2011 SMBSC RESEARCH REPORT

Southern Minnesota Beet Sugar Cooperative

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SMBSC Official Variety Trial Procedures

Four Official Variety Trial locations were planted in 2011. These trials were located near Murdock, Renville, Lake Lillian, and Hector. Trials are planted with a modified 12 row John Deere 7300 planter. Plots are four rows wide by forty feet long. Emergence counts are taken approximately 28 days after planting, and alleys are cut perpendicular to the rows. After the emergence counts are taken, plots are thinned to a uniform spacing of approximately 190 sugarbeets per 100 foot of row, and all doubles are removed. Quadris was banded over the row after thinning to suppress rhizoctonia root and crown rot.

Weed control was accomplished by applying Roundup WeatherMax and additional herbicides if needed. All spraying operations are conducted by a tractor sprayer driving down the tilled alleys, so no wheel tracks can affect yield within the plots. All spraying operations were conducted by SMBSC Research Staff. Four cercospora leafspot fungicide applications were made on all four plots.

In early September, approximately 2.5 feet is tilled under on each end of every plot to eliminate the nitrogen 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 are defoliated using a 4-row defoliator. The center two rows of each plot are harvested using a 2-row research harvester. All beets harvested from the center two rows are weighed on a scale on the harvester and a sample of beets is taken for quality analysis.

Varieties were entered into various disease nurseries to evaluate the disease tolerance of the varieties. Cercospora leafspot nurseries were conducted near Renville and at a Betaseed location near Rosemount. Aphanomyces root rot nurseries were conducted at Betaseed's facility in Shakopee and in a Syngenta aphanomyces nursery near Glyndon, MN. Rhizoctonia tolerance was tested at a location near Clara City as well as the BSDF rhizoctonia nursery near Ft. Collins, CO.

All the data is summarized and merged with the 2009 and 2010 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 planting the next year's SMBSC sugarbeet crop.

2011 SMBSC Official Variety Trials Specifications

Trial Location	Cooperator	Entry Designation	Previous Crop	Starter Fertilizer	Planting Date	Stand Counts	Disease	Harvest Date
Hector	G.E. Johnson Inc	Official Trial	Field Corn	Yes	6/2/11	6/27/11	Moderate aphanomyces	10/12/11
Lake Lillian	Schmoll Bros.	Official Trial	Sweet Corn	No	5/18/11	6/15/11	Moderate aph, Light - Moderate rhizomania	9/29/11
Renville	C&P Haen	Official Trial	Field Corn	Yes	5/4/11	6/1/11	Moderate - Severe aphanomyces	9/24/11
Murdock	Petersen Farms	Official Trial	Sweet Corn	No	5/17/11	6/9/11	Moderate rhizoctonia and rhizomania	10/6/11

All trials were sprayed with RoundUp three times for weed control.
Quadris was band applied to all trials at approximately the 4 leaf beet stage for rhizoctonia suppression.
Four CLS fungicide applications were applied to all trial locations except the Murdock location which received five applications.

2011 Disease Nursery Trial Specifications

Disease	Cooperator	Location	Ratings Performed By	Use of Ratings in 2011 Variety Approval
Cercospora	Betaseed	Rosemount	Betaseed	50 % of 2011 CLS Rating
Cercospora	SMBSC Randy Frieborg	Renville	SMBSC Research	50% of 2011 CLS Rating
Aphanomyces	Betaseed	Shakopee	Betaseed, Jason Brantner, Carol Windels, Mark Bloomquist	50% of 2011 Aphanomyces Rating
Aphanomyces	Hilleshog	Glyndon	SMBSC Research Staff	50% of 2011 Aphanomyces Rating
Rhizoctonia	USDA/ARS/BSDF Lee Panella	Ft. Collins, CO	USDA/ARS	Specialty Approval Status
Rhizcotonia	SMBSC Bob Condon	Clara City	SMBSC Research Staff	Specialty Approval Status

SMBSC APPROVED VARIETIES – 2012

FULLY APPROVED
UNLIMITED SALES VARIETIES

Beta 99RR64
Beta 98RR08
Crystal RR265
Crystal RR850
Hilleshog 4017RR
SV 36835RR
SV 36938RR

RHIZOCTONIA
SPECIALTY
APPROVED VARIETIES

Hilleshog 9093RR (Rhizoctonia)
Hilleshog 4063RR (Rhizoctonia)

RHIZOCTONIA
SPECIALTY
TEST MARKET
(Sales limited to 5% of total seed sales)

Beta 99RR53 (Rhizoctonia)

TEST MARKET VARIETIES - All have 2 years testing.
(Sales shall not exceed 10% of total seed sales for each variety).

Beta 90RR54
Crystal RR018
SV 36091RR
SV 36094RR

Previously Approved Varieties and not
Making 2012 Approval – Last year of sales.

Hilleshog 4096RR

High Sugar Specialty Approval
*****total seed use limited to 10% or less of total acres for 2012

Beta 99RR84
SV 36135RR

Table 1. Comparison of Three Year 2012 SMBSC Varieties Aproved for Unlimited Sales - Based Upon Approval Criteria

Entry	RST+ RSA	*Rec/T (lbs)* 3 yr avg	% of mean	*Rec/A (lbs)* 3 yr avg	% of mean	*Yield (T/A)* 3 yr avg	% of mean	*Sugar %* 3 yr avg	% of mean	*Cercospora Leaf Spot* 3 yr avg	% of mean	*Emerg-ence (%)* 3 yr avg	% of mean	*Aphano-myces* 3 yr avg	% of mean	*Purity (%)* 3 yr avg	% of mean	*Revenue/ * Ton* % of mean	*Revenue/ * Acre* % of mean
2012 APPROVED VARIETIES																			
Beta 98RR08	202.94	272.44	101.52	8178.55	101.41	30.02	100.13	16.11	101.41	4.34	90.27	67.07	99.10	4.24	97.43	90.83	100.00	102.48	102.62
Beta 99RR64	202.72	269.61	100.46	8246.23	102.25	30.41	101.45	15.92	100.22	4.83	100.60	67.67	99.99	4.96	113.92	90.89	100.07	100.53	102.01
Crystal RR265	202.18	266.70	99.38	8290.41	102.80	30.87	102.98	15.86	99.86	4.56	94.96	63.89	94.40	3.97	91.12	90.51	99.64	98.99	101.97
Crystal RR850	201.80	265.33	98.87	8300.70	102.93	31.16	103.94	15.79	99.38	5.35	111.23	68.26	100.87	4.09	93.88	90.56	99.70	98.28	102.17
Hilleshog 4017RR	195.01	268.42	100.02	7660.49	94.99	28.61	95.45	15.99	100.64	5.31	110.42	69.65	102.92	4.50	103.35	90.57	99.71	100.51	95.95
SV 36835RR	194.51	263.03	98.01	7782.13	96.50	29.53	98.50	15.51	97.62	4.88	101.53	68.83	101.71	4.41	101.37	91.14	100.34	96.54	95.11
SV 36938RR	200.84	272.99	101.73	7992.71	99.11	29.24	97.55	16.02	100.87	4.37	90.99	68.36	101.01	4.31	98.92	91.32	100.54	102.68	100.18
		268.36	100.00	8064.46	100.00	29.98	100.00	15.89	100.00	4.81	100.00	67.68	100.00	4.35	100.00	90.83	100.00	100.00	100.00
RHIZOCTONIA SPECIALTY APPROVED VARIETIES WITH THREE YEARS OF DATA																			
Beta 99RR53	199.94	252.97	94.27	8522.28	105.68	33.48	111.69	15.02	94.55	5.14	106.94	71.53	105.70	4.71	108.06	90.81	99.97	90.41	100.99
Hilleshog 4063RR	197.01	262.35	97.76	8003.96	99.25	30.75	102.56	15.67	98.67	4.24	88.23	72.04	106.45	4.20	96.37	90.48	99.61	96.84	99.34
Hilleshog 9093RR	196.51	262.98	98.00	7944.49	98.51	30.34	101.22	15.71	98.88	4.34	90.32	72.43	107.03	4.06	93.22	90.58	99.72	97.45	98.65
PREVIOUSLY APPROVED VARIETY WITH THREE YEARS OF DATA - NOT MAKING APPROVAL FOR 2012 - LAST YEAR OF SALES																			
Hilleshog 4096RR	193.24	264.18	98.44	7644.50	94.79	28.85	96.22	15.80	99.48	3.99	83.02	64.85	95.82	4.63	106.25	90.24	99.34	97.70	94.02
HIGH SUGAR SPECIALTY VARIETY WITH THREE YEARS OF DATA																			
Beta 99RR84	203.12	271.77	101.27	8213.82	101.85	30.23	100.83	15.99	100.68	5.31	110.41	64.62	95.49	4.54	104.25	91.17	100.37	101.98	102.85

* Revenue per Ton and Revenue per Acre figures were produced using the SMBSC payment formula for the 2010 crop.

Table 2. Comparison of 2012 Approved Varieties to Candidate Test Market Varieties Based on 2 Year Data, 2010 - 2011

Entry		RST+ RSA	*Rec/T (lbs)* 2 yr avg	% of mean	*Rec/A (lbs)* 2 yr avg	% of mean	*Yield (T/A)* 2 yr avg	% of mean	*Sugar %* 2 yr avg	% of mean	*Cercospora Leaf Spot* 2 yr avg	% of mean	*Emerg-ence (%)* 2 yr avg	% of mean	*Aphano-myces* 2 yr avg	% of mean	*Purity (%)* 2 yr avg	% of mean	*Revenue/ * Ton* % of mean	*Revenue/ * Acre* % of mean
2012 APPROVED VARIETIES																				
Beta 98RR08		200.30	271.70	101.30	7328.94	99.01	27.01	98.21	16.18	101.28	4.50	92.51	63.90	96.58	4.27	95.63	90.25	99.90	102.03	100.26
Beta 99RR64		201.73	269.99	100.66	7481.90	101.07	27.52	100.06	16.02	100.31	5.27	108.51	66.48	100.48	5.27	118.06	90.42	100.09	100.73	100.85
Crystal RR265		204.31	267.84	99.86	7732.21	104.45	28.61	104.00	16.00	100.18	4.39	90.31	63.55	96.05	3.84	85.92	90.09	99.73	99.73	103.78
Crystal RR850		206.12	262.88	98.01	8002.87	108.11	30.33	110.28	15.76	98.65	5.57	114.70	65.39	98.83	4.05	90.78	90.03	99.66	96.91	106.93
Hilleshog 4017RR		192.97	268.45	100.09	6875.77	92.88	25.56	92.92	16.10	100.81	5.19	106.82	68.35	103.31	4.59	102.92	90.12	99.76	100.90	93.80
SV 36835RR		193.52	263.35	98.18	7057.21	95.33	26.68	97.01	15.60	97.65	4.82	99.19	68.11	102.94	4.84	108.40	90.70	100.40	96.72	93.87
SV 36938RR		201.05	273.35	101.91	7339.06	99.14	26.83	97.53	16.15	101.12	4.28	87.97	67.36	101.81	4.39	98.29	90.76	100.46	102.98	100.50
			268.22	100.00	7402.56	100.00	27.50	100.00	15.97	100.00	4.86	100.00	66.16	100.00	4.46	100.00	90.34	100.00	100.00	100.00
TEST MARKET VARIETIES FOR LIMITED SALES WITH 2 YEARS OF DATA (% OF MEAN IS OF APPROVED MEAN)																				
Beta 90RR54		205.62	275.11	102.57	7628.56	103.05	27.48	99.90	16.28	101.94	4.34	89.29	63.73	96.32	4.78	106.96	90.70	100.40	104.28	104.24
Crystal RR018		206.84	273.17	101.84	7772.17	104.99	28.53	103.73	16.28	101.91	4.81	99.00	54.45	82.29	4.69	105.01	90.58	100.26	103.92	107.87
SV 36091RR		198.33	269.39	100.43	7246.84	97.90	26.79	97.41	15.96	99.93	3.88	79.75	58.21	87.98	4.31	96.44	90.57	100.25	100.43	97.88
SV 36094RR		200.31	271.38	101.18	7338.50	99.13	26.95	97.99	16.04	100.40	4.33	89.15	64.55	97.56	4.47	100.11	90.83	100.55	101.89	99.90
2012 RHIZOCTONIA SPECIALTY APPROVED VARIETIES (% OF MEAN IS OF APPROVED MEAN)																				
Beta 99RR53	Spec	196.72	248.11	92.50	7715.09	104.22	30.80	111.97	14.85	92.98	5.47	112.63	70.14	106.00	4.91	109.95	90.26	99.92	87.53	98.07
Hilleshog 4063RR	Spec	196.52	262.25	97.77	7310.18	98.75	28.06	102.00	15.78	98.81	3.90	80.17	71.05	107.38	4.39	98.28	90.02	99.65	97.16	99.16
Hilleshog 9093RR	Spec	196.13	263.91	98.39	7235.20	97.74	27.60	100.33	15.86	99.31	4.16	85.60	71.70	108.36	4.32	96.86	90.18	99.83	98.41	98.80
PREVIOUSLY APPROVED VARIETY - NOT MAKING APPROVAL FOR 2012 - LAST YEAR OF SALES																				
Hilleshog 4096RR		190.98	262.22	97.76	6900.24	93.21	26.21	95.30	15.81	98.99	3.98	81.79	65.01	98.25	4.83	108.26	89.67	99.26	96.63	92.14
HIGH SUGAR SPECIALTY VARIETY WITH TWO YEARS OF DATA																				
Beta 99RR84		204.16	271.97	101.40	7607.13	102.76	27.93	101.53	16.08	100.65	5.60	115.23	61.58	93.07	4.64	103.92	90.76	100.47	102.17	103.79

* Revenue per Ton and Revenue per Acre figures were produced using the SMBSC payment forumla for the 2010 crop.

Table 3. Comparison of 2012 Full Approved Varieties to Test Market and Specialty Approved Varieties Based on 1 Year Data, 2011

2012 APPROVED VARIETIES

Entry	Specialty	RST+ RSA	*Rec/T (lbs)* 1 yr avg	*Rec/T (lbs)* % of mean	*Rec/A (lbs)* 1 yr avg	*Rec/A (lbs)* % of mean	*Yield (T/A)* 1 yr avg	*Yield (T/A)* % of mean	*Sugar %* 1 yr avg	*Sugar %* % of mean	*Cercospora Leaf Spot* 1 yr avg	*Cercospora Leaf Spot* % of mean	*Emergence (%)* 1 yr avg	*Emergence (%)* % of mean	*Aphanomyces* 1 yr avg	*Aphanomyces* % of mean	*Purity (%)* 1 yr avg	*Purity (%)* % of mean	*Revenue/Ton* % of mean	*Revenue/Acre* % of mean
Beta 98RR08		200.49	266.39	100.52	5926.61	99.97	22.54	100.54	16.20	101.16	4.79	100.32	60.94	98.88	4.33	95.94	88.81	99.51	100.94	101.56
Beta 99RR64		195.07	264.98	99.99	5636.73	95.08	21.29	94.96	15.87	99.10	4.96	103.77	58.33	94.64	5.18	114.74	89.55	100.34	99.17	94.24
Crystal RR265		206.38	263.68	99.50	6336.33	106.88	24.10	107.49	15.97	99.72	4.49	94.01	59.12	95.92	3.47	76.83	89.02	99.75	98.95	106.45
Crystal RR850		210.01	260.75	98.39	6617.19	111.62	25.42	113.38	15.87	99.10	5.38	112.60	62.45	101.33	4.31	95.33	89.06	99.79	97.95	111.14
Hilleshog 4017RR		190.85	263.90	99.58	5410.90	91.27	20.61	91.93	16.12	100.66	4.93	103.16	63.91	103.69	4.81	106.59	88.91	99.63	100.32	92.29
SV 36835RR		195.57	261.70	98.75	5739.74	96.82	21.72	96.88	15.69	97.98	4.54	95.16	64.29	104.31	5.06	111.98	89.63	100.43	97.37	94.40
SV 36938RR		201.64	273.69	103.27	5831.30	98.36	21.26	94.83	16.38	102.28	4.34	90.97	62.39	101.23	4.45	98.60	89.73	100.54	105.29	99.92
			265.01	100.00	5928.40	100.00	22.42	100.00	16.01	100.00	4.78	100.00	61.63	100.00	4.52	100.00	89.24	100.00	100.00	100.00

