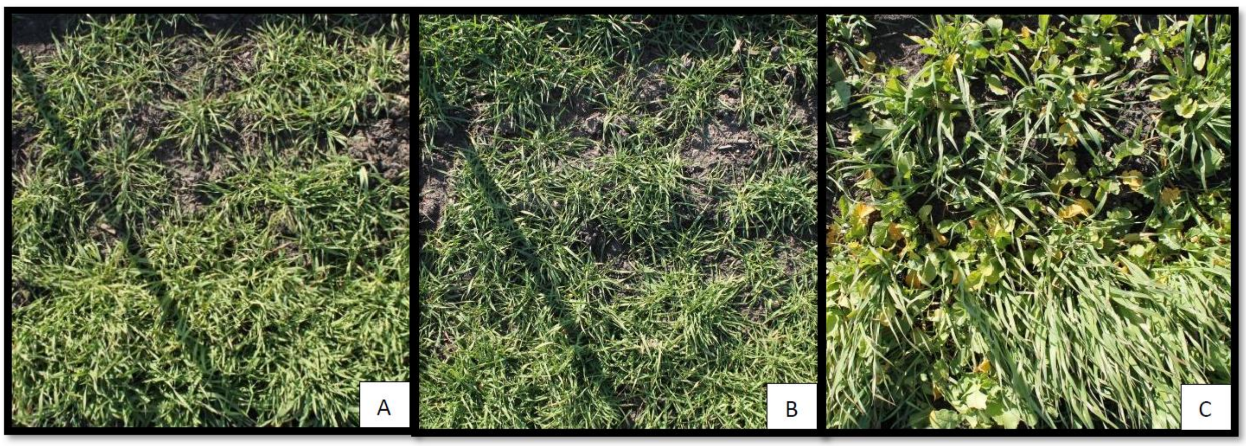

Fig 3: Three cover crop options all planted September 12th: A) Winter Rye seeded at 100lbs/acre, B) Winter Wheat seeded at 90lbs/acre, and C) Oat + Oilseed Radish at 50+15lbs/acre. Pictures were taken November 16th, 2016.

Nitrate-N in the surface 2 feet of the spring soil samples and amount of above ground dry matter had an inverse relationship (Figure 4). This means that as the amount of plant biomass increased, the amount of soil nitrate, prone to leaching, decreased. The amount of total nitrogen found in the plant dry matter also increased as the plant biomass increased. Winter rye had the greatest ability to scavenge and retain nitrogen of the cover crop species tested. Winter rye also had the greatest amount of biomass for all planting dates. However, very little growth and biomass production occurred when cover crops were planted on October 10th and the level of nitrate in the soil was not different than the check.

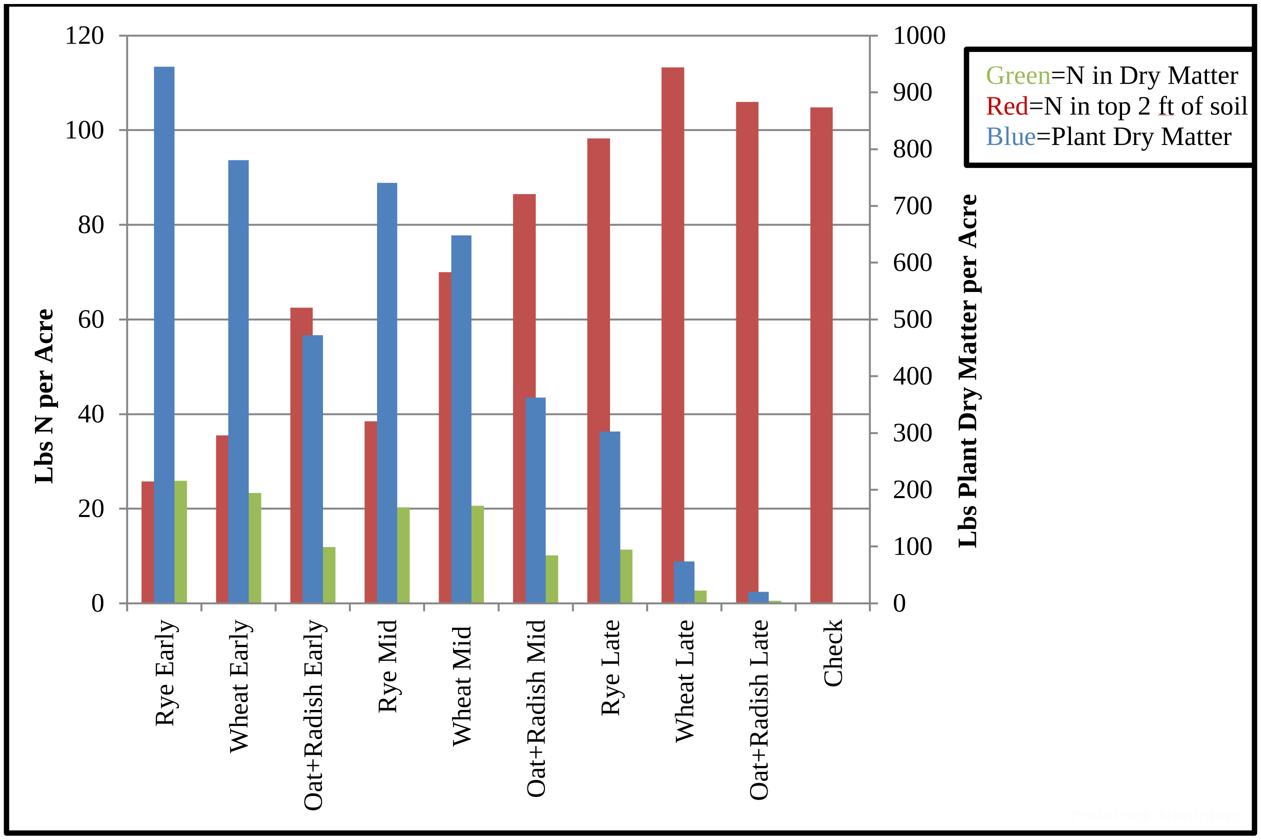

Fig. 4: Plant dry matter analysis for dry weight and nitrogen and soil sample nitrate in the spring of 2017 from cover crop established in fall of 2016. The green and red bars are represented on the primary y-axis and the blue bars are represented on the secondary y-axis. Cover crop species by planting time are shown on the x-axis.

Conclusion: Successful establishment of a fall cover crop is very dependent on the environmental conditions. Therefore, success will vary on any given year. The ability to successfully establish a cover crop increases when planting earlier in the fall. This trial showed very little growth or soil nitrate reduction from planting a cover crop on Oct. 10th in both 2016 and 2017. Winter rye had the most uniform and vigorous establishment of the cover crop species evaluated in this trial and had the greatest reduction in soil nitrate. One caveat may be the difficulty of control in the spring. This concern is addressed in the article titled: *Terminating Fall-Seeded Cover Crops* found in this research report. Establishing fall cover crops will continue to be a research priority moving forward as new methods and species are being tested.

EFFICACY OF 'RESCUE' HERBICIDES IN SUGARBEET

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The objective of this trial was to evaluate 'rescue' control of waterhemp using herbicides in sugarbeet. Rescue applications of herbicides are made after an initial herbicide application fails to provide adequate weed control. This is often the situation when glyphosate resistance is first observed in weeds in a field and the initial application of glyphosate failed to provide adequate weed control.

MATERIALS AND METHODS

An experiment was conducted near Lake Lillian, MN in 2017. The seedbed was prepared using a 's-tine' field cultivator. Crystal 'M380' was seeded in 22-inch rows at 60,500 seeds per acre on May 8. Post emergence (POST) treatments were applied June 6 and 20. All herbicide treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO_2 at 40 psi to the center four rows of six row plots 40 feet in length.

A similar experiment was conducted near Moorhead, MN in 2017. The seedbed was prepared using a Kongskilde 's-tine' field cultivator equipped with rolling baskets on May 10. Hilleshog 'HM4022RR' sugarbeet was seeded in 22-inch rows at 60,560 seeds per acre on May 11 with a John Deere 1700XP 6-row planter. POST treatments were applied June 29 and July 7. All herbicide treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO_2 at 35 psi to the center four rows of six row plots 40 feet in length.

All weed control evaluations were a visual estimate of percent fresh weight reduction in the four treated rows compared to the adjacent untreated strip. Experimental design was randomized complete block with 4 replications for each trial. Data were analyzed with the ANOVA procedure of ARM, version 2017.4 software package.

Table 1. Application information for trials at Lake Lillian and Moorhead, MN in 2017.

	Lake Lillian, MN		Moorhead, MN	
	A	**B**	**A**	**B**
Date	June 6	June 20	June 29	July 7
Time of Day	10:00 AM	9:45 AM	10:30 AM	9:30 AM
Air Temperature (F)	78	70	70	75
Relative Humidity (%)		48	69	57
Wind Velocity (mph)	10	11	0	6
Wind Direction	SE	N	NE	E
Soil Temp. (F at 6")		71	69	70
Soil Moisture	Good	Good	Good	Good
Cloud Cover (%)	0	10	95	0
Next Rainfall (amount)	June 11 (1.0")	June 28 (1.0")	July 4	July 18
Sugarbeet Stage	4 leaf	8 leaf	10-12 leaf	14-16 leaf
Waterhemp	4 inch	6 inch	2.5 inch	5 inch
Common Lambsquarters	4 inch	6 inch	4 inch	6 inch

SUMMARY

<u>Lake Lillian</u>
Waterhemp showed an intermediate level of glyphosate resistance. Roundup PowerMax (glyphosate) at 28 fl oz/A fb Roundup PowerMax at 28 fl oz + Ethofumesate 4 SC (ethofumesate) at 6 fl oz + Destiny HSMOC at 1.5 pt/A +

N-Pak AMS at 2.5 % v/v gave only 63% and 50% waterhemp control at 6 and 16 days after application (DAT) B, respectively (Table 2). At 16 DAT, neither UpBeet (triflusulfuron) at 1 oz/A, Ethofumesate 4 SC at 12 fl oz/A, or a combination of both herbicides gave greater than 25% control of waterhemp. The lack of waterhemp control from UpBeet at 1 oz/A suggests the population may also have been resistant to ALS herbicides. No 'rescue' treatment tested gave acceptable control of waterhemp.