TEST MARKET VARIETIES WITH 1 YEAR DATA (% OF MEAN IS OF APPROVED MEAN)

Entry	Specialty	RST+ RSA	Rec/T 1 yr avg	Rec/T % of mean	Rec/A 1 yr avg	Rec/A % of mean	Yield 1 yr avg	Yield % of mean	Sugar 1 yr avg	Sugar % of mean	Cercospora 1 yr avg	Cercospora % of mean	Emergence 1 yr avg	Emergence % of mean	Aphanomyces 1 yr avg	Aphanomyces % of mean	Purity 1 yr avg	Purity % of mean	Revenue/Ton % of mean	Revenue/Acre % of mean
Beta 90RR54		209.30	275.22	103.85	6251.30	105.45	22.61	100.85	16.52	103.16	4.54	95.00	61.91	100.45	4.99	110.48	89.66	100.47	106.67	107.65
Crystal RR018		212.13	273.33	103.14	6461.39	108.99	23.71	105.75	16.55	103.35	4.67	97.88	49.31	80.01	5.05	111.72	89.58	100.38	106.79	113.02
SV 36091RR		195.74	265.77	100.29	5658.74	95.45	21.29	94.96	16.02	100.04	3.94	82.54	48.77	79.13	4.56	100.85	89.28	100.04	100.16	95.18
SV 36094RR		204.22	272.76	102.92	6005.10	101.29	21.84	97.41	16.37	102.22	4.31	90.23	59.79	97.01	4.65	102.87	89.79	100.61	105.33	102.68

2012 RHIZOCTONIA SPECIALTY APPROVED VARIETIES (% OF MEAN IS OF APPROVED MEAN)

Entry	Specialty	RST+ RSA	Rec/T 1 yr avg	Rec/T % of mean	Rec/A 1 yr avg	Rec/A % of mean	Yield 1 yr avg	Yield % of mean	Sugar 1 yr avg	Sugar % of mean	Cercospora 1 yr avg	Cercospora % of mean	Emergence 1 yr avg	Emergence % of mean	Aphanomyces 1 yr avg	Aphanomyces % of mean	Purity 1 yr avg	Purity % of mean	Revenue/Ton % of mean	Revenue/Acre % of mean
Beta 99RR53	RCZ	187.61	240.21	90.64	5748.76	96.97	24.00	107.05	14.59	91.11	5.40	113.05	66.40	107.73	5.00	110.65	89.19	99.94	84.16	90.16
Hilleshog 4063RR	APH & RZC	200.42	261.49	98.67	6031.84	101.74	23.33	104.06	15.97	99.72	3.86	80.81	65.84	106.83	4.64	102.79	89.23	99.98	99.48	103.60
Hilleshog 9093RR	APH & RZC	200.66	262.81	99.17	6016.91	101.49	23.02	102.68	16.02	100.04	4.07	85.14	67.96	110.27	4.57	101.20	89.23	99.98	100.03	102.79

PREVIOUSLY APPROVED VARIETY - NOT MAKING APPROVAL FOR 2012 - LAST YEAR OF SALES

Entry	Specialty	RST+ RSA	Rec/T 1 yr avg	Rec/T % of mean	Rec/A 1 yr avg	Rec/A % of mean	Yield 1 yr avg	Yield % of mean	Sugar 1 yr avg	Sugar % of mean	Cercospora 1 yr avg	Cercospora % of mean	Emergence 1 yr avg	Emergence % of mean	Aphanomyces 1 yr avg	Aphanomyces % of mean	Purity 1 yr avg	Purity % of mean	Revenue/Ton % of mean	Revenue/Acre % of mean
Hilleshog 4096RR	APH & RZC	192.54	259.43	97.89	5611.30	94.65	21.74	96.97	15.92	99.41	3.96	82.99	56.54	91.74	4.81	106.43	88.38	99.03	96.78	93.91

HIGH SUGAR SPECIALTY VARIETY WITH ONE YEARS DATA

Entry	Specialty	RST+ RSA	Rec/T 1 yr avg	Rec/T % of mean	Rec/A 1 yr avg	Rec/A % of mean	Yield 1 yr avg	Yield % of mean	Sugar 1 yr avg	Sugar % of mean	Cercospora 1 yr avg	Cercospora % of mean	Emergence 1 yr avg	Emergence % of mean	Aphanomyces 1 yr avg	Aphanomyces % of mean	Purity 1 yr avg	Purity % of mean	Revenue/Ton % of mean	Revenue/Acre % of mean
Beta 99RR84		205.20	269.94	101.86	6126.42	103.34	22.69	101.20	16.21	101.22	5.54	116.08	58.86	95.50	4.83	106.85	89.57	100.36	102.99	104.31
SV 36135RR		209.72	278.42	105.06	6204.94	104.66	22.43	100.04	16.57	103.47	4.58	95.92	67.87	110.12	4.95	109.47	89.87	100.70	107.76	107.89

* Revenue per Ton and Revenue per Acre figures were produced using the SMBSC payment forumla for the 2010 crop.

2010-2011 Rhizoctonia Nursery Results

2011 SMBSC - Clara City Nursery

%CV	17.24
LSD (0.05)	0.87
Expt. Mean	4.41

	Average Root Rating
2012 Fully Approved Varieties	
Beta 98RR08	5.12
Beta 99RR64	5.01
Crystal RR265	4.47
Crystal RR850	5.07
Hilleshog 4017RR	4.05
SV 36835RR	4.35
SV 36938RR	4.39
2012 Test Market Varieties	
Beta 90RR54	4.11
Crystal RR018	4.25
SV 36091RR	5.40
SV 36094RR	5.14
2012 Rhizoctonia Specialty Approved Varieties	
Beta 99RR53	3.71
Hilleshog 4063RR	2.99
Hilleshog 9093RR	2.37
2012 High Sugar Specialty Approved Varieties	
Beta 99RR84	5.43
SV 36135RR	4.93
2012 Last Year of Sales	
Hilleshog 4096RR	4.09
Coded Resistant Check	3.38
Coded Susceptible Check	5.36
Baseline 5a Beta 95RR03	4.70
Baseline 5b Beta 95RR03	4.45
Baseline 6a Crystal RR265	4.48
Baseline 6b Crystal RR265	4.80
Baseline 7a Hilleshog 4017RR	4.58
Baseline 7b Hilleshog 4017RR	4.85
Baseline 8a Hilleshog 9093RR	3.52
Baseline 8b Hilleshog 9093RR	3.00

2011 BSDF - Ft. Collins Nursery

%CV	19.37
LSD (0.05)	0.74
Expt. Mean	3.1

	Disease Index Rating
Beta 98RR08	3
Beta 99RR64	2.8
Crystal RR265	3.1
Crystal RR850	3
Hilleshog 4017RR	3.7
SV 36835RR	3.6
SV 36938RR	3.5
Beta 90RR54	3.3
Crystal RR018	3.1
SV 36091RR	3.7
SV 36094RR	3
Beta 99RR53	2.8
Hilleshog 4063RR	2.2
Hilleshog 9093RR	2.9
Beta 99RR84	2.9
SV 36135RR	3.1
Hilleshog 4096RR	2.9
Coded Resistant Check	2.5
Coded Susceptible Check	3
Baseline 5a Beta 95RR03	3.6
Baseline 5b Beta 95RR03	3.2
Baseline 6a Crystal RR265	3
Baseline 6b Crystal RR265	3.4
Baseline 7a Hilleshog 4017RR	3.6
Baseline 7b Hilleshog 4017RR	3.9
Baseline 8a Hilleshog 9093RR	2.5
Baseline 8b Hilleshog 9093RR	2.5
Ft. Collins Checks	
Highly Resistant Check FC705/1	2
Susceptible Check - (FC901/C817)//413	2.8
Resistant Check FC703	2.5
Highly Resistant Check FC709-2	1.7
Commercial Susceptible	3.3
Commercial Resistant	2.4
Commercial Resistant	2.3

2010 BSDF - Ft. Collins Nursery**

%CV	10.83
LSD (0.05)	0.79
Expt. Mean	5.8

	Disease Index Rating
Beta 90RR54	6.1
Crystal RR018	5.6
Beta 99RR53	5.0
Hilleshog 4063RR	5.8
Hilleshog 9093RR	5.6
Hilleshog 4096RR	6.4
Coded Resistant Check	5.7
Coded Susceptible Check	5.9
Baseline 5a Beta 95RR03	5.8
Baseline 5b Beta 95RR03	5.5
Baseline 6a Crystal RR265	6.1
Baseline 6b Crystal RR265	6.2
Baseline 7a Hilleshog 4017RR	6.3
Baseline 7b Hilleshog 4017RR	6.2
Baseline 8a Hilleshog 9093RR	6.0
Baseline 8b Hilleshog 9093RR	5.7

*Roots are dug in Late August - Early September and visually rated.
Ratings for all rhizoctonia nurseries are on a 1-7 scale.
1 = Healthy
7 = Dead

** Not all varieties were entered in 2010 BSDF Ft. Collins Nursery

2011 SMBSC Strip Trial Results

Northern Strip Trial

Agriculturist: Lon Buss
Location: Appleton

Plant date: 4/27/2011
Harvest date: 9/21/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean
Beta 99RR64	30.28	14.71	89.47	7335	102.35%
Beta 99RR84	30.06	15.07	90.49	7584	109.11%
Beta 98RR08	28.35	14.6	88.87	6751	92.95%
Crystal RR850	27.86	14.91	89.4	6839	96.42%
SV 36938RR	31.16	14.87	90.8	7785	111.21%
Hilleshog 4063RR	28.25	14.76	89.54	6875	96.28%
Hilleshog 9093RR	28.67	14.7	88.53	6841	94.34%
Hilleshog 9093RR +Dynasty	29.95	14.43	89.37	7098	97.33%
Average	**29.32**	**14.76**	**89.56**	**7138.50**	**100%**

*Revenue calculated using the 2010 crop revenue calculator
**Hand harvested by harvesting 10 foot of row in ten locations across field.

Northern Strip Trial

Agriculturist: Jim Radermacher
Location: Belgrade early harvest

Plant date: 5/3/2011
Harvest date: 9/21/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean
Beta 99RR64	26.7	14.38	88.33	6204	99.58%
Beta 99RR84	23.42	14.83	89.66	5739	96.10%
Beta 98RR08	26.29	14.57	88.54	6215	101.19%
Crystal RR850	26.05	14.76	89.57	6343	105.70%
SV 36938RR	27.95	14.56	89.61	6711	110.63%
Hilleshog 4063RR	23.23	14.78	88.56	5578	91.95%
Hilleshog 9093RR	24.28	14.97	89.35	5982	100.57%
Hilleshog 9093RR +Dynasty	23.18	14.87	89.14	5652	94.29%
Average	**25.14**	**14.72**	**89.10**	**6053.00**	**100%**

*Revenue calculated using the 2010 crop revenue calculator
** Hand harvested by harvesting 10 foot of row in 10 locations across field.

Northern Strip Trial

Agriculturist: Jim Radermacher
Location: Belgrade late harvest

Plant date: 5/3/2011
Harvest date: 10/24/2011

Variety	Foliar Rhizoc Rating (A-F)**	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean
Beta 99RR64	B-	25.6	16.33	90.39	7023	95.90%
Beta 99RR84	C-	23.69	16.72	90.91	6712	93.51%
Beta 98RR08	C	24.8	15.79	88.88	6411	84.19%
Crystal RR850	B	30.07	16.27	90.44	8223	112.07%
SV 36938RR	B	28.81	16.76	91.35	8235	115.31%
Hilleshog 4063RR	A-	26.67	16.72	90.16	7476	103.47%
Hilleshog 9093RR	A-	24.89	17.1	91.03	7234	102.29%
Hilleshog 9093RR +Dynasty	A-	23.28	16.89	90.81	6658	93.26%
Average		**25.98**	**16.57**	**90.50**	**7246.50**	**100%**

*Revenue calculated using the 2010 crop revenue calculator

2011 SMBSC Strip Trial Results

Test Market Varieties Strip Trial

Agriculturist: Lon Buss
Location: **Benson**

Plant date: 5/17/2011
Harvest date: 9/24/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean
SV 36938RR	12.26	15.02	90.94	3102	97.14%
Crystal RR850	16.7	15.32	89.9	4251	133.69%
Beta 98RR08	13.56	14.23	89.17	3156	92.64%
Beta 99RR64	8.59	16.21	90.17	2331	76.53%
Average	12.78	15.20	90.05	3210	100%

Moderate to Severe rhizoctonia pressure

*Revenue calculated using the 2010 crop revenue calculator

Test Market Variety Strip Trial

Agriculturist: Les Plumley
Location: **Bird Island early harvest**

Plant date: 5/18/2011
Harvest date: 9/23/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean
Beta 99RR64	13.09	15.45	89.78	3356	103.81%
Beta 98RR08	10.53	15.83	90.34	2793	88.42%
Crystal RR850	14.75	16.09	90.21	3973	127.05%
SV 36938RR	13.47	16.14	90.76	3669	118.18%
Hilleshog 4063RR	9.42	15.75	89.61	2459	77.00%
Hilleshog 9093RR	10.13	15.93	90.11	2696	85.54%
Average	11.90	15.87	90.14	3157.67	100%

*Revenue calculated using the 2010 crop revenue calculator

Test Market Variety Strip Trial

Agriculturist: Les Plumley
Location: **Bird Island late harvest**

Plant date: 5/18/2011
Harvest date: 10/24/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean
Beta 99RR64	14.56	16.85	90.81	4154	96.21%
Beta 98RR08	12.92	17.14	90.44	3733	87.11%
Crystal RR850	17.47	16.96	90.77	5015	116.60%
SV 36938RR	14.89	17.47	90.78	4411	104.40%
Hilleshog 4063RR	14.42	17.71	91.07	4351	104.04%
Hilleshog 9093RR	13.64	17.09	90.5	3932	91.64%
Average	14.65	17.20	90.73	4266.00	100%

*Revenue calculated using the 2010 crop revenue calculator

2011 SMBSC Strip Trial Results

Test Market Variety Strip Trial

Agriculturist: Cody Bakker
Location: Clara City
Plant date: 5/17/2011
Harvest date: 10/21/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean	Notes
SV 36938RR	26.1	17.21	90.5	7580	120.76%	
Crystal RR850	25.71	16.34	88.96	6909	104.97%	
Beta 98RR08	18.21	16.47	89.17	4951	75.78%	Wheel Tracks
Beta 99RR64	22.24	16.79	90.39	6283	98.48%	
Average	23.07	16.70	89.76	6431	100%	

*Revenue calculated using the 2010 crop revenue calculator

Test Market Variety Strip Trial

Agriculturist: Paul Wallert
Location: Murdock
Plant date: 5/18/2011
Harvest date: 9/30/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean	Notes
Beta 98RR08	21.67	16.61	88.63	5895	84.15%	On field edge
Beta 99RR64	24.26	16.65	90.32	6786	98.56%	
Beta 99RR84	23.99	17.34	90.69	7042	105.21%	
SV 36938RR	25.51	17.05	92.05	7497	112.08%	
Average	23.86	16.91	90.42	6805.00	100%	

Rhizoctonia root rot patches in strip trial

*Revenue calculated using the 2010 crop revenue calculator

Test Market Variety Strip Trial

Agriculturist: Jim Radermacher
Location: Raymond
Plant date: 5/19/2011
Harvest date: 10/1/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean
SV 36938RR	15.45	17.34	92.1	4625	107.62%
Crystal RR850	17.7	15	92.2	4551	96.37%
Beta 98RR08	17	16.25	90.64	4656	102.82%
Beta 99RR64	14.5	16.57	91.86	4124	93.20%
Average	16.16	16.29	91.70	4489	100%

*Revenue calculated using the 2010 crop revenue calculator

2011 SMBSC Strip Trial Results

Rhizoctonia Specialty Variety Strip Trial

Agriculturist: Mike Schjenken
Location: Renville

Plant date: 5/16/2011
Harvest date: 9/29/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean
Beta 99RR53	18.43	15.75	90.1	4845	106.89%
Hilleshog 4063	16.03	17.01	89.83	4554	105.50%
Hilleshog 9093	16.23	17	90.24	4635	107.74%
Hilleshog 9093 + Dynasty	14.29	16.8	89.63	3995	91.66%
Beta 98RR08	13.7	16.54	90.93	3839	88.21%
Average	15.74	16.62	90.15	4373.60	100%

*Revenue calculated using the 2010 crop revenue calculator

Rhizoctonia Specialty Variety Strip Trial

Agriculturist: Greg Johnson
Location: Olivia

Plant date: 5/19/2011
Harvest date: 10/1/2011

Variety	Tons Per Acre	Sugar %	Purity %	ESA lbs/acre	Revenue / Acre % of Mean
Beta 99RR53	18.87	15.86	91.09	5069	110.76%
Hilleshog 4063RR	15.81	16.41	90.56	4370	97.24%
Hilleshog 9093RR	14.38	16.58	90.4	4009	89.68%
Hilleshog 9093RR +Dynasty	16.42	16.58	90.37	4576	102.33%
Average	16.37	16.36	90.61	4506	100%

*Revenue calculated using the 2010 crop revenue calculator

SMBSC Application of Pop-up and Foliar Fertilizer Products for Enhancement of Sugarbeet Growth

SMBSC growers have adopted the practice of applying products for enhancement of sugar beet production. SMBSC research has reviewed the data available from various sources pertaining to the pop-up and foliar products. The products tested in the following article are products that are marketed by in combination with 10-34-0 starter fertilizer.

Methods

Testing was initiated in 2010 to evaluate the influence of pop-up and foliar products on sugarbeet production. The test sites were at Bird Island and Maynard, Mn in 2010 and in Cosmos and Sacred Heart, Mn in 2011. Carbon Boost is an in-furrow product and Lucrose is a foliar applied product of which the manufacturer claims increases nutrient uptake and efficacy. Statistical analysis of the data for homogeneity of combinability determined that the data could be combined across environments and locations.

Table A shows the total (N-P-K) available at the various locations. All plots were adjusted to the SMBSC recommendation of 100 lbs. Tables 1 show the site specifics for all locations. Plots were 11 feet (6 rows) wide and 35 feet long. Infurrow applications were applied at planting time with a 6 row planter. Sugarbeet samples were collected from rows 3 and 4 of a 6 row plot. Sugarbeets at all locations were harvested with a 2 row research harvester. One sub-sample was collected from each plot. The weights were collected and weighed on the harvester for yield calculation and the subsample was analyzed in the SMBSC quality lab.

Result and Discussion

The testing will be summarized in accordance with table 6 since statistical analysis shows the data is similar at all locations. All treatments increase tons, extractable sucrose per acre and revenue per acre compared to the untreated except with treatment 4 with 10-34-0 plus carbon boost. The data indicated that the addition of Lucrose to the treatment enhanced tons per acre, extractable sucrose per acre and revenue more that 10-34-0 or carbon boost. The data indicated that Lucrose tended to increase sugar content.

Table 1 A: Site Specific for Total N-P-K for each Location. 2010-2011

Location	Total N	P-O ppm	K ppm
Maynard	104	5	173
Bird Island	101	15	168
Cosmos	47	10	168
Sacred Heart	80	18	232

Table 1 B. Site Specific for Evaluation of Starter Fertilizers and Carbon Based Ammendments for Sugarbeet Production, 2010-2011

Location	Planting Date	Soil Conditions
Maynard, 2010	5/7/2010	Moist
Bird Island, 2010	5/4/2010	Moist
Cosmos, 2011	5/18/2011	Damp
Sacred Heart, 2011	5/19/2011	Damp

Table 2. Carbon Products Comparison Report
Maynard, 2010

Trt	Product	Rate	Timing	Stand Avg	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	untreated		N/A	170	15.0	16.20	90.11	4055	72.46
3	10-34-0 starter	3 gal/a	at planting	180	19.5	16.12	90.77	5295	94.92
4	10-34-0 starter	3 gal/a	at planting	190	20.8	16.27	90.27	5670	101.96
	Carbon Boost	6 oz./a	at planting						
5	10-34-0	3 gal/a	at planting	180	21.9	16.25	90.22	5969	107.14
	Carbon Boost	6 oz./a	at planting						
	Lucros	16 oz./a	at full canopy						
6	10-34-0	3 gal/a	at planting	180	24.7	16.28	90.62	6771	122.38
	Carbon Boost	6 oz./a	at planting						
	Lucros	16 oz./a	at full canopy						
	Lucros	16 oz./a	10-14 days aft.						
			1st app. of 1056						
7	10-34-0	3 gal/a	at planting	190	25.6	15.90	90.76	6827	120.55
	Lucros	16 oz./a	at full canopy						
		C.V		11	8.7	2.60	1.64	4	11.38
		LSD (0.05)		3	2.5	0.60	2.11	17	107.57

Table 3. Carbon Products Comparison Report
Bird Island, 2010

Trt	Product	Rate	Timing	Stand Avg	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	untreated		N/A	140	16.9	16.78	91.23	4844	88.30
3	10-34-0 starter	3 gal/a	at planting	150	21.9	16.71	90.90	6215	112.40
4	10-34-0 starter	3 gal/a	at planting	160	17.4	16.42	90.93	4834	86.04
	Carbon Boost	6 oz./a	at planting						
5	10-34-0	3 gal/a	at planting	140	20.4	16.90	90.76	5835	106.26
	Carbon Boost	6 oz./a	at planting						
	Lucrose	16 oz./a	at full canopy						
6	10-34-0	3 gal/a	at planting	130	21.3	16.89	90.92	6105	111.28
	Carbon Boost	6 oz./a	at planting						
	Lucrose	16 oz./a	at full canopy						
	Lucrose	16 oz./a	10-14 days aft.						
			1st app. of Lucrose						
7	10-34-0	3 gal/a	at planting	130	24.1	16.61	90.77	6764	121.41
	Lucrose	16 oz./a	at full canopy						
		C.V		30	11.6	3.11	1.52	13	14.84
		LSD (0.05)		6	3.2	NS	NS	1006	20.99

Table 4. Carbon Products Comparison Report
Maynard, 2010

Trt	Product	Rate	Timing	Stand Avg	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	untreated		N/A	170	15.0	16.20	90.11	4055	72.46
3	10-34-0 starter	3 gal/a	at planting	180	19.5	16.12	90.77	5295	94.92
4	10-34-0 starter	3 gal/a	at planting	190	20.8	16.27	90.27	5670	101.96
	Carbon Boost	6 oz./a	at planting						
5	10-34-0	3 gal/a	at planting	180	21.9	16.25	90.22	5969	107.14
	Carbon Boost	6 oz./a	at planting						
	Lucrose	16 oz./a	at full canopy						
6	10-34-0	3 gal/a	at planting	180	24.7	16.28	90.62	6771	122.38
	Carbon Boost	6 oz./a	at planting						
	Lucrose	16 oz./a	at full canopy						
	Lucrose	16 oz./a	10-14 days aft.						
			1st app. of Lucrose						
7	10-34-0	3 gal/a	at planting	190	25.6	15.90	90.76	6827	120.55
	Lucrose	16 oz./a	at full canopy						
		C.V		11	8.7	2.60	1.64	4	11.38
		LSD (0.05)		3	2.5	NS	NS	17	107.57

Table 5. Carbon Products Comparison Report
Bird Island, 2010

Trt	Product	Rate	Timing	Stand Avg	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	untreated		N/A	140	16.9	16.78	91.23	4844	88.30
3	10-34-0 starter	3 gal/a	at planting	150	21.9	16.71	90.90	6215	112.40
4	10-34-0 starter	3 gal/a	at planting	160	17.4	16.42	90.93	4834	86.04
	Carbon Boost	6 oz./a	at planting						
5	10-34-0	3 gal/a	at planting	140	20.4	16.90	90.76	5835	106.26
	Carbon Boost	6 oz./a	at planting						
	Lucrose	16 oz./a	at full canopy						
6	10-34-0	3 gal/a	at planting	130	21.3	16.89	90.92	6105	111.28
	Carbon Boost	6 oz./a	at planting						
	Lucrose	16 oz./a	at full canopy						
	Lucrose	16 oz./a	10-14 days aft.						
			1st app. of Lucrose						
7	10-34-0	3 gal/a	at planting	130	24.1	16.61	90.77	6764	121.41
	Lucrose	16 oz./a	at full canopy						
		C.V		30	11.6	3.11	1.52	13	14.84
		LSD (0.05)		6	3.2	NS	NS	1006	20.99

Table 6. Carbon Products Comparison Report
2 Year Combined Data, 2010-2011

Trt	Product	Rate	Timing	Stand Avg	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	untreated		N/A	171	15.4	16.05	90.11	4152	80.66
3	10-34-0 starter	3 gal/a	at planting	179	19.9	16.18	90.61	5439	108.47
4	10-34-0 starter	3 gal/a	at planting	185	17.5	16.01	90.41	4729	92.06
	Carbon Boost	6 oz./a	at planting						
5	10-34-0	3 gal/a	at planting	176	18.7	16.44	90.71	5208	103.34
	Carbon Boost	6 oz./a	at planting						
	Lucrose	16 oz./a	at full canopy						
6	10-34-0	3 gal/a	at planting	179	20.4	16.34	90.39	5621	111.30
	Carbon Boost	6 oz./a	at planting						
	Lucrose	16 oz./a	at full canopy						
	Lucrose	16 oz./a	10-14 days aft.						
			1st app. of Lucrose						
7	10-34-0	3 gal/a	at planting	175	21.9	16.25	90.39	5964	118.14
	Lucrose	16 oz./a	at full canopy						
		C.V		18	8.8	2.97	1.40	10	12.99
		LSD (0.05)		NS	2.5	0.35	NS	645	13.07

Evaluation of Infurrow Products to Enhance Sugar Beet Production 2008-2011

Pop-up fertilizer testing by SMBSC Research has shown there is a benefit to using 10-34-0 starter fertilizer to enhance sugarbeet production. A test was developed in 2008 to test various pop-up products and determine if any of the tested products alone or in combination with 10-34-0 would further increase production.

Methods

Sugarbeets were planted at three locations in in 2008, two locations in 2009, two locations in 2010 and one location in 2011 to test the influence of pop-up fertilizer and infurrow products on sugarbeet production. The site specific data for 2008 – 2011 is included in table 1. The locations were Wood Lake, Clara City and Hector, MN in 2008, Clara City and Hector, MN in 2009, Bird Island and Maynard, MN in 2010 and Cosmos in 2011. Plots were 11 feet (6 rows) wide and 35 feet long. Pop-up fertilizers and in-furrow products were applied at planting time with a 6 row planter. Mixtures of product tested were applied as a 6 gal per acre mix.

In 2008 all research sites and in 2009 the Clara City site was harvested with a 1 row research harvester. Two quality sub samples were collected from each plot and analyzed for quality and weighed for yield calculation. Each sample was collected from 10 feet of row. Harvest data was collected from rows 3 or 4 of a 6 row plot. In 2009 the Hector site and the sites in 2010 and 2011 were harvested with a 2 row research harvester and the whole plot length was harvested. One sub-sample was collected from each plot and analyzed for quality. Statistical analysis of the data for homogeneity of combinability determined that the data could not be combined across locations for 2008 – 2011. Data from 2010 was combined across locations. Treatments were expanded in 2010 and 2011 which complicated the ability to combine all 2008, 2009, 2010 and 2011data. Data was analyzed for 2010 combined across locations and 2011 separately and with common treatments across years of 2008, 2009, 2010 and 2011. The analysis for the fore mentioned comparisons are presented in table 5 and 6 and graphs 1, 2, 3 and 4.

Materials

Popup fertilizer used in this experiment was 10-34-0. Nachurs 6-24-6 which is an in-furrow fertilizer derived from ammonium hydroxide, phosphoric acid, and potassium hydroxide. Soygreen® is a dry water soluble powder 6% Iron ORTHO-ORTHO EDDHA Chelate. Redline™ contains many nutrients that are necessary for plant growth as well as the same technology that is used in Soygreen®. A three gallon application of redline provides 1 lb., of Soygreen. EB Mix® is a product containing a blend of nitrogen, sulfur, boron, iron, manganese and zinc. Riser® is 7-17-3 with micronutrients and ACA® Technology. Radiate® contains two different plant growth regulators. JumpStart® contains the naturally occurring fungus *Penicillium bilaii*, which naturally forms Carboxillic acid and helps increase the amount of phosphate readily available to plants by releasing bound phosphate from the soil. MAN-GRO DF is a highly concentrated water soluble manganese powder designed for foliar application. It is designed to combat Glyphosate induced Manganese Deficiency that has been known to occur in glyphosate resistant plants. Boron was applied using Tetra-Bor 10. The product contains 10% boron as well as some macro-nutrients.

Results and Discussion

The presented data is separated into a progression of research over the duration of testing. The research on infurrow products comparison with the traditional 10-34 0 started in 2008. As previously mentioned, in 2010 treatments were significantly changed and again changed significantly in 2011. Thus, the 2010 and 2011 data are presented separately in table 2 and 3, respectively. The treatments common in 2009-2011 are presented in table 4 and treatments common in 2008-2011 are presented in table 5. Data presented in the tables are Tons per acre (Tons), sugar percent (% sugar), purity, extractable sugar per ton (ext. suc. per ton), extractable sugar per acre (ext. suc. per acre), and percent of revenue (% revenue). The percent of revenue is the treatments revenue relative to the mean expressed as a percent. In 2010 Tons per acre, Purity, extractable sucrose per acre and revenue was significantly influenced by the infurrow treatments. Redline at 3 gal. /acre, E-B mix at 1 qt. +10-34-0 at 3 gal/acre and Man-Gro DF at 3 lbs. /acre gave the highest revenue per acre of treatments tested in 2010. In 2011 all variables presented were significantly influenced by infurrow treatments tested. The highest revenue was realized with Redline at 3 gal/acre and Soygreen at 1lb. /acre + 10-34-0 at 3 gal/acre. Popup fertilizer 10-34-0 gave 105% revenue percent of mean and multiple other similar type products gave equal revenue percent of mean. The treatments applying micronutrients manganese and boron gave significantly lower revenue percent of mean compared to the standard 10-34-0. There is no clear explanation of this anomaly since in most cases the application of manganese has shown to be beneficial for sugarbeet production. The combined data over 2009 and 2011 showed all treatments to be statistically significant when compared to the untreated plot. Using any of the tested infurrow treatments should increase production. Redline and Soygreen +10-34-0 produced revenue percent of mean greater than the standard 10-34-0. The treatments common in testing from 2008 through 2011 are presented in table 5. These data show that there was no significant difference among infurrow products tested over the duration of testing. There was a trend for Soygreen at 1 lb. /acre and Man-Gro at 3 lbs. /acre to be beneficial for sugarbeet production. The overall summary of the infurrow product testing from 2008 to 2011 showed that the inclusion of pop-up fertilizer was beneficial to sugarbeet production. And the combination of Soygreen and pop-up fertilizer significantly increased sugarbeet production. Future work should include research investigating infurrow products with a holistic nutrient approach. The interest in a holistic approach is a result of research demonstrating the advantage of fertilizer products applied together and individually showing a beneficial benefit to sugarbeet production. Research will need to consider method, rate and timing of application to best benefit sugarbeet production.