Table 2. Waterhemp and common lambsquarters control from rescue herbicides at Lake Lillian, MN in 2017.

Treatment	Rate/A	Appl[1]	June 26 waterhemp	July 6 waterhemp	July 6 lambsquarters
			-----------------% control-----------------		
UpBeet + MSO	1 oz + 1.5 pt	B	3	18	0
Ethofumesate 4SC + MSO	12 fl oz + 1.5 pt	B	8	25	8
UpBeet + Ethofumesate 4SC + MSO	1 oz + 12 fl oz + 1.5 pt	B	3	20	10
Roundup PowerMax fb	28 fl oz fb	A			
Roundup PowerMax+ Ethofumesate + N-Pak AMS + Destiny HC	28 fl oz + 6 fl oz + 2.5 % v/v + 1.5 pt	B	63	50	100
LSD (0.05)			**11**	**15**	**4**

[1]Appl= Application code listed in Table 1.

Common lambsquarters control was 100% from the treatment containing Roundup PowerMax at 16 DAT (Table 2). UpBeet failed to provide any lambsquarters control. Ethofumesate 4 SC and the combination of UpBeet + Ethofumesate gave 10% or less lambsquarters control.

<u>Moorhead</u>

Sugarbeet injury was generally negligible from herbicides applied. Betamix at 3 pt/A gave 10% to 15% visual injury at 8 and 17 DAT (Table 3) even though sugarbeet were 14 to 16 leaf at application. Injury symptoms were necrotic spots on leaves. All other treatments gave 10% or less injury.

Waterhemp showed an intermediate level of glyphosate resistance. Control from two applications of Roundup PowerMax + Ethofumesate was 78% at 8 days after the second application but only 22% at 17 days after the second application. Treatments containing Betamix provided control ranging from 28% to 40% at 8 DAT but declined to 13% to 36% at 17 DAT. At 17 DAT, those treatments that were a tank-mix of two herbicides tended to give better control than individual herbicides, though no treatment gave greater than 36% control (Betamix + Ethofumesate). No treatment tested provided adequate control of waterhemp.

Common lambsquarters control ranged from 0 to 48% control at 17 DAT from treatments not containing Roundup. Two applications of Roundup PowerMax + Ethofumesate gave 100% common lambsquarters control at 17 DAT.

Table 3. Sugarbeet injury and waterhemp and common lambsquarters control from rescue herbicides at Moorhead, MN in 2017.

			----------July 15----------			-----------July 24-----------		
Treatment	Rate/A	Appl[1]	sgbt	wahe	colq	sgbt	wahe	colq
			----------------------------------%----------------------------------					
Betamix	3 pt	B	10	28	45	15	13	18
UpBeet	1 oz	B	8	10	3	0	8	0
Ethofumesate 4SC	12 fl oz	B	0	18	15	8	25	33
Betamix + UpBeet	3 pt + 1 oz	B	8	40	45	8	33	20
Betamix + Ethofumesate 4SC	3 pt + 12 fl oz	B	8	23	30	10	36	30
UpBeet + Ethofumesate 4SC	1 oz + 12 fl oz	B	0	10	23	0	30	43
Betamix + UpBeet + Ethofumesate 4SC	3 pt + 1 oz + 12 fl oz	B	8	30	38	5	33	48
Roundup PowerMax+ Ethofumesate fb Roundup PowerMax+ Ethofumesate	28 fl oz + 6 fl oz fb 28 fl oz + 6 fl oz	A B	0	78	100	0	22	100
LSD (0.05)			**NS**	**24**	**24**	**8**	**18**	**12**

CONCLUSIONS

Treatments that did not contain Roundup PowerMax failed to provide adequate control of waterhemp, regardless of herbicide combination or location. Two applications of Roundup PowerMax failed to provide adequate waterhemp control at 16 DAT at either location. Making 'rescue' applications of POST herbicides to control waterhemp that survived a previous POST application will likely result in little to no improvement in waterhemp control in sugarbeet.

Common lambsquarters control was near perfect at both locations from two applications of Roundup PowerMax. All 'rescue' treatments tested failed to provide greater than 48% lambsquarters control at 16 DAT. However, nearly all herbicides evaluated provided some control. This suggests that, if used in conjunction with glyphosate, these herbicides may help delay the onset of glyphosate resistance in common lambsquarters.

SMBSC Cercospora Leaf Spot Fungicide Trials 2017

David Mettler

Introduction: Cercospora Leaf Spot (CLS) is a foliar disease that can have a major impact on sugar beet production in the SMBSC growing region every year. In the 2016 season alone it was estimated that growers lost $250-$300 per acre. A disease that can impact the profitability of a crop in such a drastic way needs to be under constant surveillance and requires the use of best management practices. An important practice for controlling CLS is an appropriately timed fungicide program that takes into account fungicide mode of action, disease resistance, and disease pressure.

Objective: The 2016 season has shown that disease resistance is on the rise and poor control in 2016 fields resulted in a large amount of disease potential for the 2017 season. As a result, the need to evaluate fungicide efficacy against CLS was important for making effective recommendations. Conducting trials with individual fungicides and fungicide programs allowed for the evaluation of efficacy of a program, as well as, the contribution of individual fungicides to a program. While it is not recommended to use any single fungicide without rotating chemistries, the Single-Mode trial was necessary to evaluate the effectiveness of those fungicides alone. This allows us to see the benefit of adding those fungicides into a recommended program.

Materials and Methods: Separate trials were conducted at the same site to evaluate fungicides individually and in a program setting, Single-Mode and Program respectively. Both of these trials were designed as a randomized complete block with four replications. Treatment plots were six (22 inch) rows wide by 35 feet long. This site was planted on April 25 using Betaseed 92RR60 with 6-24-6 starter fertilizer at 3gpa. Two applications of Roundup Powermax and Dual Magnum were made to keep the site weed free. Quadris was banded over the trials to suppress Rhizoctonia Root Rot on June 7. The site was inoculated with 3.3lbs/acre of pulverized CLS infected leaves collected from the previous year. This inoculum was spread evenly over the site using a Gandy Orbit-Air applicator. Fungicide spray applications were scheduled for every ten days starting on July 14. The actually timing of the five fungicide applications varied depending on rainfall events. These applications were done using a custom-made tractor sprayer travelling at 3.5mph with a spray volume of 20.2gpa, 90psi, and XR110015VS spray nozzles. This sprayer used CO2 as a propellant and was designed to spray the center four rows of a six row plot. This method of application left rows one and six untreated. Treatments were given a foliar rating between applications using the KWS (Kleinwanzlebener Saatzucht) scale with 1 being disease free and 9 being completely brown. The center two rows of the plots were harvested using a six row defoliator and a two row harvester. The beets harvested from those two rows were weighed in field and a sample from those harvested beets was used for quality analysis in the tare lab. These data were analyzed for significance using SAS version 9.4.

Program Trial Results: Significant differences were found in the yield parameters of the Program trial (Table 1). The untreated check had significantly lower yield and quality parameters compared to all of the other treatments, except for the percent purity, which was similar to the "No Tank-Mix" treatment 7. The quality parameters were similar between treatments 2, 3, and 7. The most significant difference found between these treatments was tons per acre. The "No Tank-Mix" treatment had significantly lower tons per acre compared to treatments 2 and 3. These lower tons per acre and slightly lower quality (% sugar and % purity) led to a large difference in extractable sugar per acre between the "No Tank-Mix" program treatment and the other two treatments which used tank-mix partners in every application (Figure 1). These differences in quality and yield resulted in an approximately $350 difference in revenue per acre between treatments using tank-mix partners and the treatment with no tank-mix partners. This is a large and significant difference in return and shows that the added cost of using tank-mix partners is well worth the investment.

The differences found in the yield parameters were directly correlated with differences observed in the foliar ratings taken between treatment applications (Table 2). The last four foliar ratings had the untreated control with a significantly higher rating than all of the other treatments. The "No Tank-Mix" treatment also had significantly higher foliar ratings compared to treatments 2 and 3, which had tank-mix partners (Figure 2). There were no differences observed between treatments 2 and 3 for any of the parameters measured in this trial.

Single-Mode Trial Results: The Single-Mode trial had varying amounts of significance across the yield parameters and the foliar ratings (Tables 3 and 4). The main take away message from the Single-Mode trial is that tank-mix partners in addition to the main chemistries do better than the main chemistries applied alone (Figure 3). Another important observation of this trial was that the strobilurin (Priaxor) treatment was not significantly different than the untreated control for any of the tested parameters.

Conclusion: The results from 2017 indicate a CLS fungicide program that includes tank-mixing was far superior to a fungicide program with no tank-mixing. A monetary difference of $350/Acre is very significant, but these tank-mix partners also aid in preventing resistance development to the main chemistries. This continues to be very important moving forward as seen in this year's trial showing that the strobilurins provided no suppression of CLS development. We need to continue protecting the remaining main chemistries (triazoles and tin). Based on the results of this study it is important that research continues to evaluate the efficacy of the fungicides available to control CLS and monitor any changes in disease resistance development.