Table 1. Site Specifics for Pop-up Fertilizer Testing, 2008-2011

Task	2008			2009		2010		2011
	Wood Lake	Clara City	Hector	Clara City	Hector	Maynard	Bird Island	Cosmos
Planting date	5/19/2008	5/19/2008	5/9/2008	4/24/2009	4/28/2009	4/27/2010	4/29/2010	5/18/2011
Fertility								
Nitrogen	75	77	NO SOIL TEST	75	52	99	121	87
Phosphorus	5	19		8.0	7.9	7.7	7.5	8.0
Potassium	165	244		244	164	180	181	132
OM.	4.3	5.2		5.2	5.5	4.7	5.5	4.2
Fertilizer Applied								
Nitrogen	30 lbs.	30 lbs.	30 lbs.	35 lbs.	30 lbs.	30 lbs.	0 lbs.	20
Phosphorus								
Potassium								
Harvest	10/1/2008	10/4/2008	9/29/2008	10/24/2009	10/21/2009	10/19/2010	10/2/2010	9/30/2011

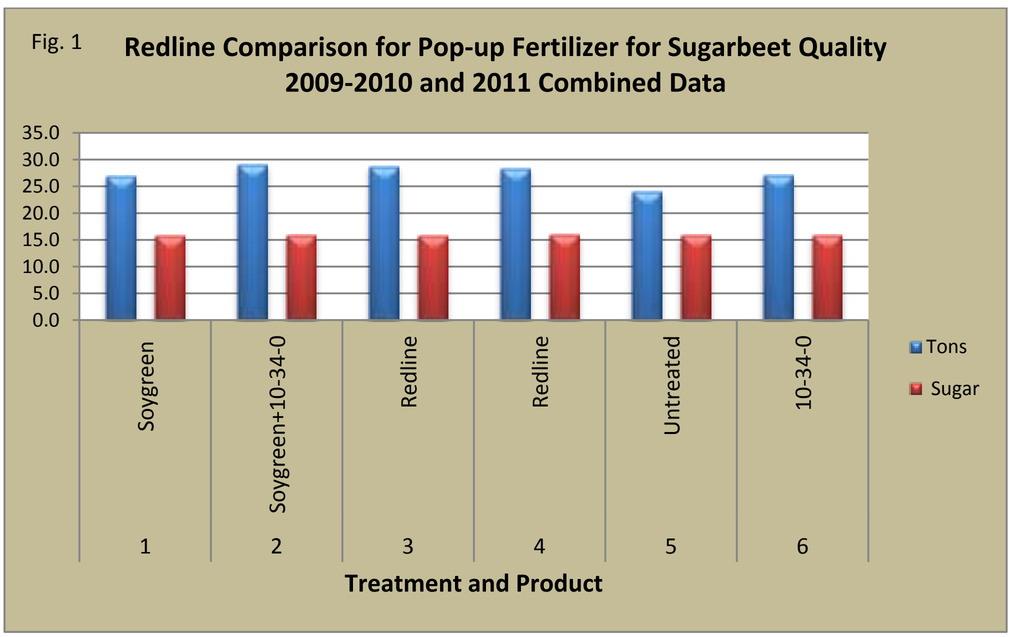
Table 2. Pop-up Fertilizer and its affects on Sugarbeet Quality and Revenue as a Percent of Means Combinded Data 2010

Trt No.	Product	Rate/Acre	Timing	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Soygreen	1 lbs.	at planting in furrow	20.9	16.11	90.54	5673	96.54
2	Broadcast P	45 lbs	at planting incorporated	19.5	16.22	90.75	5347	91.74
3	10-34-0	3 gal	at planting in furrow	20.1	16.22	90.56	5537	94.70
4	Soygreen+10-34-0	1 lb.+ 3 gal.	at planting in furrow	22.2	16.12	90.71	6033	102.90
5	Untreated	N/A	N/A	18.2	16.30	90.53	4981	85.73
6	Redline	2 gal	at planting in furrow	22.7	16.28	90.78	6246	107.57
7	Redline	3 gal	at planting in furrow	23.4	16.18	91.08	6428	110.27
8	EB Mix	1 qt	at planting in furrow	22.1	16.21	91.64	6113	105.64
9	EB Mix + 10-34-0	1 qt. + 3 gal.	at planting in furrow	24.1	16.07	90.77	6525	110.58
10	ManGro DF	3 lbs	at planting in furrow	24.3	16.01	90.59	6563	110.81
11	Boron	1.81 gal	at planting in furrow	20.3	16.30	91.02	5606	96.74
12	Untreated	N/A	N/A	18.5	16.22	90.70	5062	86.78
			C.V	8.6	2.63	1.12	9	9.79
			LSD (0.05)	1.6	NS	1.08	518	11.03

Table 3. Pop-up Fertilizer and its affects on Sugarbeet Quality and Revenue as a Percent of Means Cosmos, 2011									
Trt #	Product	Rate	Timing	Stand	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Untreated	N/A		185	14.9	15.5	90.0	3846	84.06
2	10-34-0	3 gal	at planting in furrow	194	20.6	14.9	89.3	5055	105.70
3	Nachurs 6-24-6	3 gal	at planting in furrow	180	20.5	14.9	88.7	4985	103.30
4	Soygreen	1 lbs.	at planting in furrow	203	20.5	15.0	89.0	5035	105.30
5	Soygreen +10-34-0	1 lbs. + 3 gal.	at planting in furrow	183	21.4	15.3	89.8	5433	117.07
6	Broadcast P	45 lbs	at planting incorporated	198	17.3	15.2	90.0	4373	93.91
7	Redline	2 gal	at planting in furrow	213	21.3	15.0	89.4	5263	110.51
8	Redline	3 gal	at planting in furrow	208	21.6	15.7	90.0	5631	124.19
9	EB Mix	1 qt	at planting in furrow	208	19.2	15.5	89.4	4925	106.91
10	EB Mix +10-34-0	1 qt. + 3 gal.	at planting in furrow	176	20.4	14.8	88.8	4918	101.38
11	ManGro DF	3 lbs	at planting in furrow	205	14.1	15.1	89.5	3516	74.59
12	Boron	1.81 gal	at planting in furrow	179	15.3	15.0	88.6	3740	77.81
13	Riser	2.5 gal	at planting in furrow	205	18.5	15.4	89.6	4724	102.30
14	Riser + Radiate	2.5 gal + 2 oz.	at planting in furrow	170	18.7	15.5	89.8	4840	105.72
15	LI 6372	3 pt.	at planting in furrow	191	18.1	15.3	89.5	4564	97.86
16	LI 6372	4 pt.	at planting in furrow	215	17.4	15.4	90.2	4473	97.45
			C.V	14	8.2	4.4	1.4	10	14.5
			LSD (0.05)	38	2.2	0.9	1.8	693	20.5

Table 4.Redline Comparison for Pop-up Fertilizer and it affects on Sugarbeet Quality and Revenue as a Percent of Means
Combined 2009, 2010 and 2011

Product	Rate	Timing	Tons/Acre	%Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
Soygreen	1 lbs.	at planting in furrow	27.0	15.87	90.57	7176	97.05
Soygreen +10-34-0	1 lbs. + 3 gal.	at planting in furrow	29.1	15.96	90.98	7877	107.25
Redline	2 gal	at planting in furrow	28.8	15.85	90.77	7669	104.40
Redline	3 gal	at planting in furrow	28.4	16.07	90.94	7689	107.35
Untreated	N/A	N/A	24.1	15.97	90.70	6441	86.24
10-34-0	3 gal	at planting in furrow	27.2	15.93	90.38	7261	97.71
		C.V	16.2	6.38	0.94	10	9.30
		LSD (0.05)	2.0	NS	NS	517	10.06



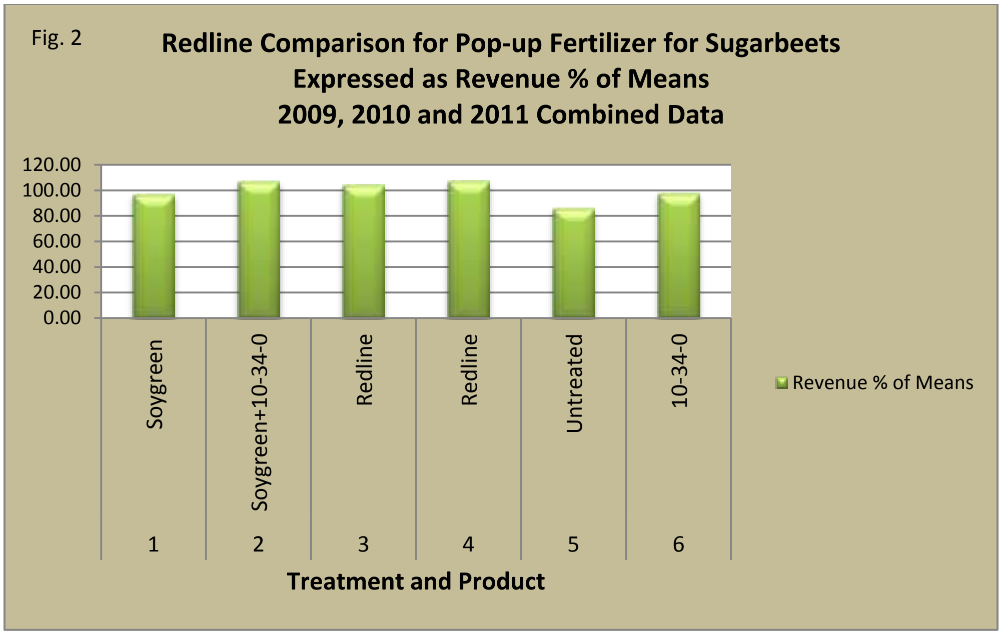


Table 5.Soygreen and 10-34-0 Comparison for Pop-up Fertilizer and it affects on Sugarbeet Quality and Revenue as a Percent of Means **(all treatments applied infurrow at planting)**

Combined Data 2008-2011

Trt No.	Product	Rate	Tons	Sugar	Purity	Ext. Sucrose Per Acre	Revenue % of Means
1	Untreated	N/A	25.3	16.13	91.13	6919	95.22
2	10-34-0	3 gal	26.6	16.01	91.04	7250	99.84
3	Boron	1.81 gal	26.2	16.08	91.05	7158	98.68
4	Broadcast P	45 lbs.	25.5	16.23	91.26	7047	97.94
5	ManGro DF	3 lbs.	27.0	16.09	91.23	7416	102.96
6	Soygreen	1 lbs.	27.3	16.18	91.01	7512	104.44
		C.V	19.4	5.54	1.10	19	13.29
		LSD (0.05)	2.5	0.32	0.47	638	11.98

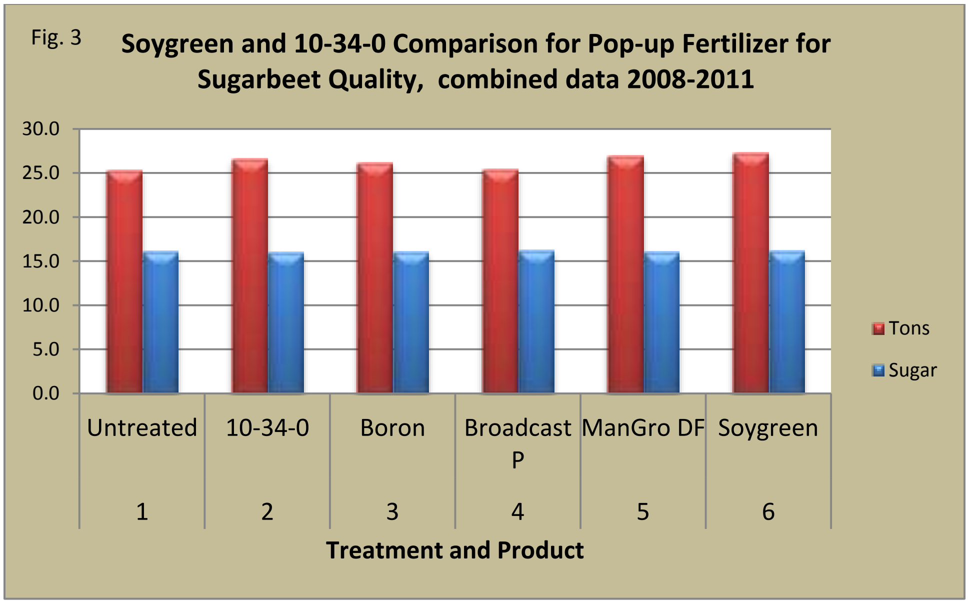


Fig. 3
Soygreen and 10-34-0 Comparison for Pop-up Fertilizer for Sugarbeet Quality, combined data 2008-2011
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Untreated
10-34-0
Boron
Broadcast P
ManGro DF
Soygreen
1
2
3
4
5
6
Treatment and Product
Tons
Sugar

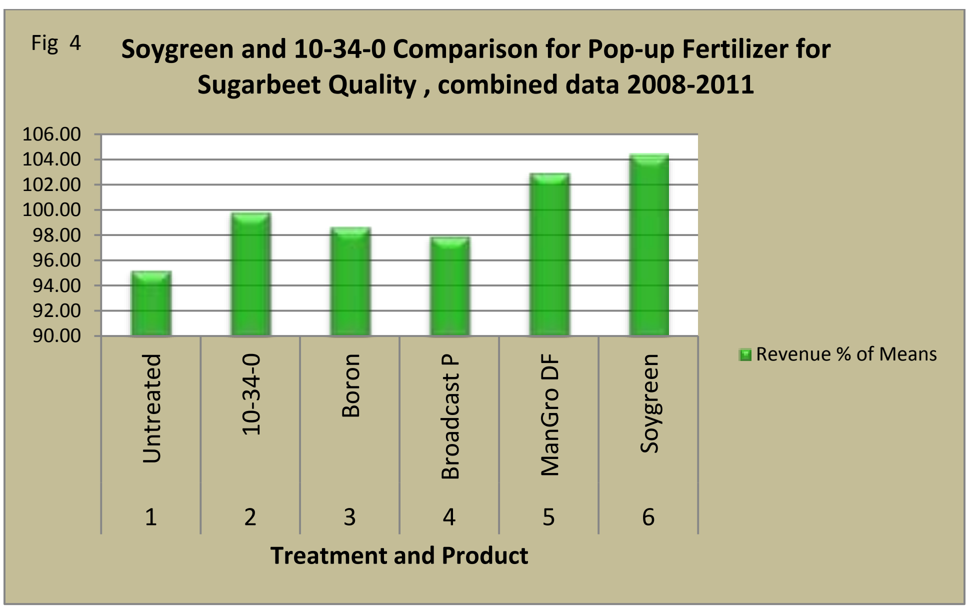


Fig 4
Soygreen and 10-34-0 Comparison for Pop-up Fertilizer for Sugarbeet Quality , combined data 2008-2011
106.00
104.00
102.00
100.00
98.00
96.00
94.00
92.00
90.00
Untreated
10-34-0
Boron
Broadcast P
ManGro DF
Soygreen
1
2
3
4
5
6
Treatment and Product
Revenue % of Means

SWEET CORN IN ROTATION WITH SUGARBEET AS A POTENTIAL HOST OF *RHIZOCTONIA SOLANI* AG 2-2

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Rhizoctonia crown and root rot (RCRR) is an increasing problem throughout sugarbeet-growing areas of Minnesota and North Dakota. The disease is caused by the soilborne fungus, *Rhizoctonia solani*, which is separated into different genetic populations called anastomosis groups (AGs) (4). The AG causing RCRR on sugarbeet is AG 2-2, which is further divided into the intraspecific groups (ISGs) AG 2-2 IV and AG 2-2 IIIB (4, 6). Both ISGs cause RCRR on sugarbeet, but AG 2-2 IV is reported as the primary cause (6) while AG 2-2 IIIB is reported as the more aggressive population (5).

In Europe, *R. solani* AG 2-2 IIIB is an aggressive root pathogen on both corn and sugarbeet in rotation (3). In the southeastern U.S.A., *R. solani* AG 2-2 IIIB causes a crown and brace root rot on corn (7, 8). Recent reports in Minnesota have demonstrated that corn is a host for *R. solani* AG 2-2 IIIB, and soybean for both ISGs, without any effects on yield or presence of aboveground symptoms (1, 10, 11, 12). In southern Minnesota, sugarbeet follows corn on 75% acres, sweet corn (10%), soybean (10%), and other crops (5%). Information is not available on the relationship of sweet corn to *R. solani* AG 2-2 ISGs.

OBJECTIVES

A field trial was established in southern Minnesota to determine 1) pathogenicity and survival of *R. solani* AG 2-2 IV and AG 2-2 IIIB on sweet corn compared to field corn, soybean, and wheat and 2) effects on a subsequent sugarbeet crop.

MATERIALS AND METHODS

2010 Rotation crops. A field trial was established in a split plot design with six replicates in the spring of 2010 near Gluek, Minnesota. Main plots (88 ft wide by 20 ft long) consisted of a non-inoculated control, inoculation with *R. solani* AG 2-2 IV, and inoculation with *R. solani* AG 2-2 IIIB. Inoculum of *R. solani* was grown for 3 weeks on sterilized barley, air-dried in the greenhouse, and hand-spread in plots (at an equivalent of 31 lb A^{-1}) and incorporated into soil on May 4. There were 11 ft by 20 ft buffers between each main plot. Main plots were divided into eight, 11 ft by 20 ft subplots which were sown on May 7, May 18 and June 30, to an early-, mid-, and late-maturing sweet corn variety, respectively. Field corn was planted on May 7, soybean on May 18, and wheat on May 19. Field corn and soybean were Roundup Ready varieties. Within main plots, there were 11 ft buffers between sweet corn and each field crop and between wheat and each RoundUp Ready crop. On June 27, weeds were controlled in sweet corn with Laudis and in field corn and soybean, with RoundUp Powermax (3 and 22 oz A^{-1}, respectively). Wheat plots were hand-weeded.

To obtain root disease ratings and plant samples to assay for *R. solani* AG 2-2, 10 plants of sweet corn and field corn and 20 plants of soybean and wheat were dug from each plot. Early- and mid-season sweet corn varieties and wheat were collected on August 4 and late-maturing sweet corn, field corn, and soybean were collected on August 24. Roots were washed and rated for root rot. Sweet corn and field corn were rated on a 1-5 scale where 1 = less than 2% of roots discolored or decayed, 5 = entire root system rotted and plant dead or dying (7). Soybean basal stems and roots were rated on a 1-5 scale where 1 = no symptoms and 5 = shoot dead and more than 75% of stem girdled (2). Wheat subcrown internodes were rated on a 0-3 scale where 0 = clean and healthy and 3 = more than 50% of the surface with lesions and discoloration (9).

After roots were assessed for disease, they were assayed to isolate *R. solani* AG 2-2. Four, 1-inch root segments were excised from each sweet corn and field corn plant, surface-treated 15 seconds in 0.5% sodium hypochlorite (bleach solution), rinsed twice in sterile deionized water, and placed on modified tannic acid medium. After 1 week, *R. solani* cultures were transferred to acidified potato dextrose agar for further identification. One-inch soybean basal stem segments and wheat subcrown internodes were cultured in the same way.

Yields of sweet corn and field corn were made by hand-harvesting all ears within 10 feet of two center rows per plot on August 24, September 14, and September 27 for early-, mid-, and late-maturing sweet corn varieties, respectively, and on September 27 for field corn. Ears of field corn were shelled with a stationary corn sheller. Wheat was harvested with a small plot combine. Soybean yield data were compromised by severe iron chlorosis in several plots and are not reported.

Data was subjected to analysis of variance (ANOVA) and if significant (P = 0.05), means were separated by Least Significant Difference (LSD).

2011 Sugarbeet crop. Plots previously infested with *R. solani* and planted with rotation crops in 2010 as described above were fertilized to recommended levels and planted to sugarbeet 'HM 4017RR' at 4 9/16 inch spacing on May 19. Sugarbeet plots were 6 rows wide, spaced 22 inches apart, and were 20 feet long. Applications of RoundUp WeatherMAX (32 oz A^{-1} on June 16) and RoundUp PowerMAX (32 oz A^{-1} on July 7 and August 1) were made for weed control using a tractor-mounted sprayer and TeeJet 8003 flat fan nozzles at 40 psi. Cercospora leafspot was controlled with applications of Inspire (7 oz A^{-1}), Agritin (8 oz A^{-1}), and Gem (3.5 oz A^{-1}) on July 20, August 1, and August 19, respectively.

Stand counts were done on June 29 and the middle two rows of plots were harvested on October 6. Beets were lifted and laid in place. Twenty roots were randomly selected from each plot and rated for RCRR with a 0 to 7 scale, where 0 = healthy and 7 = root completely rotted and foliage dead. Roots were analyzed for yield and quality by Southern Minnesota Beet Sugar Cooperative, Renville, MN.

Data were subjected to analysis of variance (ANOVA) for main effects of inoculum and previous crop and interactions between inoculum and previous crop. Where significant (P = 0.05), means were separated by Least Significant Difference (LSD).

RESULTS

Root rot ratings were not significantly different (P = 0.05) among *R. solani*-inoculated and control treatments for all crops (Table 1). Root rot ratings averaged 2.8, 3.3, and 2.6 for early-, mid-, and late-maturing sweet corn, respectively, and 1.7, 3.1, and 2.3 for wheat, field corn, and soybean, respectively.

Recovery of *R. solani* AG 2-2 from all crops was very low (data not shown). The fungus was not recovered from roots of early- and late-maturing sweet corn or from field corn. In mid-maturing sweet corn *R. solani* was isolated from 1.7% of roots in non-inoculated plots and none in *Rhizoctonia*-inoculated plots. The fungus was recovered from 0.8% of wheat roots in *R. solani* AG 2-2 IV-inoculated plots and was not isolated from roots in the non-inoculated or AG 2-2 IIIB-inoculated plots. In soybean, *R. solani* was found in 0.8% of plants in AG 2-2 IV- and AG 2-2 IIIB-inoculated plots and none in the non-inoculated control.

Inoculum treatment had no effect on yield for early-, mid-, and late-maturing varieties of sweet corn (Table 2). Late-maturing sweet corn had the lowest yields (mean = 7.5 ton A^{-1}) compared to 10.9 and 11.1 ton A^{-1} for early- and mid-maturing varieties, respectively. Yields of wheat and field corn also were not affected by inoculum treatment (Table 2) and averaged 48 and 219 bu A^{-1}, respectively.

2011 Sugarbeet crop. There were no significant (P = 0.05) interactions between inoculum treatment and previous crop, so main effects are shown separately in Table 3. There were no significant effects of inoculum on early season stands and sucrose yields. Rhizoctonia crown and root rot ratings were equal and significantly (P = 0.05) higher in plots inoculated with *R. solani* AG 2-2 ISG IIIB and *R. solani* AG 2-2 ISG IV compared to ratings in non-inoculated plots (Table 3). Root yields were higher in plots previously inoculated with *R. solani* AG 2-2 IV compared to non-inoculated plots; plots inoculated with *R. solani* AG 2-2 IIIB were intermediate.

Table 1. Root rot ratings of sweet corn, wheat, field corn, and soybean sown into soil inoculated (before crops were planted) with *Rhizoctonia. solani* AG 2-2 IV, AG 2-2 IIIB, or not inoculated in 2010.

	Root rot rating					
	Sweet corn (1-5)[X]			Wheat	Field corn	Soybean
Soil treatment [W]	Early	Middle	Late	(0-3)[Y]	(1-5)[X]	(1-5)[Z]
Non-inoculated	2.8	3.4	2.4	1.7	3.1	2.5
R. solani AG 2-2 IV	2.9	3.4	2.6	1.6	3.0	2.3
R. solani AG 2-2 IIIB	2.8	3.3	2.7	1.7	3.1	2.3
ANOVA *P*-value	0.929	0.953	0.600	0.900	0.669	0.052

[W] Inoculum of *R. solani* was grown for 3 weeks on sterilized barley, air-dried in the greenhouse, and hand spread in plots on May 4 at an equivalent of 31 lb A^{-1}.

[X] Sweet corn and field corn were rated on a 1-5 scale where 1 = less than 2% of roots were discolored or decayed, 5 = entire root system rotted and plant dead or dying (7). Each number is an average of 60 plants (10 plants/plot x 6 replicates).

[Y] Wheat subcrown internodes were rated on a 0-3 scale where 0 = clean and healthy and 3 = more than 50% of the surface with lesions and discoloration (9). Each number is an average of 120 plants (20 plants/plot x 6 replicates).

[Z] Soybean basal stems and roots were rated on a 1-5 scale where 1 = no symptoms and 5 = shoot dead and more than 75% of stem girdled (2). Each number is an average of 120 plants (20 plants/plot x 6 replicates).

Table 2. Yield of sweet corn, field corn and soybean sown into soil inoculated (before crops were planted) with *Rhizoctonia solani* AG 2-2 IV, AG 2-2 IIIB, or not inoculated in 2010.

	Yield					
	Sweet corn (ton A^{-1})[X]			Wheat[Y]	Field corn[X]	Soybean[Z]
Soil treatment[W]	Early	Middle	Late	(Bu A^{-1})	(Bu A^{-1})	(Bu A^{-1})
Non-inoculated	11.8	11.4	7.3	46	228	-
R. solani AG 2-2 IV	9.9	11.1	7.2	48	212	-
R. solani AG 2-2 IIIB	11.0	10.8	8.1	48	217	-
ANOVA *P*-value	0.062	0.938	0.373	0.923	0.185	-

[W] Inoculum of *R. solani* was grown for 3 weeks on sterilized barley, air-dried in the greenhouse, and hand spread in plots on May 4 at an equivalent of 31 lb A^{-1}.

[X] Sweet corn and field corn yield estimates were made by hand-harvesting all ears within 20 feet of row per plot on August 24, September 14, and September 27 for early-, mid-, and late-maturing sweet corn varieties, respectively, and September 27 for field corn. Field corn ears were shelled with a stationary corn sheller.

[Y] Wheat yield estimates were made with a small plot combine.

[Z] Soybean yields are not reported as data was compromised by severe iron chlorosis in several plots.

There were no significant effects of previous crop on early season stands, RCRR, root yield, and recoverable sucrose per acre. There were, however, significant effects of previous crop on percent sucrose and recoverable sucrose per ton. Percent sucrose and recoverable sucrose per ton were significantly higher in plots following early, middle, and late-planted sweet corn and field corn (P = 0.05) compared to plots following wheat; percent sucrose and recoverable sucrose per ton were intermediate in plots following soybean (Table 3).

Table 3. Early season stand, root rot ratings, yield, and quality of sugarbeet sown May 19, 2011 in experiments inoculated in May, 2010 with *Rhizoctonia solani* AG 2-2 IV, AG 2-2 IIIB, or not inoculated and then planted to full-season crops of sweet corn, field corn, soybean, or wheat in a field near Clara City, MN.

Main effect	Stand/100 ft June 29 [z]	RCRR (0-7) [z]	Yield T/A [z]	Sucrose [z] %	Sucrose [z] lb/ton	Sucrose [z] lb recov./A
Inoculum						
Non-inoculated control	196	1.7 b	28.5 b	16.4	260	7424
R. solani AG 2-2 IV	174	1.8 a	30.4 a	16.3	261	7959
R. solani AG 2-2 IIIB	188	1.8 a	29.9 ab	16.3	259	7733
LSD (P = 0.05)	NS	0.1	1.5	NS	NS	NS
Previous crop						
Early sweet corn	197	1.9	29.9	16.4 a	262 ab	7853
Middle sweet corn	190	1.8	29.2	16.5 a	262 ab	7657
Late sweet corn	178	1.8	29.5	16.7 a	268 a	7954
Field corn	192	1.8	30.1	16.4 a	263 ab	7910
Soybean	189	1.7	28.7	16.2 ab	256 bc	7362
Wheat	171	1.8	30.0	15.8 b	250 c	7496
LSD (P = 0.05) [z]	NS	NS	NS	0.5	11	NS

[z] For each column, numbers followed by the same letter are not significantly different according to Fisher's protected least significant difference (LSD, P = 0.05); NS = not significantly different.

DISCUSSION

In this experiment, inoculation of soil with *R. solani* AG 2-2 IV or 2-2 IIIB did not affect root rot or yield of sweet corn or any rotation crops compared to a non-inoculated control. Also, the fungus was infrequently recovered from roots of all crops, regardless of soil treatment. These results are not consistent with previous trials where root rot ratings of field corn were significantly higher in plots inoculated with *R. solani* AG 2-2 IIIB (11,12) and the fungus was isolated more frequently compared to non-inoculated plots. Previous trials also have shown consistent recovery of *R. solani* from soybean plants in plots inoculated with *R. solani* AG 2-2 IV and AG 2-2 IIIB compared to non-inoculated controls (1, 12). As in previous trials, growing wheat in *Rhizoctonia*-inoculated soil did not affect yield and the fungus was infrequently recovered compared to the non-inoculated control (11, 12). Inconsistencies in the 2010 trial compared to previous trials may reflect different environmental factors including soil moisture, temperature, and other pathogens and microbes present in the soil.

Inoculation of soil with *R. solani* AG 2-2 IV or 2-2 IIIB also did not have much of an effect on a subsequent sugarbeet crop. Root rot ratings were statistically lower in non-inoculated plots, but rating differences were not biologically meaningful. All treatments resulted in a mean RCRR rating <2 which is 'shallow rot, dry rot cankers, or active lateral lesions affecting ≤5% of root'. Yields were lower for the non-inoculated control plots compared to plots inoculated with *R. solani* AG 2-2 IV indicating that there was not enough pathogen population to cause damage to the sugarbeet crop. This is not surprising considering the lack of effect of inoculum treatments on the previous crops in 2010. This trial is being repeated in 2011-2012. Sugarbeets will be planted in 2012 and a report will be written for the 2012 Sugarbeet Research and Extension Reports.

ACKNOWLEDGEMENTS

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NITROGEN MANAGEMENT STRATEGIES FOR FIELD CORN BEFORE SUGARBEET

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Justification: Nitrogen management for quality sugar beet production has been a focus of nutrient management research for a number of years. A key factor in being able to manage N for sugar beet production is to have a smaller amount of residual soil nitrate-N before planting sugar beet. Close to 70 % of the sugar beet grown in the Southern Minnesota Beet Sugar Cooperative is preceded by corn. Corn needs proper N application to optimize grain yield. Corn grain yield is not hurt by over application of nitrogen when compared to sugar beet.

The use of corn stalks for bedding and a possible biofuel has increased in the last few years. The removal of the corn stalks could affect the soil mineralization processes of nitrogen. This mineralization change could affect the nitrogen management for sugar beet production following corn.

Research is needed to optimized nitrogen management throughout the whole crop rotation with or without removal of corn stalks for the greatest profit. To answer questions about nitrogen management in a corn/sugar beet production system a study with the objectives of 1; determining the effect on residual soil nitrate-N by different nitrogen and residue management systems for corn production, and 2; determining the effect of different nitrogen and residue management systems for corn grown previous to sugar beet production on sugar beet yield and quality.

Materials and Methods: The first year of this study was 2011. Two sites were chosen and corn was grown. Nitrogen treatments included a check, 120 lb N/acre, 160 lb N/acre, 200 lb N/acre, and 300 lb N/acre. The 120 lb N/acre is the University of Minnesota guideline for corn following soybean. The 160 lb N/acre treatment is based on SMBSC corn guideline when using a nitrate-N soil test (soil test nitrate-N to 2 ft. plus fertilizer = 160). The 200 and 300 lb N/acre are aggressive and excessive N applications for corn production. The nitrogen fertilizer was applied as urea or as a mix of ¼ urea and ¾ ESN. ESN is a polymer coated urea that is designed as a slow release nitrogen product. Two other treatments were added. These products have claims to boost sugar production. They are Ag Performance and LCO. The Ag Performance treatment included 3 gal/acre of Ag Performance plus 32 oz/acre of mineral 75 applied in-furrow with the 3 gal/acre of 10-34-0. The LCO was foliar applied twice during the growing season along with a preplant application of 160 lb N/acre as urea. The LCO was applied on 7/19/2011 at the V7 leaf stage and on 8/4/2011 at the V12 stage. All plots received 3 gal/acre of 10-34-0 in-furrow at planting. There were 4 replications of the treatments. Corn was hand harvested in the fall and on half of the plots the corn residue was removed. Soil samples were taken after harvest to a depth of four feet. Nitrate-N was determined and the results will determine that amount of fertilizer N will be applied for sugar beet production in 2012. A summary of the treatments can be found in Table 1.

Table 1. Summary of the Fertilizer and Residue Treatments in 2011.