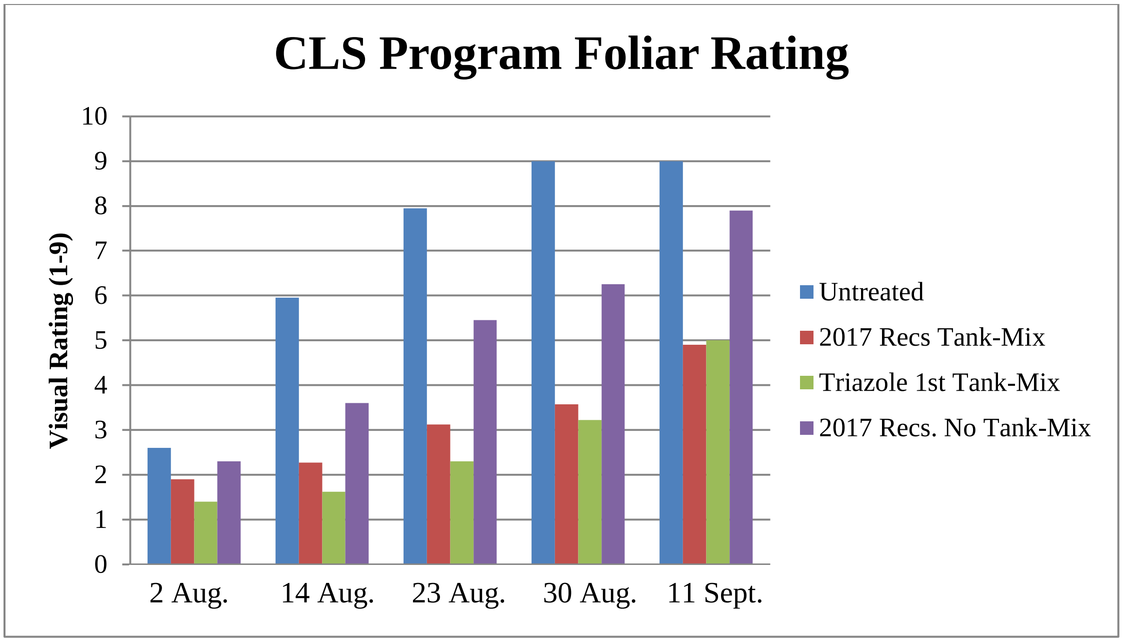

Figure 1: Visual foliar rating for the Program trial using the KMS rating system with 1 being disease free and 9 being completely brown.

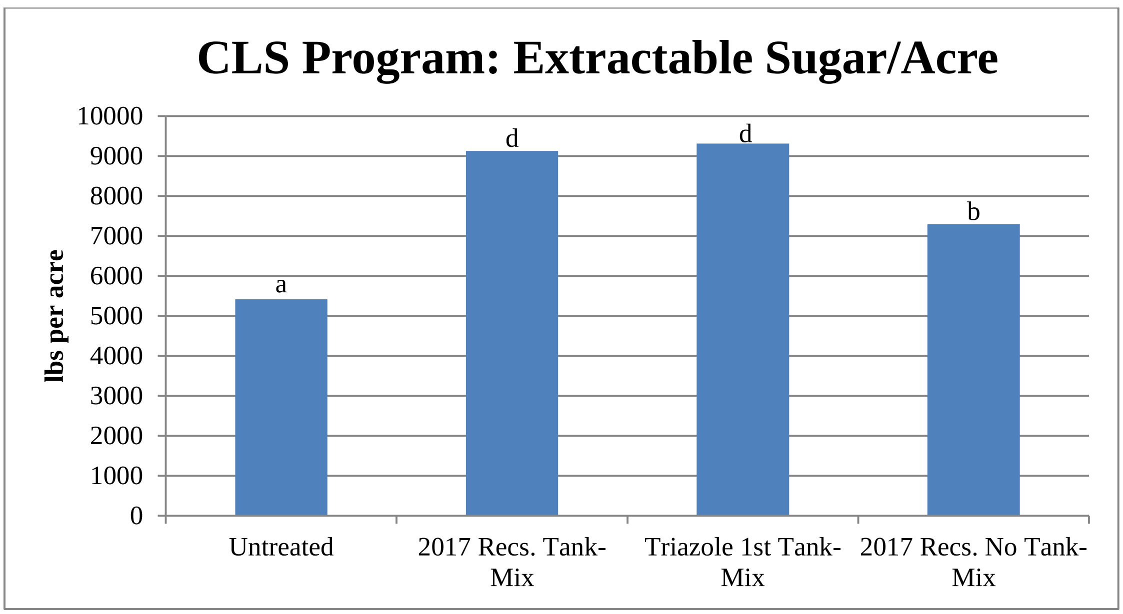

Figure 2: Extractable sugar per acre for the Program trial. Based on the payment factors released on Nov. 22 2017, the monetary difference between "No Tank-Mix" and the 2017 season recommendations would be approximately $350 per acre.

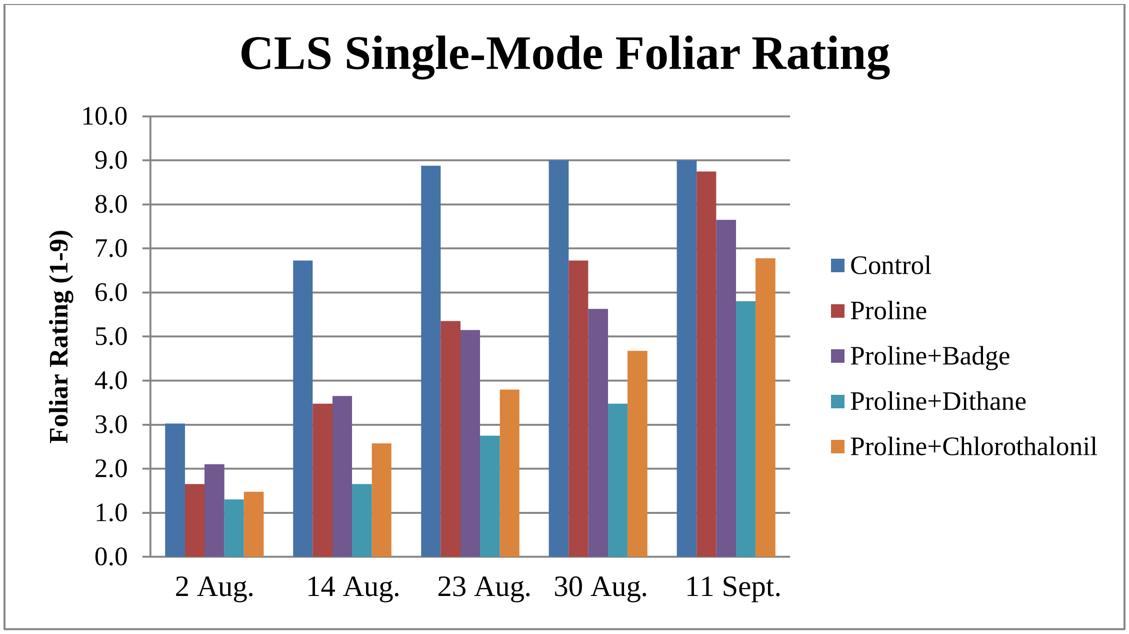

Figure 3: Visual foliar rating for the Single-Mode trial using the KMS rating system with 1 being disease free and 9 being completely brown.

Split Nitrogen Applications in Southern Minnesota 2017 – non-irrigated heavy textured soils.

John Lamb

Introduction and Objective:

Producing sucrose in Minnesota requires growers to optimize their N application for increasing root yield with the decreasing effect of N application on sucrose concentration and purity. The optimum N rate has been the topic of many research studies with the N fertilizer being applied pre-plant. There has been interest in splitting the N application between pre-plant and sometime during the growing season to "spoon feed" the sugar beet root for optimum root yield while not having the negative effects on sucrose concentration and purity. The objective of this study is to determine if split applications of N fertilizer can improve root yield without decreasing root quality. The sub-objectives were a) to conduct an N rate study to supply more information for the N fertilizer recommendations and to also determine if the site is responsive to N application and b) to determine if a split N application is superior to a pre-plant or an in-season application.

Methods and Materials:

To meet the objectives, a study was conducted during the growing season at two locations within the Southern Minnesota Beet Sugar Cooperative growing area. The initial soil test values are reported in Table 1. Ten treatments were established (Table 2). Treatments 1 through 6 were used to determine the response to N application while treatments 3, 4, 7, 8, 9, and 10 were used to compare N application timing responses. The experiment was a randomize complete block design with four replications. The plots were six – 22 inch rows wide and 30 ft. long. The pre-plant N applications were broadcast treatments of urea. The urea was incorporated immediately after application. The in-season N applications were injected between the sugar beet plant rows as liquid urea ammonium nitrate solution. The Redwood Falls location was planted on May 9, 2017 to Beta 9475 and the in-season N application occurred on June 20, 2017. This site was harvested on October 17, 2017. The Clara City location was planted on May 6, 2017 to Beta 9475. The in-season application was applied on June 20, 2017. Harvest occurred on October 13, 2017.

Table 1. Soil test information for 2017 In-season N locations.

Soil test and depth	Redwood Falls	Clara City
Nitrate-N (lb/A) 0-24 inches	39	75
Olsen P (ppm) 0-6 inches	22	18
Soil test K (ppm) 0-6 inches	302	348
pH (unitless) 0-6 inches	7.8	7.9
Organic matter (%) 0-6 inches	5.9	6.4

Table 2. Treatments for the N application study in 2017.

Treatment number	Pre-plant	In-season
	----------- lb N/A ----------	
1	0	0
2	30	0
3	60	0
4	90	0
5	120	0
6	150	0
7	30	30
8	45	45
9	0	60
10	0	90

Results and Discussion:

This study was analyzed as three different groups of treatments. The first was to analyze all of the treatments together to identify the amount of variability in the study. The second set of treatments include the N rate study. This analysis identified if there was a response to N application and also the optimum N application for maximum return to N applied. The final analysis was to determine the effect of the timing of N application on the measured parameters.

Redwood Falls Site:

When considering all of the treatments together, there were very few significant differences in response to the application of the treatments (Table 3). The mean root yield was 34.5 ton/acre and the sucrose averaged 17.0 %. These parameters were above the Cooperative average for the 2017 harvest. The purity was also notably high. To better understand what is happening with the treatments, it is best to break the study into parts.