Product	N rate	Residue removed
Check	0	Yes/No
Urea	120	Yes/No
Urea/ESN	120	Yes/No
Urea	160	Yes/No
Urea/ESN	160	Yes/No
Urea	200	Yes/No
Urea/ESN	200	Yes/No
Urea	300	Yes/No
Urea/ESN	300	Yes/No
Ag Performance		Yes/No
LCO	160	Yes/No

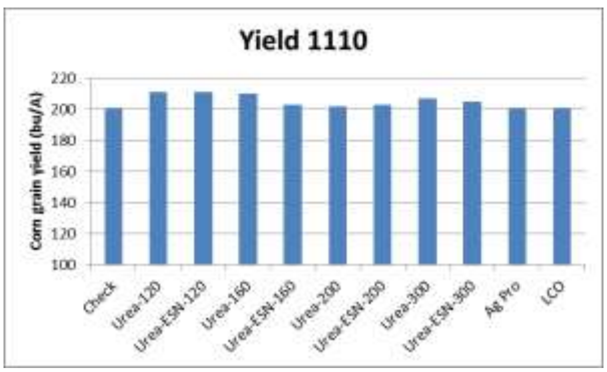
Results: The initial soil tests for sites 1110 and 1111 are in Table 2. The organic matter is greater at 1111 compared to 1110 but the initial soil nitrate-N was greater at site 1110 (72 lb N/acre) compared to site 1111 (18 lb N/acre).

Table 2. Initial Soil Test Values for Sites 1110 and 1111 in Spring 2011.

Soil test	1110 (4/25/2011)	1111 (5/2/2011)
pH	7.9	7.2
Organic matter (%)	3.5	4.8
Nitrate-N (0-2 ft.)	72	18
Olsen-P (ppm)	19	14
K (ppm)	175	164
Zinc (ppm)	1.33	1.37

Grain yield: The corn grain yield for site 1110 averaged around between 200 and 210 bu/acre in 2011. Figure 1. There was no response in corn grain yield to nitrogen application and no significant differences between the different N treatments at this site between treatments. The residual nitrate-N was 72 lb/acre. This is greater than the other site but a N response would have been expected.

Figure 1. Corn grain yields as affected by nitrogen application and nitrogen sources at site 1110 in 2011.



The corn grain yield for site 1111 responded to nitrogen fertilizer application, Figure 2. The corn grain yield for the check was 106 bu/acre while the corn grain yields increased with the 160 lb N/acre treatment being the optimum at 200 bu/acre. The average grain yield for the other product treatments was 192 bu/acre, Figure 3. There were no significant differences between the nitrogen treatments.

Figure 2. Corn grain yields as affected by nitrogen application at site 1111 in 2011.

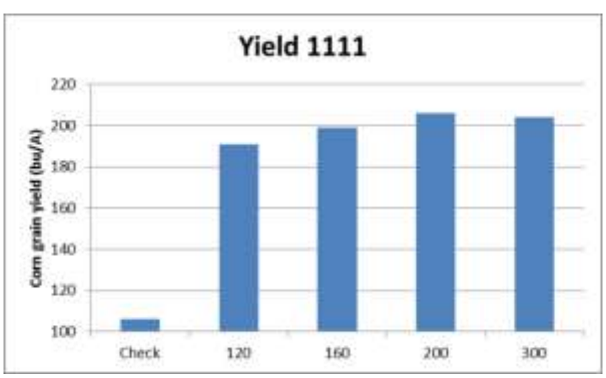


Figure 3. Corn grain yields as affected by nitrogen application and nitrogen sources at site 1111 in 2011.

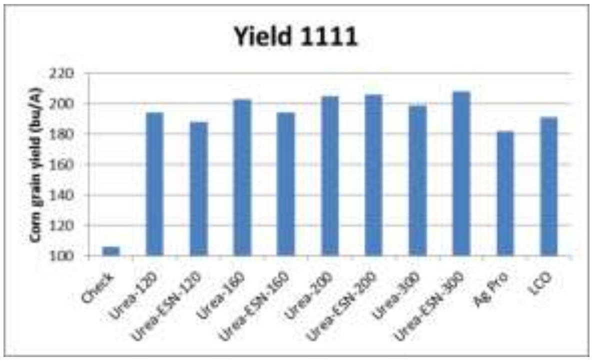
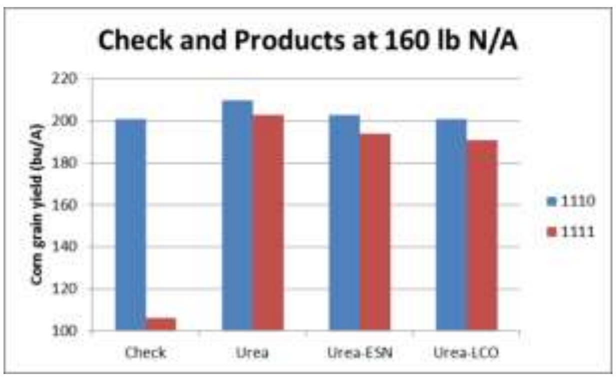


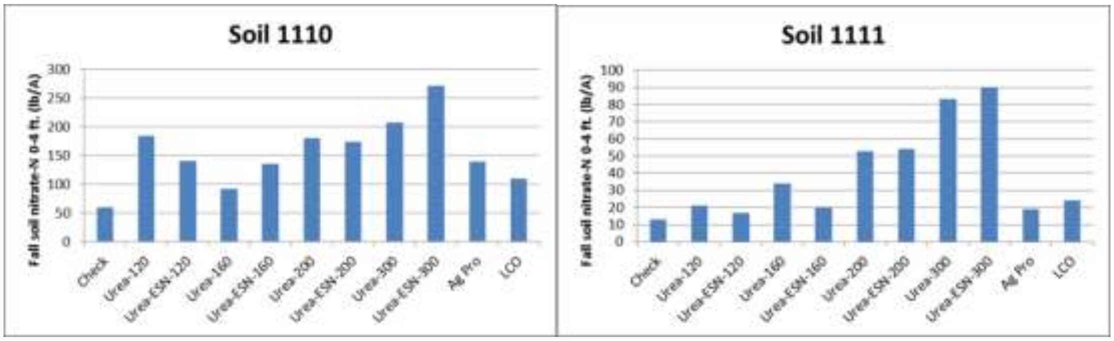
Figure 4. summarizes the corn grain yields for the check and the nitrogen sources at the 160 lb N/acre rate. There were no significant differences between the use of urea, ¼ urea- ¾ ESN mix, or the Urea and LCO treatments. Even though 2011 had a wet start, the use of a nitrogen product that extended the release of N was not beneficial. A corn grain yield response to N application occurred at 1 of the 2 sites in 2011. It was at the site with the lowest soil nitrate-N in the surface two feet.

Figure 4. Corn grain yields for the check and as affected by nitrogen sources at the 160 lb N/acre rate for sites 1110 and 1111 in 2011.



<u>Soil test:</u> After corn harvest, soil samples to four feet were taken and analyzed for nitrate-N at both locations, Figure 5. Site 1110 had significantly greater amounts of residual nitrate-N in the soil after corn production compared to site 1111. At the 1110 site, the residual soil nitrate-N from the check and Urea 160 lb N/acre treatment were low enough to recommend application of nitrogen fertilizer for the 2012 sugar beet crop. At the 1111 site, the residual soil nitrate-N amounts for all treatments were low enough to require a nitrogen fertilizer application for the 2012 sugar beet crop. At both locations, the greater amount of N applied to the corn in 2011, the greater the amount of residual nitrate-N. This indicates the excess nitrogen fertilization of corn prior to sugar beet production can leave excess residual soil nitrate-N. This can make nitrogen management for quality sugar beet more difficult.

Figure 5. Residual soil nitrate-N to a depth of four feet as affect by nitrogen rate application and nitrogen source at sites 1110 and 1111 after corn production in Fall 2011.



Summary: The grain yield at one of the two sites was increased by the addition of nitrogen. The site with the lower amount of residual soil nitrate-N in the surface two feet was the responsive site. At the site that grain yield responded to nitrogen, the optimum N rate was 160 lb N/acre.

At both sites, there was no difference in corn grain yield from the use of different N sources. All though the 2011 growing season started out wet, the use of products to extend the release of nitrogen to the plant did not affect grain yield.

The nitrogen treatments for corn grown in 2011 affected the amount of residual soil nitrate-N to four feet in the fall of 2011. In general the greater the amount of nitrogen applied, the greater the residual soil nitrate-N. Once the nitrogen application rate for corn was above the optimum needed for corn grain yield, the residual soil nitrate-N increased in the fall. In the case of one site, the residual soil nitrate-N was greater than the recommended amount for quality sugar beet production in 2012. This indicates that management of nitrogen nutrition during the whole crop rotation is very important for optimum sugar beet production.

NITROGEN AND POTASSIUM EFFECTS ON SUGAR BEET QUALITY

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Justification of Research: Growers in the Southern Minnesota have been concerned about potassium nutrition in sugar beet. Some of this concern comes from the increase in the number of potassium soil test values from production fields that are decreasing into the 100 to 120 ppm range. The concern is about loss of root yield from the lower soil test values and the loss of quality if potassium fertilizer is applied. Little research has been done on potassium in the Southern Minnesota Beet Sugar Cooperative growing area. There is a need to investigate this.

Summary of Literature Review: The current fertilizer recommendations for growing sugar beet in Minnesota include the use of potassium when soil test values are below 120 ppm, (Lamb et. al 2001). At that time the optimum N guideline was 130 pounds per acre. The amount of N was from soil nitrate-N to a depth of 4 feet. Potassium use for sugar beets grown in Minnesota was investigated in 1985, Lamb 1986. In this study, potassium was looked at as part of a nitrogen, phosphorus, and potassium factorial. There were only a couple of application rates and the rates did not cover a wide range. The combination of nitrogen and potassium could lead to increased efficiency of the plant use.

Objectives:

1. Determine the effect of nitrogen and potassium applications on sugar beet root yield and quality.

Materials and Methods: An experiment at five locations was established in the Southern Minnesota Beet Sugar Cooperative growing area, 3 in 2010 and 2 in 2011. One of the two sites in 2011 was lost because of the wet planting conditions in May. The experiment included the factorial combination of four nitrogen application rates (0, 40, 80, and 120 lb N/A) and six potassium rates (0, 30, 60, 90, 300, and 500 lb K_2O/A). The two highest potassium rates are extreme to assess the effect of potassium on the root quality, percent sucrose and beet purity. The study will have five replications. During the 2011 growing season (July) petioles from the most recently matured leaves were sampled to determine the effect of the treatments on the sugarbeet plants. In October sugarbeet roots were harvested. Root yield and quality were determined.

Results and Discussion:

Soil Test: The initial soil test for the site is reported in Table 1. The 1073 and 1172 sites are irrigated sandy soils while the other soils are glacial till soils with a texture of silty clay loam. The potassium soil tests for 3 of the 4 sites are in the marginal range. The 1075 would be considered very high.

Table 1. Initial soil test values for the sites in 2010 and 2011.

Soil test	1073 (Elrosa)	1074(RRF)	1075(Maynard)	1172(Sudan)
pH	6.7	6.6	7.9	6.3
Organic matter (%)	4.1	2.6	NA	4.0
Nitrate-N 0-4 ft. (lb./A)	62	25	111	30 (0-2ft)
Olsen – P (ppm)	10	20	6	15
K (ppm)	127	139	177	120

Root Yield: Sugar beet root yield was increased at two of the four sites by the application of nitrogen fertilizer, Table 2 and Figures 1 and 2. Increases in root yield also occurred that same sites with potassium application. At both sites there was an interaction between the root yield responses from N application and K applications. The interaction at the 1075 caused the response required more nitrogen, 80 lb. N/A for optimum root yield at the 0 and 30 lb. K_2O/A rates while the optimum was 40 lb. N/A for the sugar beet roots grown at greater rates of potassium.

Table 2. Statistical analysis for root yield for sites in 2010 and 2011.

Statistic	1073	1074	1075	1172
N rate	0.72	0.25	0.0001	0.0003
K rate	0.13	0.13	0.0002	0.0001
N rate X K rate	0.13	0.07	0.008	0.05
C.V. (%)	9.2	6.9	6.0	18.2

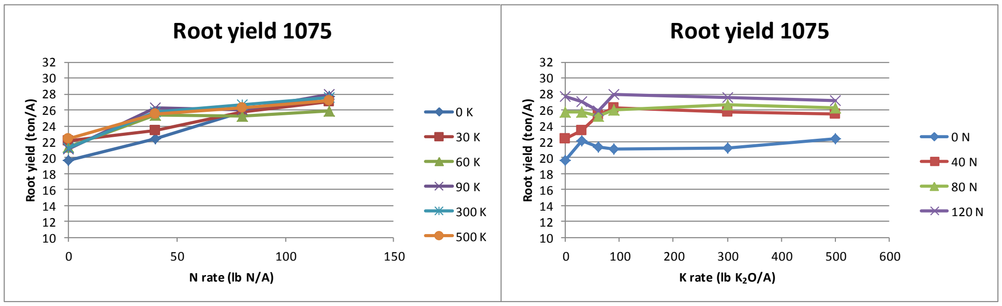

Figure 1. Root yield response to nitrogen and potassium at site 1075 in 2010.

The root yield at site 1172 was affected by the wet weather and disease in 2011, Figure 2. The root yields were as small as 10 ton/A and as large as 22 tons. There is no trend in the interaction between nitrogen and potassium at this site.

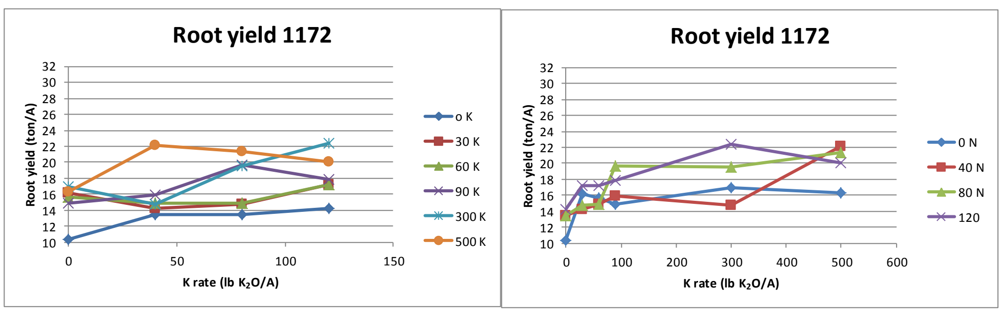

Figure 2. Root yield response to nitrogen and potassium at site 1172 in 2011.

Extractable Sucrose per ton: Nitrogen reduced extractable sucrose per ton at three of the four sites, Table 3. Potassium increased extractable sucrose per ton at two of the four sites.

At site 1075, the addition of nitrogen decreased extractable sucrose per ton from 288 lb. /ton to 278 lb. /ton, Figure 4. Potassium did not affect extractable sucrose per ton at this site.

At sites 1074 and 1172, nitrogen application decreased extractable sucrose per ton, Figures 5 and 6. This has occurred several times in nitrogen studies through the years. Nitrogen is an impurity in the sugar beet. At these same sites, potassium application increased extractable sucrose per acre, Figures 5 and 6. This is unexpected. Potassium is an impurity in the sugar beet that makes extraction of sucrose more difficult. The main increase at site 1074 occurred for the first 90 lb. K_2O/A while about that the response leveled out. At site 1172 the increase in extractable sucrose per ton increased up to the greatest K_2O rate of 500 lb. /A.

Table 3. Statistical analysis for extractable sucrose per ton for sites in 2010 and 2011.

Statistic	1073	1074	1075	1172
N rate	0.40	0.0001	0.06	0.02
K rate	0.86	0.003	0.46	0.0001
N rate X K rate	0.17	0.02	0.34	0.49
C.V. (%)	4.5	2.5	4.6	5.0

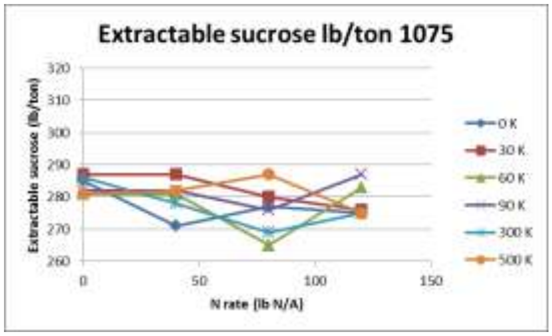

Figure 4. Extractable sucrose per ton to nitrogen for site 1075 in 2010.