Sugar beet root yield, sucrose, extractable sucrose per ton, and extractable sucrose per acre were influenced by the amount of N that was applied pre-plant (Table 4). Root yield was increased with the application of up to 120 lb N/A and then a decline. Sucrose and extractable sucrose per ton were increased up to the addition of 60 lb N/A and then decreased. Purity was not affected by the addition of N fertilizer. The extractable sucrose per acre was optimized between 60 and 120 lb N/A. The soil test nitrate-N was 39 lb N/A in the surface 2 feet. The current guideline for a 2 foot soil sample is 80 so the optimum was about 20 lb N/A greater than recommended in this study. Because of the wet spring, we were only able to soil sample to the 2 foot depth instead of the recommended 4 foot depth.

Table 3. Redwood Falls root yield, sucrose, purity, extractable sucrose per ton, and extractable sucrose per acre for all treatments in 2017.

N rate (lb N/A)		Root yield	Sucrose	Purity	Extractable sucrose	
Pre-plant	In-season	ton/A	%	%	lb/ton	lb/A
0	0	31.7	17.1	93.7	301	9262
30	0	31.1	16.8	93.3	293	9104
60	0	35.3	17.5	93.6	309	11043
90	0	35.0	17.0	93.7	299	10459
120	0	39.2	16.7	93.2	292	11630
150	0	33.0	16.7	93.3	291	9593
30	30	37.2	17.3	94.2	303	10961
45	45	33.5	17.1	93.8	301	10102
0	60	33.6	17.0	93.3	298	9994
0	90	34.6	17.1	93.5	301	10931
Grand mean		34.5	17.0	93.5	298	10287
Statistical Analysis						
Treatment		0.4	0.12	0.68	0.12	0.03
C.V. (%)		7.8	2.2	0.7	2.6	7.9

Table 4. The effect of pre-plant N application rates on root yield, sucrose, purity extractable sucrose per ton, and extractable sucrose per acre at the Redwood Falls location 2017.

N rate	Root yield	Sucrose	Purity	Extractable sucrose	
lb N/A	ton/A	%	%	lb/ton	lb/A
0	31.7	17.1	93.7	301	9262
30	31.1	16.8	93.3	293	9104
60	35.3	17.5	93.6	309	11043
90	35.0	17.0	93.7	299	10459
120	39.2	16.7	93.2	292	11630
150	33.0	16.7	93.3	291	9593
Grand mean	34.3	16.9	93.4	297	10248
Statistical Analysis					
N rate	0.02	0.07	0.92	0.08	0.007
C.V. (%)	6.7	2.2	0.8	2.7	6.3

The effect of in-season application of N verses pre-plant and split on measured parameters is reported in Table 5. At the Redwood Falls location, the different application treatments did not affect any of the parameters measured. In fact, there were no significant differences between the check (zero N) and the other N application treatments. At this site, the method of application did not factor into the production.

Table 5. The effect of N application timing on root yield, sucrose, purity extractable sucrose per ton, and extractable sucrose per acre at the Redwood Falls location 2017.

N rate (lb N/A)		Root yield	Sucrose	Purity	Extractable sucrose	
Pre-plant	In-season	ton/A	%	%	lb/ton	lb/A
0	0	31.7	17.1	93.7	301	9262
60	0	35.3	17.5	93.6	309	11043
90	0	35.0	17.0	93.7	299	10459
30	30	37.2	17.3	94.2	303	10961
45	45	33.5	17.1	93.8	301	10102
0	60	33.6	17.0	93.3	298	9994
0	90	34.6	17.1	93.5	301	10931
Statistical Analysis						
Check vs rest		0.15	0.58	0.75	0.63	0.17
N rate		0.50	0.19	0.71	0.27	0.35
Timing		0.67	0.55	0.24	0.35	0.45
N rate * Timing		0.41	0.31	0.60	0.19	0.41
C.V. (%)		8.6	2.1	0.7	2.3	8.9

Clara City Site:

The effect of the applied treatment on sugar beet root yield, sucrose, purity, extractable sucrose per ton, and extractable sucrose per acre at the Clara City location is reported in Table 6. The treatments did effect purity and extractable sucrose per ton. The grand means for this site are also reported in Table 6. The yield and quality for this location was very good.

The application of nitrogen fertilizer at pre-plant significantly decreased purity and extractable sucrose per ton (Table 7). The application did not have a significant effect on root yield, sucrose, or extractable sucrose per acre. The soil test nitrate to a depth of 2 feet for this location was 75 lb N/A. This is close to the optimum of the recommended amount of N of 80 lb N/A. This could explain the lack of response to N application for root yield, sucrose, or extractable sucrose per acre. Also, this site did have some water standing on it later in the season that could have affected the beet growth.

The effect of the different N application timings is reported in Table 8. Root yield was affected by the timing of application. The greatest root yield was with the pre-plant, with the split or half at pre-plant and half in-season intermediate, while the in-season application had the least root yield.

The sucrose concentration was affected by the N application rate. As the N application rate increased from 60 to 90 lb N/A the sucrose concentration decreased. Extractable sucrose per ton had an interaction with N rate and application timing. At the 60 lb N/A N rate, the extractable sucrose per ton was similar for the split application (half the N at pre-plant and half in-season) and the in-season application while the pre-plant N application resulted in a decreased amount of extractable sucrose per ton. At the 90 lb N/A N rate, the extractable sucrose per ton for the pre-plant and split N applications was less than the in-season application.

Table 6. Clara City root yield, sucrose, purity, extractable sucrose per ton, and extractable sucrose per acre for all treatments in 2017.

N rate (lb N/A)		Root yield	Sucrose	Purity	Extractable sucrose	
Pre-plant	In-season	ton/A	%	%	lb/ton	lb/A
0	0	33.4	17.1	93.4	300	10002
30	0	36.4	15.2	92.3	284	103400
60	0	36.3	16.4	92.5	283	10346
90	0	39.7	16.5	93.0	292	11652
120	0	38.8	16.7	92.8	292	11117
150	0	35.4	16.3	91.9	280	9907
30	30	35.6	17.0	93.8	299	10735
45	45	36.0	16.2	92.7	289	10581
0	60	33.1	17.2	93.6	302	10019
0	90	33.5	16.7	93.3	298	10684
Grand mean		35.8	16.5	92.9	292	10473
Statistical Analysis						
Treatment		0.29	0.22	0.03	0.0003	0.65
C.V. (%)		9.3	5.7	0.7	2.1	9.4

Table 7. The effect of preplant N application rates on root yield, sucrose, purity extractable sucrose per ton, and extractable sucrose per acre at the Clara City location 2017.

N rate	Root yield	Sucrose	Purity	Extractable sucrose	
lb N/A	ton/A	%	%	lb/ton	lb/A
0	33.4	17.1	93.4	300	10002
30	36.4	15.2	92.3	284	10340
60	36.3	16.4	92.5	283	10346
90	39.7	16.5	93.0	292	11652
120	38.8	16.7	92.8	292	11117
150	35.4	16.3	91.9	280	9907
Grand mean	36.5	16.4	92.6	288	10451
Statistical Analysis					
N rate	0.20	0.33	0.04	0.02	0.46
C.V. (%)	8.4	6.7	0.7	2.3	10.4

Table 8. The effect of N application timing on root yield, sucrose, purity extractable sucrose per ton, and extractable sucrose per acre at the Clara City location 2017.

N rate (lb N/A)		Root yield	Sucrose	Purity	Extractable sucrose	
Pre-plant	In-season	ton/A	%	%	lb/ton	lb/A
0	0	33.4	17.1	93.4	300	10002
60	0	36.3	16.4	92.5	283	10346
90	0	39.7	16.5	93.0	292	11652
30	30	35.6	17.0	93.8	299	10735
45	45	36.0	16.2	92.7	289	10581
0	60	33.1	17.2	93.6	302	10019
0	90	33.5	16.7	93.3	298	10684
Statistical Analysis						
Check vs rest		0.14	0.14	0.41	0.07	0.10
N rate		0.81	0.06	0.33	0.24	0.33
Timing		0.08	0.21	0.23	0.006	0.34
N rate * Timing		0.71	0.26	0.21	0.04	0.17
C.V. (%)		8.7	3.2	0.7	2.0	6.9

Summary:

In 2017, sugar beet yield and quality responded to N application at one of the two sites. These results were similar to the current N fertilizer guideline for high quality sugar beet. The use of a split (half at pre-plant and half in-season) or an in-season N application, did not help or hurt sugar beet production. More sites are needed to make a firm recommendation on the use of in-season applications. Right now, it appears the use of pre-plant N applications on non-irrigated heavy textured soils in the Southern Minnesota Beet Sugar Cooperative growing area is a very good practice for optimum root yield and quality.

CONTINUED REFINEMENT OF THE WATERHEMP CONTROL STRATEGY IN SUGARBEET

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SUMMARY

1. Chloroacetamide herbicide application timing tended to have a greater effect on waterhemp control than choice of chloroacetamide herbicide.
2. Split application of chloroacetamide herbicides improved waterhemp control compared to a single chloroacetamide herbicide application.
3. Applying Dual Magnum preemergence (PRE) fb a chloroacetamide herbicide lay-by improved waterhemp control compared to chloroacetamide alone.
4. Lambsquarters control from glyphosate + ethofumesate was not affected by chloroacetamide herbicide applied with glyphosate and ethofumesate (data not presented).

INTRODUCTION

Survey data indicates waterhemp is the primary weed control challenge in sugarbeet fields in Southern Minnesota Beet Sugar Cooperative, in Minn-Dak Farmers' Cooperative, and in fields south of Grand Forks in American Crystal Sugar Cooperative. Waterhemp populations are a mixture of glyphosate susceptible and resistant biotypes. Roundup PowerMax at 28 fl oz/A controlled 78% of the first flush of emerged waterhemp based on waterhemp counts taken immediately prior to and 9 days following application (Peters, 2015). However, control does not improve by increasing the glyphosate rate or with repeat glyphosate applications. Early-season weed escapes cause late-season weed control failures and weed disasters at harvest. There are no effective POST herbicide options for rescue control of resistant biotypes, especially when waterhemp is greater than 4-inches tall.

Ethofumesate or Ro-Neet provide effective early-season waterhemp control but are expensive or do not provide full-season control (Peters, 2016). Use of site of action (SOA) 15 herbicides (chloroacetamides) applied early postemergence (EPOST) provide the most effective and consistent waterhemp control (Peters, 2015; Peters, 2016; Peters, 2017). However, several important statements should be made about chloroacetamide herbicides and waterhemp control. First, sugarbeet must reach the 2-leaf stage before chloroacetamides can be applied. Thus, planting date influences how and when they can be applied. Second, chloroacetamides need to be activated by timely precipitation in order to control waterhemp. Third, waterhemp seems to be emerging earlier in the spring. Are we selecting for earlier germinating biotypes or have we improved awareness and identification? Maybe some of both. Finally, sugarbeet grower surveys indicate approximately 85% satisfaction (excellent or good response) with current waterhemp control strategies. How can we improve satisfaction to 90% or 95%?

Waterhemp control in soybean was improved using repeat application of chloroacetamide herbicides; a practice referred to as 'layering' (Steckel, 2002). Sugarbeet experiments conducted at Herman and Moorhead, MN in 2015 investigate repeat applications of chloroacetamide herbicides in sugarbeet. Dual Magnum (s-metolachlor) at 0.5 pt/A was applied PRE followed by glyphosate + ethofumesate plus either S-metolachlor, Warrant or Outlook at 2-lf sugarbeet stage. Waterhemp control averaged greater than 90% using the layering strategy compared to S-metolachlor, Warrant, or Outlook applied EPOST (Figure 1).

Outlook often is split-applied at 12 fl oz/A at the 2-leaf sugarbeet stage followed by 12 fl oz/A at the 6-leaf stage. This practice is common when glyphosate plus Outlook is tank-mixed with an insecticide for black cutworm control since there is a concern that applying multiple products formulated as emulsifiable concentrates may injury sugarbeet, especially under cold and wet spring environmental conditions. Split application can also improve waterhemp control consistency (conversation with Jim Radermacher, 2015). Split lay-by application buffers against the possibility of inadequate or untimely precipitation since the first application in May is followed by a second application, 14 to 21 days later, in June.

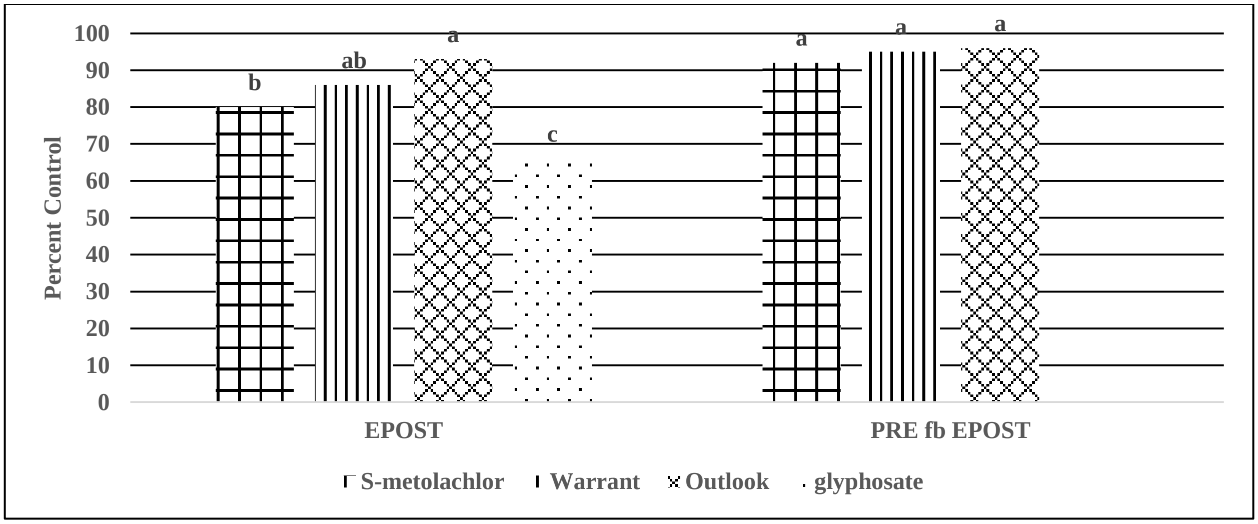

Figure 1. Waterhemp control from soil-residual herbicides applied early postemergence (EPOST) or S-Metolachlor at 0.5 pt/A preemergence (PRE) followed by soil-residual herbicides applied EPOST, averaged across Herman and Moorhead, MN, 2015.

Following successes with Outlook, sugarbeet growers and Agriculturalists have asked if Warrant and S-metolachlor should also be split-applied. The objectives of 2016 and 2017 experiments were to evaluate sugarbeet safety and waterhemp control at multiple locations from: a) Dual Magnum PRE-followed by S-metolachlor, Warrant, or Outlook EPOST in single or multiple applications and; b) S-metolachlor, Warrant, or Outlook EPOST in single or multiple applications. This report summarizes experiments conducted at Roseland, MN in 2016 and Lake Lillian, MN, and Galchutt, ND in 2017.

MATERIALS AND METHODS

Experiments were conducted on natural populations of waterhemp near Moorhead, MN in 2016 and Lake Lillian, MN and Galchutt, ND in 2017. Experimental area was prepared using a field cultivator prior to planting. Hilleshog 'HM4302RR' sugarbeet treated with Tachigaren, at 45 grams product, Cruiser Maxx (contains Cruiser 5FS at 60 gram active ingredient (g a.i.), Apron XL at 15 g a.i., and Maxim 4FS at 2.5 g a.i.) and Vibrance at 2g a.i. per 100,000 seeds was seeded 1.25 inches deep in 22 inch rows at 60,825 seeds per acre on May 12, 2016 at Moorhead. Crystal 'M380' sugarbeet treated with Tachigaren and Kabina at 45 g product and 14 g a.i. per 100,000 seeds, respectfully, was seeded 0.5 inches deep in 22 inch rows at 62,100 seeds per acre on May 8, 2017 at Lake Lillian, MN. 'HM4022RR' sugarbeet treated with Tachigaren, at 45 grams product, Cruiser Maxx (contains Cruiser 5FS at 60 gram active ingredient (g a.i.), Apron XL at 15 g a.i., and Maxim 4FS at 2.5 g a.i.) and Vibrance at 2g a.i. per 100,000 seeds was seeded 1.25 inches deep in 22 inch rows at 60,825 seeds per acre on May 9, 2017 at Galchutt.

Table 1. Application information for sugarbeet trial near Moorhead, MN in 2016.

Application code	A	B	C
Date	May 16	June 6	June 20
Time of Day	9:00 AM	2:00 PM	2:30 PM
Air Temperature (F)	51	67	73
Relative Humidity (%)	56	56	37
Wind Velocity (mph)	7	12	10
Wind Direction	N	NW	NW
Soil Temp. (F at 6")	48	62	70
Soil Moisture	Poor	Good	Good
Cloud Cover (%)	80	90	10
Sugarbeet stage (avg)	PRE	4-6 lf	10 lf
Waterhemp	-	0.5 inch	1-3 inch

Herbicide treatments were applied at Moorhead on May 16, June 6, and June 20, 2016; May 11, June 1, and June 16, 2017 at Lake Lillian, and May 9, June 1, and June 20, 2017 at Galchutt. All treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO_2 at 40 psi to the center four rows of six row plots 30 feet in length in fields with moderate to heavy infestations of glyphosate-resistant waterhemp. Ammonium sulfate (AMS) in all treatments was 'N-Pak' AMS, a liquid formulation from Winfield United. 'Destiny HC' high surfactant methylated oil concentrate (HSMOC) was also used and is a product from Winfield United.

Table 2. Application information for sugarbeet trial near Lake Lillian, MN in 2017.

Application code	A	B	C
Date	May 11	June 1	June 16
Time of Day	9:00 AM	9:00 AM	9:00 AM
Air Temperature (F)	58	70	79
Relative Humidity (%)	27	27	42
Wind Velocity (mph)	12	3	5-10
Wind Direction	NNW	SSW	SSE
Soil Temp. (F at 6")	68	70	-
Soil Moisture	Good	Good	Good
Cloud Cover (%)	-	-	Partly Cloudy
Sugarbeet stage (avg)	PRE	2-4 lf	6-8 lf
Waterhemp	-	0.5 inch	1-3 inch

Sugarbeet injury was evaluated June 24 and July 22, 2016 at Moorhead, June 6, June 26 and July 6, 2017 at Lake Lillian, and June 16, 2017 at Galchutt. Waterhemp control was evaluated June 24, June 28, July 22, and August 24, 2016 at Moorhead, June 15, June 26 and July 6, 2017 at Lake Lillian and June 16, July 5, and July 24, 2017 at Galchutt. Common lambsquarters and redroot pigweed control also was evaluated at each location, but data are not included in this report since glyphosate provided complete or near complete control of both species. All evaluations were a visual estimate of percent fresh weight reduction in the four treated rows compared to the adjacent untreated strip. Experimental design was randomized complete block with 4 replications. Data were analyzed with the ANOVA procedure of ARM, version 2017.4 software package.

Table 3. Application information for sugarbeet trial near Galchutt, ND in 2017.

Application code	A	B	C
Date	May 9	June 1	June 20
Time of Day	12:00 PM	9:00 AM	12:00 PM
Air Temperature (F)	64	70	68
Relative Humidity (%)	37	32	47
Wind Velocity (mph)	10	3	6
Wind Direction	NW	S	NW
Soil Temp. (F at 6")	54	59	64
Soil Moisture	Good	Good	Good
Cloud Cover (%)	50	10	10
Sugarbeet stage (avg)	PRE	2-lf	8-10 lf
Waterhemp	-	1 inch	2 inch

RESULTS

Waterhemp control was influenced by herbicide and application timing at Moorhead in 2016 and Lake Lillian and Galchutt in 2017 (Figure 2, Figure 3, Figure 4). In general, application timing had greater influence on waterhemp control than chloroacetamide herbicide.