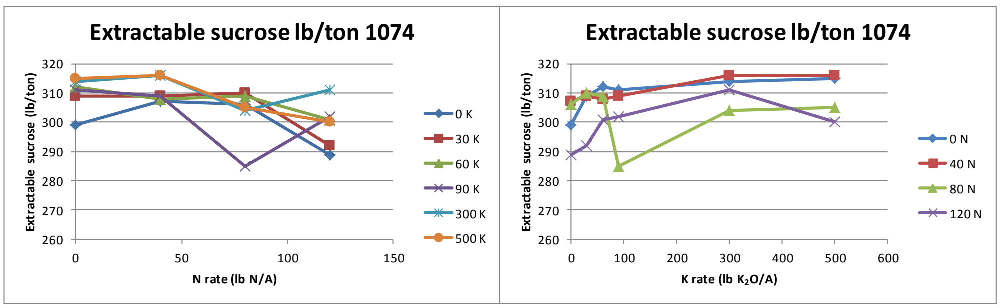

Figure 5. Extractable sucrose per ton to nitrogen and potassium for site 1074 in 2010.

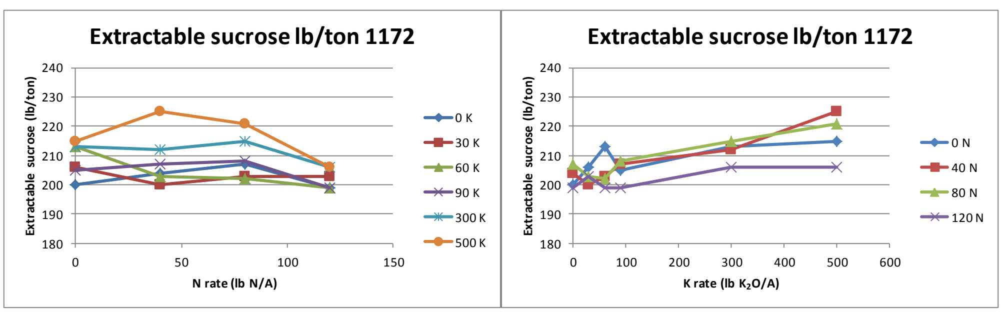

Figure 6. Extractable sucrose per ton to nitrogen and potassium for site 1172 in 2011.

Extractable Sucrose per acre: Extractable sucrose per acre was significantly affected by nitrogen application at sites 1074, 1075, and 1172, Table 4. Extractable sucrose per acre decreased with the addition of nitrogen at site 1074, Figure 7. This is a combination of the lack of root yield response to nitrogen and the decrease in quality for the application of nitrogen. There was not significant effect from the application of potassium.

At site 1075, extractable sucrose per acre was increased by application of both nitrogen and potassium, Figure 8. The optimum nitrogen rate was 80 lb. N/A for the 0 and 30 lb. K_2O/A rates and 40 lb. N/A for the 60, 90, 300, and 500 lb. K_2O/A rates. This would make the optimum N of 150 to 190 lb. N/A, soil test nitrate-N to four feet plus fertilizer N.

Nitrogen and potassium applications increased extractable sucrose per acre at the 1172 site, Figure 9. The response to potassium was greater than the response to nitrogen. This site was an irrigated sandy soil site and it was expected to respond to nitrogen and potassium application. With the above normal precipitation in 2011 movement in the soil of both N and K would be expected.

Table 4. Statistical analysis for extractable sucrose per acre for sites in 2010 and 2011.

Statistic	1073	1074	1075	1172
N rate	0.24	0.007	0.0001	0.002
K rate	0.31	0.22	0.01	0.0001
N rate X K rate	0.29	0.03	0.07	0.02
C.V. (%)	9.2	6.8	8.2	19.5

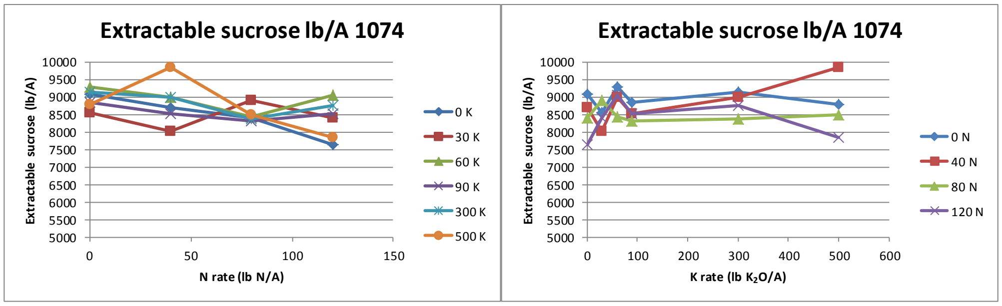

Figure 7. Extractable sucrose per acre to nitrogen and potassium for site 1074 in 2010.

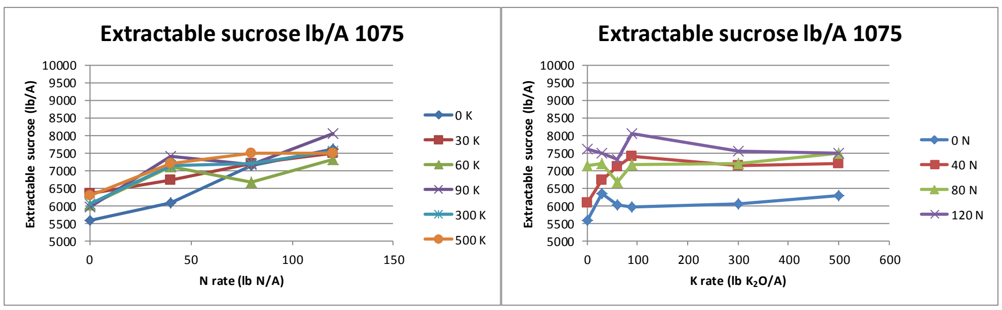

Figure 8. Extractable sucrose per acre to nitrogen and potassium for site 1075 in 2010.

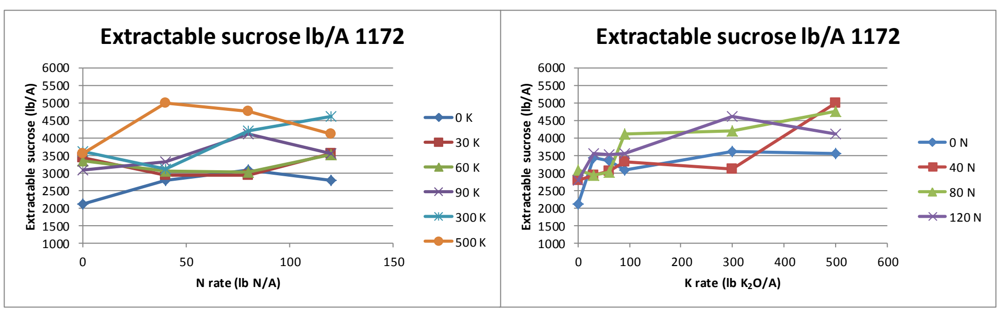

Figure 9. Extractable sucrose per acre to nitrogen and potassium for site 1172 in 2011.

Petiole Nitrate-N: Samples were taken from the most recently mature petioles in each plot at 1172 in 2011. The addition of nitrogen fertilizer increased the nitrate-N concentration in the petioles, Figure 10. The addition of potassium fertilizer decreased the concentration of nitrate-N in the petioles. This has been reported in potato petioles. This reduction in nitrate-N may explain the increase in quality from the addition of potassium even though potassium in an impurity.

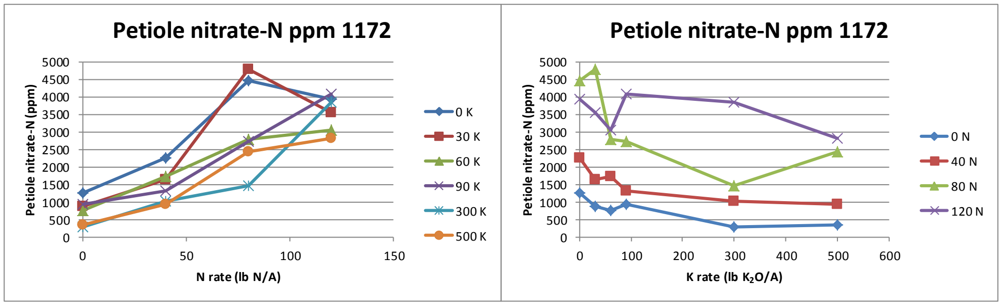

Figure 10. Petiole nitrate-N concentration as affect by nitrogen and potassium application at site 1172 in 2011.

Conclusions: Nitrogen application increased root yield at 2 of 4 sites. The use of potassium increased root yield at 2 of 4 sites. Nitrogen reduced quality at 3 of 4 sites. This was expected. The use of potassium increased quality at 2 of 4 sites even though potassium is an impurity in the extraction process. Nitrogen and potassium affected extractable sucrose per acre at 3 sites. Nitrogen increased extractable sucrose per acre at two sites and decreased it at one site. The reduction in extractable sucrose per acre is also the site where root yield was not affected by nitrogen and the quality was reduced by nitrogen application. In 2011, petiole nitrate concentrations from samples taken in mid-July were increased with the addition of N fertilizer while the addition of K fertilizer reduced it. The results reported are the produce of two years of work and because of the wet weather in 2011 should not be used with future information.

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SMBSC Evaluation of Phosphorus and its Influence on Sugarbeet Growth 2010-2011

Sugarbeets were planted at 2 locations one in 2010 in Maynard, Mn and one in 2011 in Cosmos, Mn. The data will be presented combined over the two locations. Analysis of the data was conducted for homogeneity of combinability and determined that the data could be combined across environments or locations.

Methods

Table 1 and 2 shows the specifics of activities conducted at each site. Plots were 11 ft. (6 rows) wide and 35 ft. long. Phosphorus fertilizer source 0-46-0 was applied with urea. Sugarbeets were planted with a 6 row planter. Starter fertilizer used was 10-34-0 at 3 GPA rate. The starter was mixed with water at a 1:1 ratio. The starter / water mix was applied at 6 GPA in-furrow on the seed. Harvest data was collected from the middle two rows of a 6 row plot. Research trials were harvested with a 2 row research harvester. The whole plot length was harvested and weighed. One quality sub-sample was collected from each plot and analyzed for quality at the SMBSC Tare Lab. Plots were not thinned as the sugarbeet stands did not warrant thinning.

Results and Discussion

Whether starter is or is not used 15 lbs. phosphorous per acre can increase tons per acre. In 2010 tons tended to decrease as the amount of phosphorous increased when starter was used. The phosphorous rate did not affect tons when starter was not used. Previous testing has shown starter can increase yield. This testing of phosphorous rate supports the previous work showing a benefit to the use of starter fertilizer for sugarbeet production. These results also show the benefit of using at least 15 pounds in the presence or absence of a starter.

Table 1. Site Specifics for Starter by Phosphorus Rate Testing
Maynard, 2010

DATE	PLANTED	SPACING	SOIL	APPLIED	RATE	WEATHER
4/23/2010	X	4 3/8"	Moist			
6/7/2010				Roundup/Max	32 oz	75' Cloudy, E-5
7/6/2010				Roundup/Max	32oz	70' Cloudy, NE-5
7/27/2010				Supertin	7oz	90' Pcloudy, SW-5-10
	pH	**N1 lb**	**N2 lb**	**N3 lb**	**Total N**	**P-O ppm**
	7.8	74.5	48.8	48.0	171.3	10.0

Table 2. Site Specifics for Starter by Phosphorus Rate Testing
Cosmos, 2011

DATE	PLANTED	SPACING	SOIL	APPLIED	Rate	WEATHER
5/18/2011	X	4 9/16"	Boggy			
7/13/2011				Powermax	32 oz.	71' Pcloudy E-11
				Select Max	7 oz.	
				Eminent	13 oz.	
	pH	**0-6 in. N lb**	**6-24 in. N lb**	**24-48 in. N lb**	**Total N**	**P-O ppm**
	6.9	13.8	27.8	26.0	67.5	8.0

Table 3. Starter with and without Phosphorus Rate influence on Sugarbeet Production
Maynard, 2010

Trt	Starter	P Rate	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of mean
1	Yes	0	25.7	16.97	92.20	7494	92.45
2	Yes	15	36.0	16.62	91.17	10149	122.00
3	Yes	30	29.4	16.69	91.78	8412	102.33
4	Yes	45	21.3	16.31	91.74	6094	74.10
5	Yes	60	29.4	16.75	90.86	8326	100.53
6	No	0	26.1	16.90	91.38	7549	92.65
7	No	15	27.7	16.39	91.07	7778	93.21
8	No	30	27.3	16.67	90.70	7692	92.44
9	No	45	26.8	16.40	91.45	7524	90.23
10	No	60	27.5	16.09	90.82	7481	87.31
		C.V	12.7	1.49	0.72	11	9.06
		LSD (0.05)	6.2	NS	NS	1845	24.43

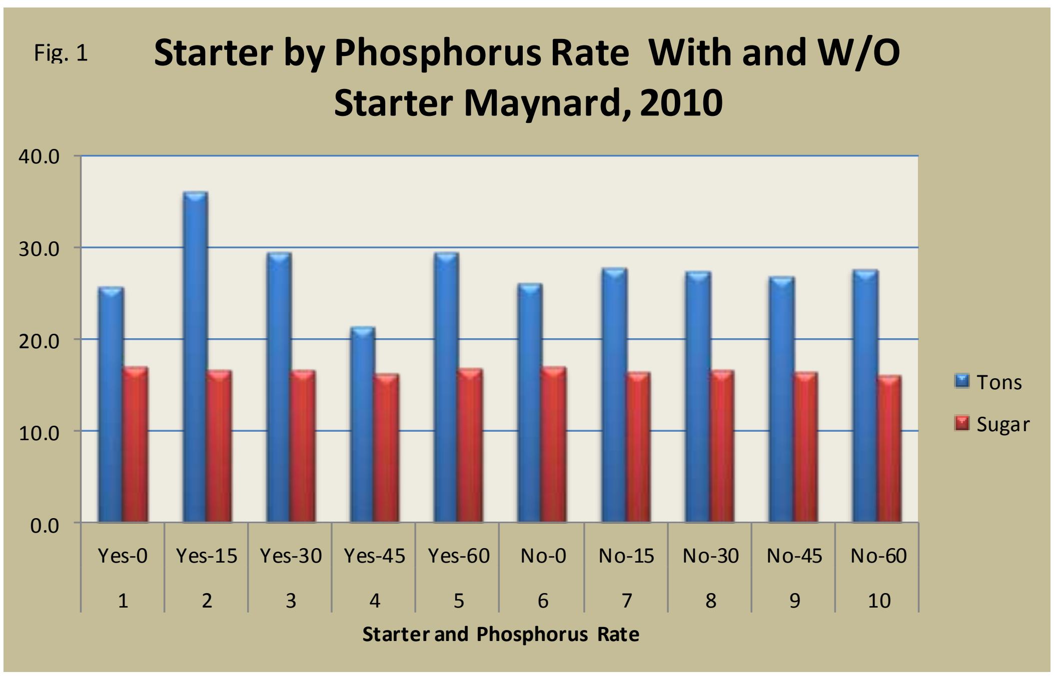
Table 4. Starter with and without Phosphorus Rate influence on Sugarbeet Production
Cosmos, 2011

Trt	Starter	P Rate	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of mean
1	Yes	0	12.4	15.77	89.91	3269	90.92
2	Yes	15	15.0	15.77	90.02	3942	109.74
3	Yes	30	16.4	15.11	89.02	4069	107.72
4	Yes	45	16.0	15.65	90.22	4187	116.13
5	Yes	60	17.8	15.36	90.15	4569	124.54
6	No	0	11.8	15.32	91.83	3074	85.21
7	No	15	13.0	15.64	89.77	3372	92.97
8	No	30	13.8	14.93	89.43	3403	89.58
9	No	45	13.0	15.61	90.39	3390	94.01
10	No	60	12.3	15.59	90.00	3197	88.11
		C.V	8.3	3.39	1.79	9	11.61
		LSD (0.05)	1.7	NS	NS	500	16.84

Table 5. Starter with and without Phosphorus Rate influence on Sugarbeet Production
Combined 2 year Data, 2010-2011