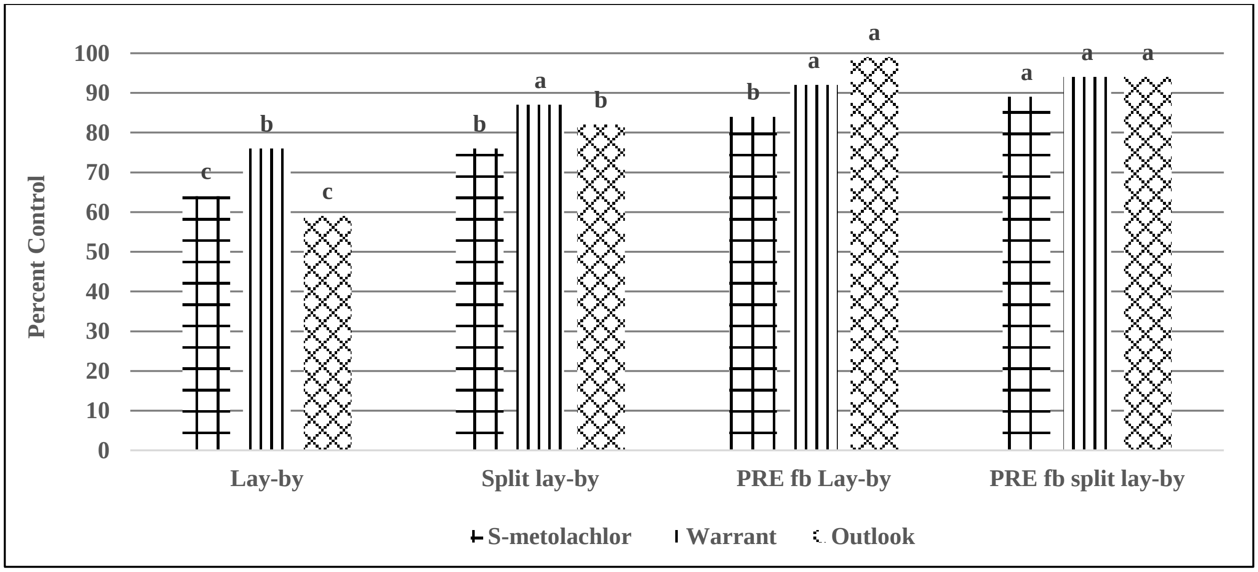

Figure 2. Waterhemp control from single lay-by or split lay-by herbicide applications and S-metolachlor preemergence (PRE) followed by lay-by or split lay-by herbicide applications, Moorhead, MN in 2016, average of July 22 and August 24 evaluation.

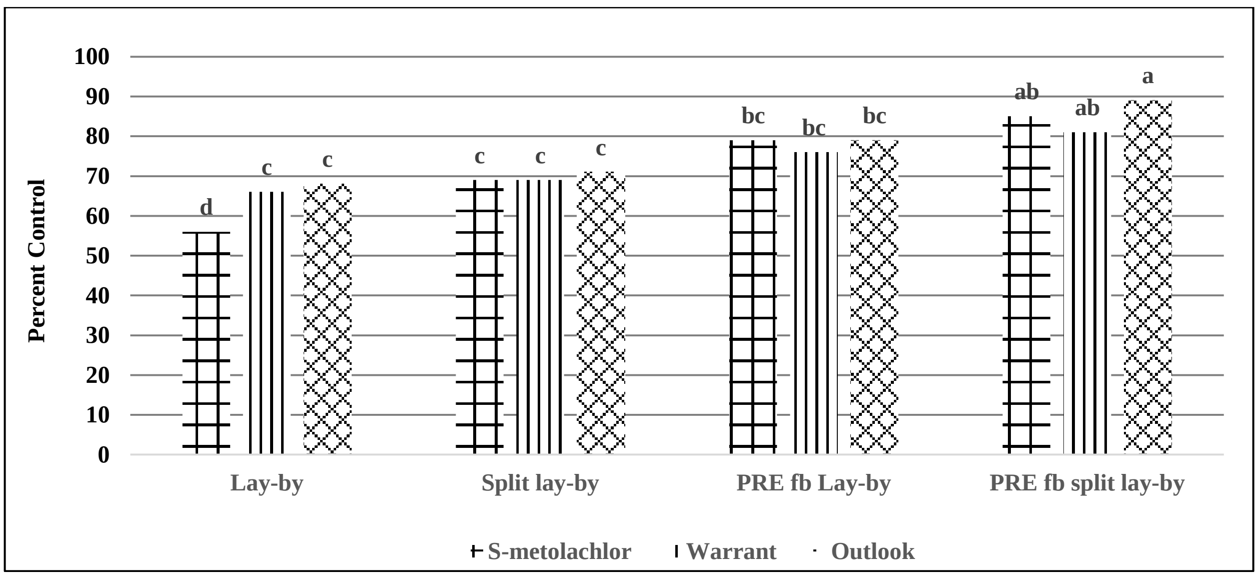

Figure 3. Waterhemp control from single lay-by or split lay-by herbicide applications and S-metolachlor preemergence (PRE) followed by lay-by or split lay-by herbicide applications, Lake Lillian, MN, 2017, July 6 evaluation.

There are several factors to consider when selecting a chloroacetamide herbicide for waterhemp control aside from relationships with a company or company representatives. Warrant costs less per acre on a rate basis than Outlook or S-metolachlor. Outlook is more water soluble than either S-metolachlor or Warrant and requires less precipitation for activation. Once activated, Warrant has longer residual than Outlook or S-metolachlor. Outlook and Warrant have a broader weed control spectrum than S-metolachlor. However, sugarbeet can be planted directly into S-metolachlor residues in the event of replant whereas three to four weeks' time is required before residue levels of Outlook and Warrant will allow sugarbeet replanting. Finally, S-metolachlor and Warrant are safer on sugarbeet than Outlook although injury generally is negligible with all chloroacetamide herbicides. Most of the factors to consider when selecting a chloroacetamide herbicide are based more around risk of sugarbeet injury than level of waterhemp control.

Waterhemp control from chloroacetamide herbicides was evaluated across locations in 2014 to 2017. Precipitation followed within 7-days of chloroacetamide activation in 2014 and 2015. However, timely precipitation did not occur in 2016 or 2017. 2016 was a dry spring, creating erratic germination and emergence patterns in experiments and in grower fields. Early postemergence chloroacetamide application was delayed five days to account for erratic emergence at the Moorhead location. Likewise, precipitation was spotty and possibly up to 24 days between the precipitation event that activated PRE herbicides and precipitation events to activate lay-by herbicides in 2017 at Lake Lillian. These climate phenomena partially explain waterhemp control observations in fields in 2016 and 2017 (Figure 2 and Figure 3).

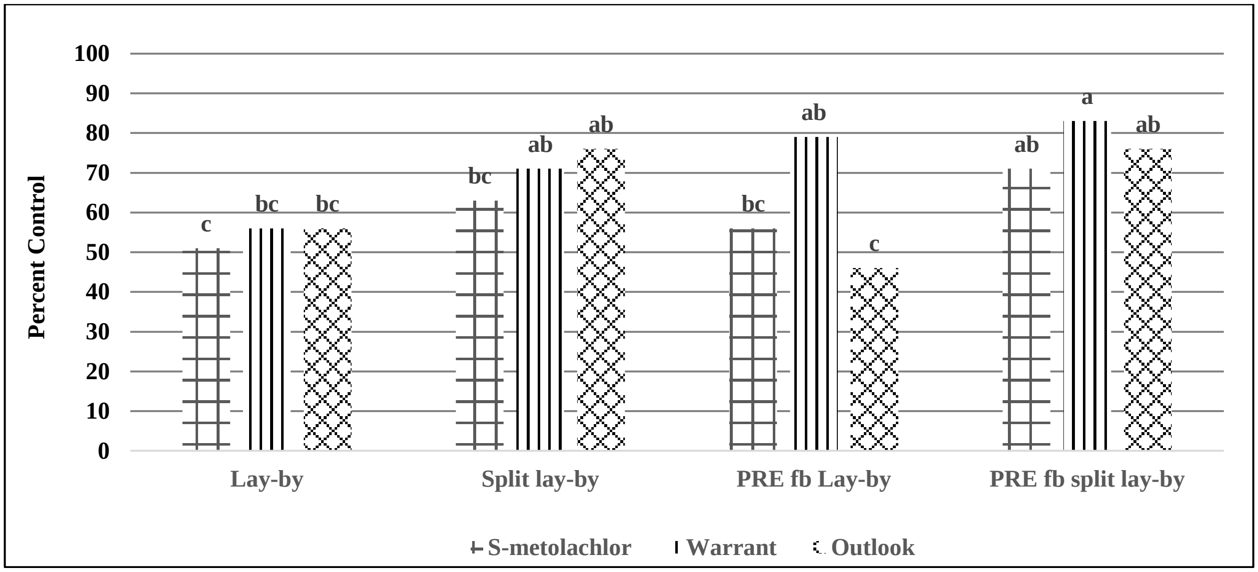

Figure 4. Waterhemp control from single lay-by or split lay-by herbicide applications and S-metolachlor preemergence (PRE) followed by lay-by or split lay-by herbicide applications, Galchutt, ND, 2017, July 25 evaluation.

The Galchutt, ND location received timely precipitation for activation of herbicides in 2017 (Figure 4). However, there was significant sugarbeet stand loss caused by rhizoctonia root rot, possibly caused by above average precipitation in June and July. Stand loss created an open canopy suitable for waterhemp germination and emergence well into July. Under these conditions, split application of chloroacetamide herbicides (EPOST fb POST) or PRE followed by split applications of chloroacetamide herbicides tended to provide better waterhemp control than single lay-by application of chloroacetamide herbicide alone or following PRE S-metolachlor.

At each of the three locations, 12 different treatment combinations of herbicide (S-metolachlor, Warrant, and Outlook) and timing (lay-by, split lay-by, PRE fb lay-by, and PRE fb split lay-by) were tested for a total of 36 observable treatments. In an effort to compare these treatments and determine which method of application resulted in the greatest and most constant control across locations, the following steps were taken. At each evaluation from each location, waterhemp control data was ranked in numerical order from greatest control to least control based upon the least significant difference (LSD). Herbicide treatments that were statistically the same as the best treatment at each evaluation timing from each location were grouped into a cluster and labeled ‘good’. The remaining treatments were once again ranked and grouped into a second and third cluster based on LSD value and labeled ‘fair’ and ‘poor’, respectively. Clusters were titled ‘good’, ‘fair’ and ‘poor’ since treatments in the good cluster generally corresponded to 80% or greater waterhemp control, the fair cluster corresponded to 80 to 65% waterhemp control, and the poor cluster corresponded to 65 to 40% waterhemp control. Chloroacetamide herbicides were combined and were grouped by application timing into four classes: lay-by, split lay-by, PRE fb lay-by, and PRE fb split lay-by. The number of observations corresponding to each cluster (good, fair, or poor) were summed and are presented in Figure 5. Data indicates PRE fb lay-by and PRE fb split lay-by application methods provided the most consistent waterhemp control across locations and years.

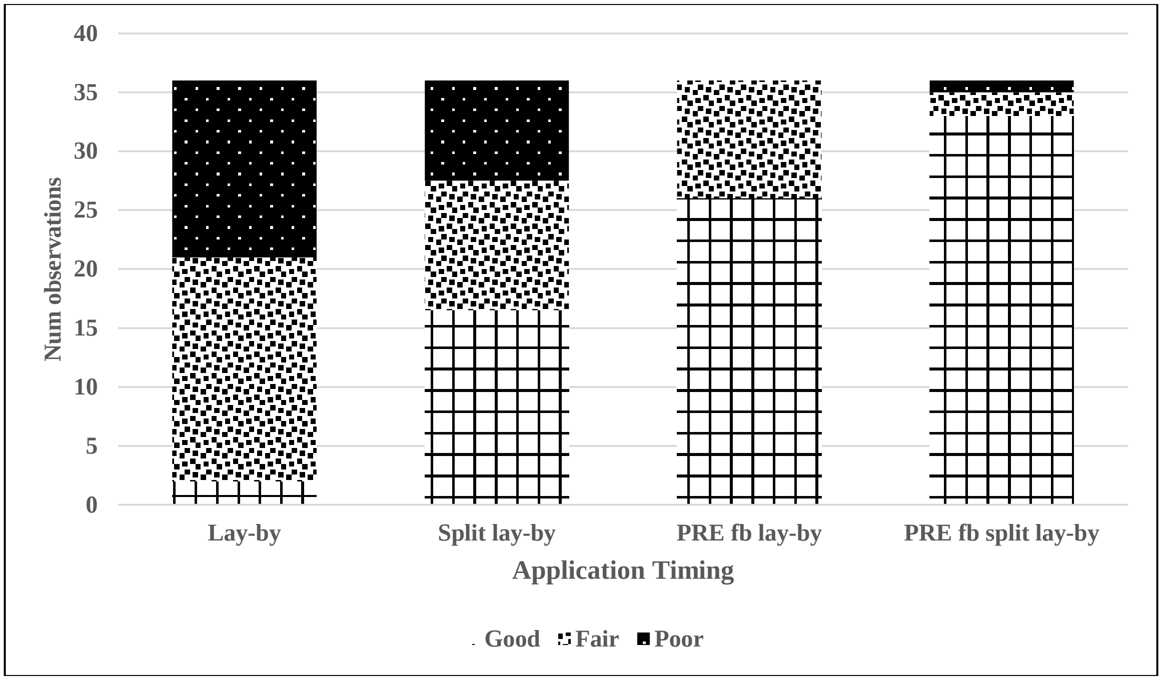

Figure 5. Number of good, fair, and poor estimates of waterhemp control across herbicides and application timing, summed across evaluations, locations, and years

CONCLUSIONS

Sugarbeet planting date is likely the most important factor to consider for herbicide selection and application timing for waterhemp control (Table 4). Split lay-by application of chloroacetamide herbicides is the preferred approach for waterhemp control for early planted sugarbeet. However, PRE followed by a split lay-by application buffers risk against early germinating weeds or uncertainty of when precipitation will occur to activate lay-by herbicides, even in early planted sugarbeet.

Late planted sugarbeet may not reach the sugarbeet 2-lf stage by May 15 (date when the growing degree day model typically forecasts waterhemp germination and emergence). Thus, Dual Magnum and/or ethofumesate should be applied PRE followed by split lay-by application of chloroacetamide herbicides. Timing of the lay-by applications will be dependent on sugarbeet planting date, precipitation to activate PRE, and waterhemp pressure in the field.

Continue to scout sugarbeet fields for waterhemp in July and August. Tank-mixes of Betamix or UpBeet with Roundup plus ethofumesate or cultivation are recommended for POST waterhemp control. Apply in combination with HSMOC adjuvant at 1.5 pt/A and AMS at 8.5 to 17 lb/100 gallon water carrier.

Table 4. Recommendation for waterhemp control in sugarbeet, by planting date.

Planting Date	Recommendation
Plant Sugarbeet in April	Split lay-by application (early postemergence / postemergence) of chloroacetamide herbicides applied at 2-lf sugarbeet fb 4 to 6-lf sugarbeet
	Dual Magnum and/or ethofumesate PRE followed by a split lay-by application at 2 to 4-lf stage fb 4 to 6-lf stage
	Single lay-by application when sugarbeet is at the 2-lf stage or greater
Plant Sugarbeet in May	Dual Magnum and/or ethofumesate PRE followed by a split lay-by
Either	Continue to scout fields for late germinating waterhemp in late June and July
Either	Be prepared to rescue with Betamix + ethofumesate, UpBeet + ethofumesate or Betamix + UpBeet (be aware of resistant biotypes)

LITERATURE CITED

1. Peters, TJ, Carlson AL (2015) Controlling Waterhemp in Fields Planted to Sugarbeet. Sugarbeet Res. Ext. Rept. 45: 29-35.
2. Peters, TJ, Lueck AB, Radermacher J (2016) A Strategy for Managing Waterhemp in Sugarbeet. Sugarbeet Res. Ext. Rept. 46: 22-30.
3. Peters, TJ, Lueck AB, Groen C (2017) Continued Evaluation of the Strategy for Managing Waterhemp in Sugarbeet. Sugarbeet Res. Ext. Rept. 47: 30-38.
4. Steckel, LE, Sprague CL, Hager AG (2002) Common Waterhemp (*Amaranthus rudis*) Conrol in Corn (*Zea mays*) with Single Preemergence and Sequential Applications of Residual Herbicides. Weed Technology. 16:755-761.

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- North Dakota State University Experiment Station and University of Minnesota Crookston Research and Outreach Center

TERMINATING FALL-SEEDED COVER CROPS

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SUMMARY

1. Seed cereal rye at no more than 25 pounds per acre.
2. Winter wheat is easier to kill than cereal rye in the spring.
3. Use full herbicides rates. Apply SelectMax at 12 to 16 fl oz/A or PowerMax at 32 to 64 fl oz/A.
4. Apply herbicides as early as possible following cover crop green-up with consideration to the weather forecast 5 to 7 days after application.
5. Herbicides work much slower in early spring and may require 2 to 3-weeks to reach 85% burndown control.
6. Cereal rye stubble may suppress emergence and development of broadleaf weeds including nightshade, lambsquarters, and pigweed.

INTRODUCTION

Sugarbeet farmers have adopted the practice of seeding nurse crops as a companion crop with sugarbeet to reduce stand losses from wind and blowing soils. Spring-seed nurse crops are seeded at sugarbeet planting and are terminated when sugarbeet is at the 4-leaf stage or when small grains are 4 to 5 leaves (tillering). Many farmers have stated they desire to implement cover crops for a longer length of time. That is, seeding cover crops after wheat harvest and prior to sugarbeet planting or after sugarbeet harvest to reduce the chances and amount of blowing soil during the winter and early spring.

Soil health is currently a popular topic in agriculture. The topic is complicated, but the goal essentially is to protect our land resource. Cover crops in sugarbeet production is often discussed since fields are very smooth and contain very little surface crop residue after sugarbeet harvest. In addition, primary and secondary fall tillage is done on fields to be planted to sugarbeet to lessen spring tillage and to conserve moisture in advance of planting next year's sugarbeet crop. Once again, tillage often creates smooth fields that are susceptible to soil erosion, especially in dry and windy conditions.

A probe experiment was initiated in September 2016 with multiple objectives including: a) how effective is spring-applied Roundup PowerMax (glyphosate) or Select Max (clethodim) for killing fall-seeded cover crops; b) when should herbicides be applied to optimize cover crop control and sugarbeet stand establishment; and c) do cover crops provide additional benefits, for example, weed suppression? The goal was to better understand how and when fall-seeded cover crops must be terminated so that sugarbeet can be planted in mid to late April.

MATERIALS AND METHODS

<u>Prosper, ND.</u> Stubble was chisel plowed following wheat harvest at the Prosper Experiment Station, near Prosper, ND. Secondary tillage was done using a Kongskilde 's-tine' field cultivator with rolling baskets on September 6, 2017. Experiment was a split plot design with 4 replications. The main (whole) plot was fall seeded cover crop; the subplot was herbicide, herbicide rate, and timing of herbicide application.

Winter wheat at 60 lb/A, cereal rye at 50 lb/A, and a mixture of oat at 40 lb/A and tillage radish at 5 lb/A were spread by hand across respective whole plots in each replication and shallow tilled to incorporate seeds into soil on September 6, 2017. One main plot was left with no cover crop.

Select Max at 6 fl oz/A + 1.5 pt/A methylated seed oil (MSO) and Roundup PowerMax at 28 fl oz/A + Prefer 90 non-ionic surfactant (NIS) at 0.25% v/v with ammonium sulfate (N-Pak-AMS) at 2.5% v/v were applied as treatments on April 17, April 21, and April 29, 2017 when winter wheat was 5, 5, and 7-inches, respectfully, and cereal rye was 8, 9, and 10 inches, respectfully (Table 1). All herbicide treatments were applied with a bicycle sprayer (without the customary hood) in 17 gpa spray solution through 110002 Turbo TeeJet nozzles pressurized with CO_2 at 40 psi across plots. Percent visual control or burndown of winter wheat and cereal rye was evaluated on October 27, 2016 and April 13, April 29, May 5, May 12, and May 23, 2017.

Table 1. Application Information – Prosper, ND 2017

Date	April 17	April 21	April 29
Time of Day	3:00 PM	3:00 PM	4:00 PM
Air Temperature (F)	49	62	58
Relative Humidity (%)	33	38	16
Wind Velocity (mph)	4	2	6
Wind Direction	NW	W	NE
Soil Temp. (F at 6”)	54	56	46
Soil Moisture	Good	Good	Good
Cloud Cover (%)	80	10	30
Winter Wheat	5 inch	5 inch	7 inch
Cereal Rye	8 inch	9 inch	10 inch

‘SV36272RR’ sugarbeet, treated with NipsIt Suite, Tachigaren at 45g per unit, and Kabina at 7g per unit, was seeded in 22-inch rows at 60,560 seeds per acre on May 26, 2017. Roundup PowerMax at 32 fl oz per acre + ClassAct NG at 2.5% v/v was applied on June 19 and July 10, 2017 to control weed escapes in the trial.

Renville, MN. Cereal rye at 100 lb/A was seeded into a preharvest sugarbeet field on September 12, 2016. Rye was harrowed into the soil following seeding using a field cultivator. Roundup PowerMax at 22, 32, and 64 fl oz/A plus Class Act NG at 2.5% v/v or SelectMax at 6 fl oz/A plus Class Act NG at 2.5% v/v was applied to the center 7.3 ft of an 11 ft plot by 30 feet long on April 7, 2017. Herbicide was applied with a bicycle sprayer at 17 GPA through TeeJet 8002XR nozzles at 40 psi.

Evaluations were a visual assessment of cereal rye control (visual reduction in ground cover) on April 17, April 21 and April 28, 2017.

Data were analyzed with the ANOVA procedure of ARM, version 2017.4 software package.

RESULTS AND DISCUSSION

Cover Crop Establishment and Overwintering at Prosper. A visual assessment of cover crop establishment was collected on October 27, 2016. In general, cover crop emergence and percent visual ground cover was very good, perhaps exceeding expectations (Table 2). Favorable moisture conditions and warm temperatures in the fall of 2016 promoted cover crop growth. Cereal rye growth was most uniform while winter wheat was the least uniform. Tillage radish emerged but were small, ranging from 0.5 to 1 inch in diameter and 2 to 4 inches long. Ground cover in the no-cover crop main plot was a uniform cover of volunteer spring wheat.

Table 2. Percent visual ground cover and range of observations across replications, October 27, 2016 at Prosper, ND

	Visual Ground Cover	Range of Visual Ground Cover Observations
Cover Crop	%	%
Winter Wheat	60	40-70
Cereal Rye	85	80-90
Oat and Tillage Radish	68	50-80
No Cover Crop[1]	38	30-40

[1]Block contained volunteer wheat from previous crop

Cover crop establishment was evaluated April 6 and April 13, 2017 following snow melt. On April 6, the cereal rye whole plots were greening up, but there was very little visual evidence of living winter wheat. Spring green-up and early season growth changed quickly in one week. On April 13 the number of green cereal rye or winter wheat plants per meter square were counted and a visual assessment of green-up was taken in $1m^2$ quadrats at three evenly spaced points within the cover crop whole plot. Cereal rye ground cover and uniformity were greater than winter wheat which may have suffered some winter-kill damage (Table 3). However, the number of rye or winter wheat plants per m^2 were similar. This may be attributed to the aggressive behavior of cereal rye which was well tillered on April 13 and was in general, much more robust than winter wheat.

Seeding rates were determined from the literature and through personal communication. In both cases, there was a wide range of opinions regarding seeding rates. Cereal rye seeding rate of 50 lb/A was much too great as the rye whole plots resembled sod.

Table 3. Percent visual ground cover, number of plants per square meter and range of observations across replications, April 13, 2017 at Prosper, ND

	Visual Ground Cover	Range of Visual Ground Cover Observations	Number of Plants per Square Meter	Range of count Observations per Square Meter
Cover Crop	%	%	Number	Number
Winter Wheat	46	0-80	16	0-44
Cereal Rye	73	40-100	17	6-32

<u>Cereal Rye and Winter Wheat Control at Prosper.</u> Percent visual control or burndown was collected April 29 (data not presented), May 5, May 12, and May 23, 2017. In general, winter wheat burndown was faster than cereal rye. Roundup PowerMax at 28 fl oz/A applied on April 17 or April 21 controlled 70% or 75% winter wheat on May 5 or 18 or 14 DAT (days after treatment), respectfully. PowerMax gave only 45% and 25% cereal rye control (Table 4). Winter wheat control from PowerMax ranged from 83 to 98% control by May 12 or 17 to 25 DAT. A minimum of 90% burndown control of cereal rye did not occur until May 23 or 32 to 28 DAT and following PowerMax application on April 21 or April 25. Roundup PowerMax provided greater overall cereal rye and winter wheat control and speed of kill than SelectMax. However, herbicide rate for both Roundup PowerMax and SelectMax probably were not sufficient, especially for early spring application. These results support the recommendation of full herbicide rates, including PowerMax at 32 to 43 fl oz/A and SelectMax at 12 to 16 fl oz/A. The use of appropriate adjuvants will also accentuate herbicide efficacy.

Cereal rye early-season growth and development was very rapid. Herbicide burndown application should be timed as early as possible or immediately after green-up in early spring. However, application timing is a compromise between growth and development of target species and environmental conditions. For example, the April 17 application was followed by wintry weather including 2 to 3 inches of snow and low temperatures. The cereal rye and winter wheat control data suggests herbicides and cover crop efficacy including speed of kill were influenced by environmental conditions.

Table 4. Percent visual cereal rye and winter wheat control, across herbicide, application timing, and evaluation date, Prosper, ND

		May 5		May 12		May 23	
		c rye	w wheat	c rye	w wheat	c rye	w wheat
Herbicide[1]	Appl Date	%	%	%	%	%	%
PowerMax	April 17	55 cd	70 ab	65 c	83 b	75 c	85 b
Select Max	April 17	20 ef	45 d	5 f	60 c	0 g	20 f
PowerMax	April 21	60 bc	75 a	83 b	98 a	100 a	99 a
Select Max	April 21	5 g	25 e	25 e	50 d	0 g	55 d
PowerMax	April 25	20 ef	30 e	70 c	88 b	98 a	100 a
Select Max	April 25	0 g	10 fg	20 e	25 e	20 f	45 e
LSD (0.05)		**10**		**7**		**7**	

[1]Roundup PowerMax at 28 fl oz/A + Prefer 90 NIS at 0.25% v/v + N-Pak AMS at 2.5% v/v; Select Max at 6 fl oz/A + Noble MSO at 1.5 pt/A

Cereal Rye Control at Renville. Cereal rye control (burndown) was dependent on Roundup PowerMax rate and number of days between application and evaluation. Roundup PowerMax at 64 fl oz/A gave 95% cereal rye control 21 DAT (Table 5). Cereal rye control from PowerMax at 32 fl oz/A was similar to control from PowerMax at 64 fl oz/A on April 21 and April 28 or 14 and 21 DAT. However, numbers of days to achieve similar numeric control from PowerMax at 64 fl oz/A was approximately 7 days faster than from PowerMax at 32 fl oz/A. PowerMax at 64 fl oz/A provided greater rye burndown control than PowerMax at 22 fl oz/A. Cereal rye control from SelectMax at 6 fl oz/A was less than control from PowerMax, regardless of rate.

Table 5. Percent visual cereal rye control, across herbicide, herbicide rate, and evaluation date, Renville, MN

Herbicide[1]	Herbicide Rate	April 17	April 21	April 28
	fl oz/A	-----------------------------	% control	-----------------------------
PowerMax	22	41 b	61 b	76 b
PowerMax	32	41 b	73 a	85 ab
PowerMax	64	69 a	86 a	95 a
SelectMax	6	10 c	17 c	31 c
LSD (0.05)		**16**	**12**	**10**

[1]Roundup PowerMax at 28 fl oz/A + Class Act NG at 2.5% v/v; SelectMax at 6 fl oz/A + Class Act NG at 2.5% v/v

Weed Suppression at Prosper. There is some evidence suggesting cover crop stubble suppresses germination and emergence of broadleaf weeds. Percent weed suppression across cover crop and burndown herbicide combination was collected visually on June 6 and June 12 and was collected using stand counts per unit area on June 12. Cereal rye stubble suppressed emergence and growth of hairy nightshade, lambsquarters, and pigweed better than winter wheat stubble or the no stubble blocks, but weed suppression was confounded by incomplete cover crop burndown control in some treatments (Table 6). Cover crop termination date did not affect weed suppression from cereal rye but delaying winter wheat termination to April 25 improved weed suppression. Winter wheat did not suppress hairy nightshade, lambsquarters, and pigweed. However, there were numeric differences in suppression when wheat cover crop termination date was delayed from April 21 to April 25 and from April 17 to April 21. Both visual and stand count data (data not presented) collected June 6 and 12 suggest that cereal rye stubble suppresses broadleaf weeds even after rye was killed with April applications of Roundup PowerMax.

Table 6. Visual weed suppression from cereal rye and winter wheat stubble, by cover crop termination date

	Cereal rye	Winter wheat
Cover Crop	%	%
April 17	91 a	39 c
April 21	96 a	51 c
April 25	93 a	71 b
No Cover Crop	55 b	54 b
LSD (0.05)	**18**	