Trt	Starter	P Rate	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of mean
1	Yes	0	19.1	16.37	91.06	5383	91.76
2	Yes	15	25.5	16.19	90.59	7052	116.22
3	Yes	30	22.9	15.90	90.40	6244	105.19
4	Yes	45	19.5	16.09	91.10	5400	103.36
5	Yes	60	23.6	16.06	90.51	6453	112.81
6	No	0	18.9	16.11	91.60	5304	88.57
7	No	15	20.4	16.02	90.42	5572	92.93
8	No	30	20.6	15.80	90.06	5548	91.05
9	No	45	19.9	16.01	90.92	5463	92.42
10	No	60	19.9	15.84	90.41	5339	87.71
		C.V	49.6	6.08	1.69	56	18.47
		LSD (0.05)	3.6	NS	NS	1027	15.17

Fig. 1



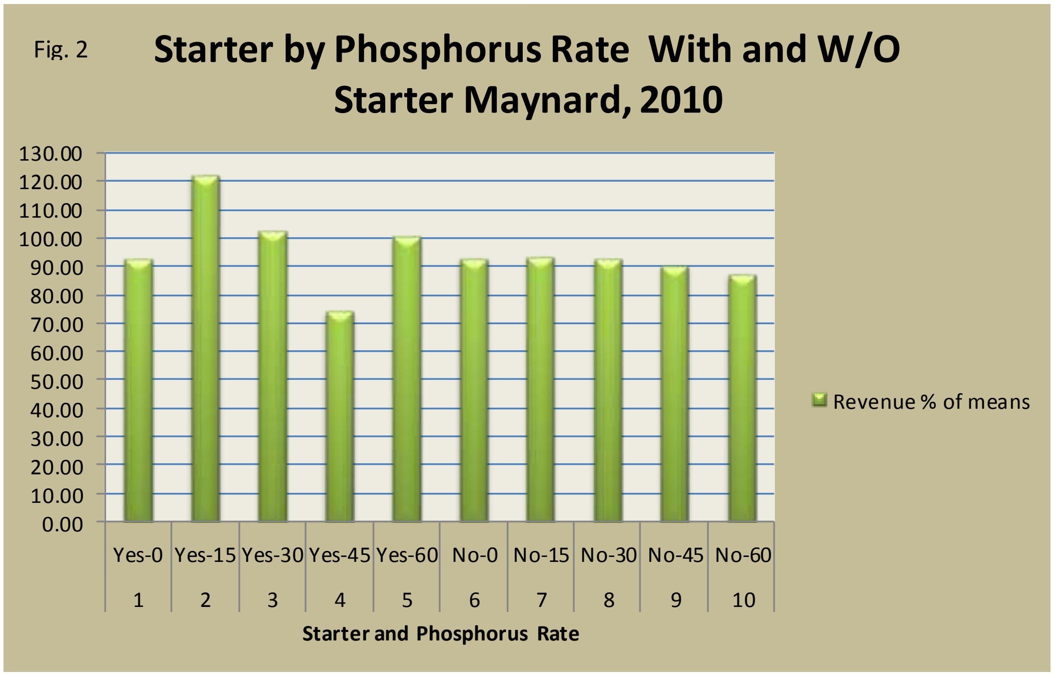


Fig. 2
Starter by Phosphorus Rate With and W/O Starter Maynard, 2010
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Yes-0 Yes-15 Yes-30 Yes-45 Yes-60 No-0 No-15 No-30 No-45 No-60
1 2 3 4 5 6 7 8 9 10
Starter and Phosphorus Rate
Revenue % of means

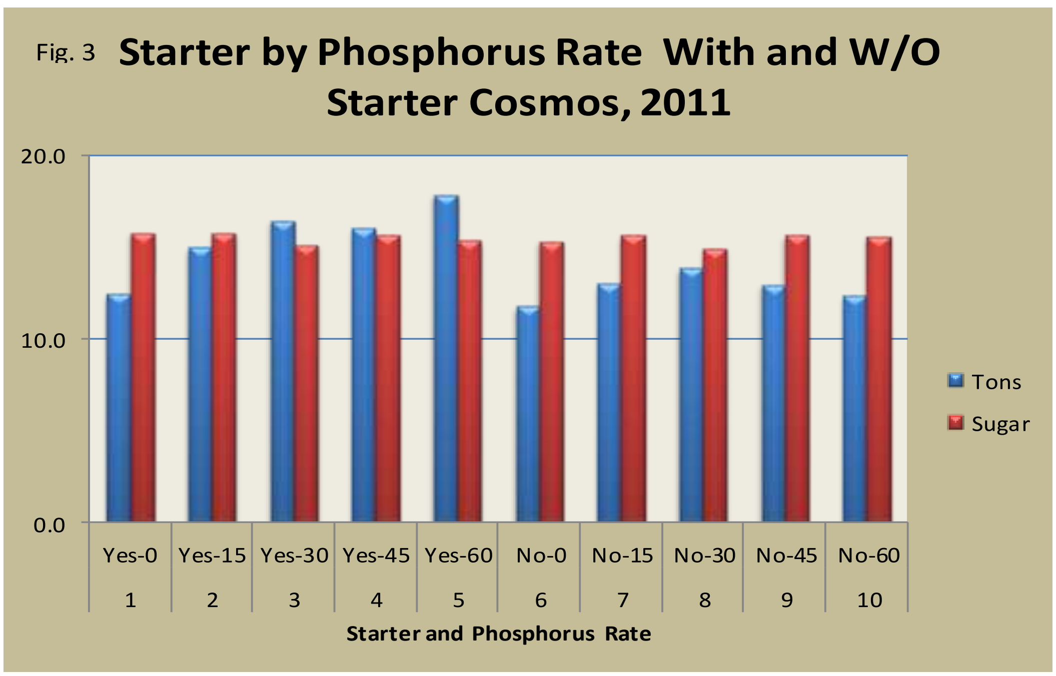
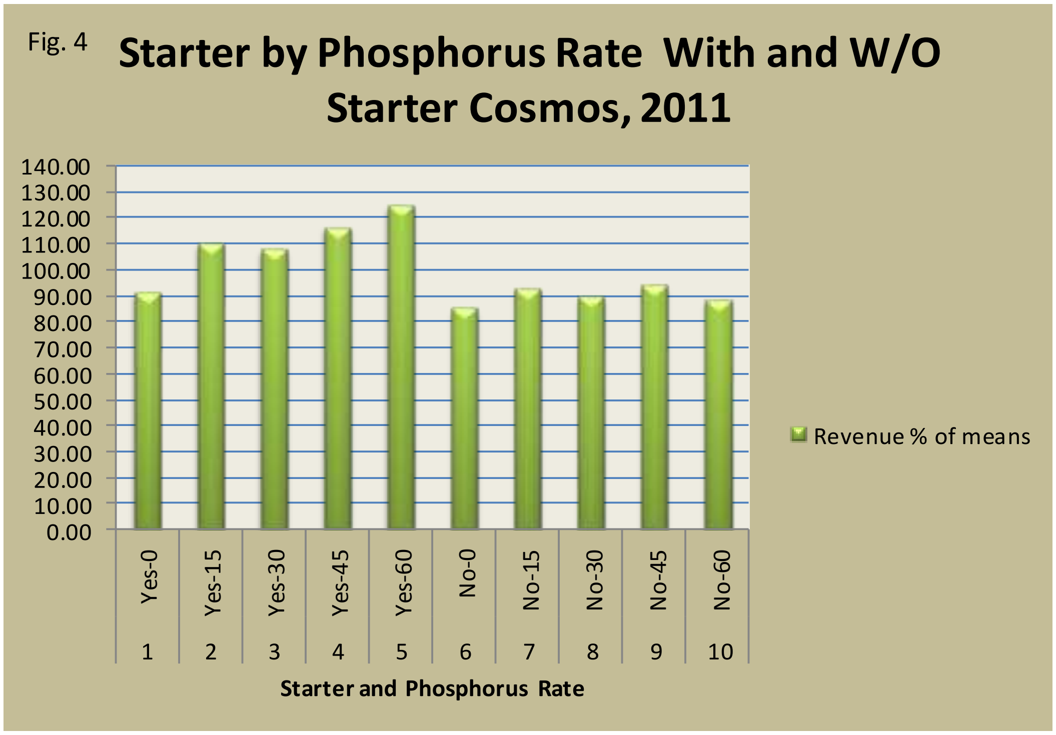


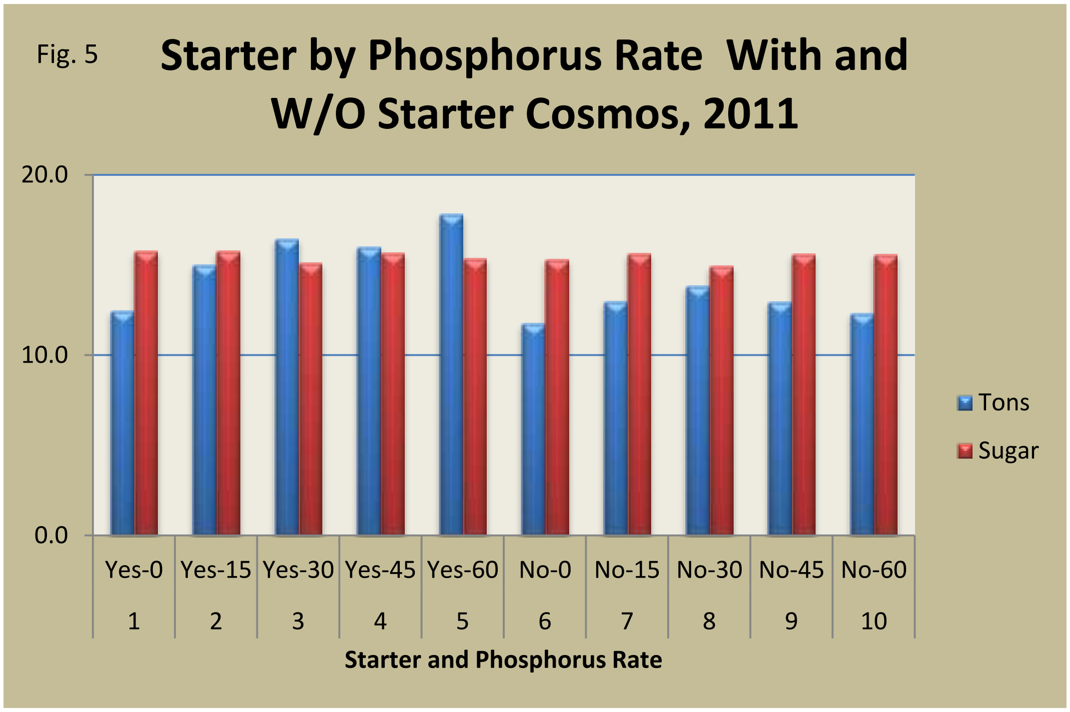
Fig. 3
Starter by Phosphorus Rate With and W/O Starter Cosmos, 2011
20.0
10.0
0.0
Yes-0 Yes-15 Yes-30 Yes-45 Yes-60 No-0 No-15 No-30 No-45 No-60
1 2 3 4 5 6 7 8 9 10
Starter and Phosphorus Rate
Tons
Sugar

Fig. 4



Starter by Phosphorus Rate With and W/O Starter Cosmos, 2011
140.00
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Yes-0
Yes-15
Yes-30
Yes-45
Yes-60
No-0
No-15
No-30
No-45
No-60
1
2
3
4
5
6
7
8
9
10
Starter and Phosphorus Rate
Revenue % of means

Fig. 5



Starter by Phosphorus Rate With and W/O Starter Cosmos, 2011
20.0
10.0
0.0
Yes-0
Yes-15
Yes-30
Yes-45
Yes-60
No-0
No-15
No-30
No-45
No-60
1
2
3
4
5
6
7
8
9
10
Starter and Phosphorus Rate
Tons
Sugar

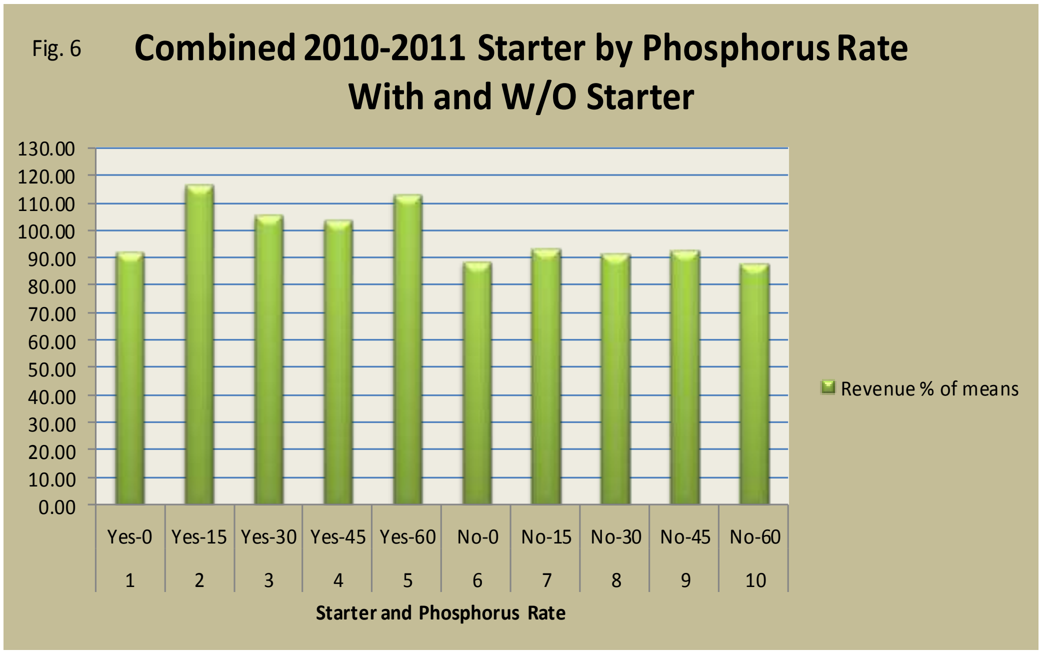


Fig. 6
Combined 2010-2011 Starter by Phosphorus Rate
With and W/O Starter
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Yes-0
Yes-15
Yes-30
Yes-45
Yes-60
No-0
No-15
No-30
No-45
No-60
1
2
3
4
5
6
7
8
9
10
Starter and Phosphorus Rate
Revenue % of means

Crop Availability of Phosphorus from SugarBeet Factory Lime

Albert L. Sims (Associate Professor) and John A. Lamb (Professor), University of Minnesota Northwest Research and Outreach Center and Department of Soil, Water, and Climate

Sugar beet factories have traditionally stockpiled factory lime near the factory site resulting in large mountains of this material. In recent years, growers have become interested in factory lime as a field amendment to reduce sugar beet root rot. Factory lime contains significant amount of nutrients, especially phosphorus. With fluctuations in fertilizer prices in recent years, many questions have been raised about the possible value of the factory lime P. While these questions are very appropriate, it cannot be answered at this time. We suspect at least a portion of the factory lime P is plant available, but we currently do not have the data to estimate that proportion.

The seven sugar beet processing factories in Minnesota and North Dakota generate approximately 500,000 dry tons of factory lime (spent lime) annually. Factory lime is produced during the sugar beet thin juice purification process. Milk of lime ($Ca(OH)_2$) and CO_2 are injected into the juice where it forms calcium carbonate (USEPA, 1997) and, along with many impurities (Dutton and Huijbregts, 2006), precipitates from the juice. The purified juice is further processed into crystal sugar, but the precipitated lime and impurities are expelled from the factory and hauled away. This factory lime meets the definition of a liming product (SSSA, 1997) and can be used on acidic soils to raise soil pH. This is being done in many European agricultural areas. However, soils in Minnesota and North Dakota, where sugar beet factories are located, are naturally high in pH and lime is not needed. Without a demand for lime, factory lime produced in the sugar beet processing factories has traditionally been stockpiled near the factory site where it was produced.

In recent years, it was discovered that soil applications of sugar beet factory lime may be beneficial in reducing Aphanomyces root rot (*Aphanomyces cochliodes* Dresch.) in sugar beet (Bresnahan et al., 2000; Bresnahan et al., 2001). This along with observations of similar benefits in a farmer's field near Breckenridge, Minnesota stimulated the establishment of two field trials to examine the effects of factory lime on Aphanomyces root rot in sugar beet (Windels et al, 2006). Soil pH at these two locations ranged from acidic (approximately 6.0) to slightly above neutral (about 7.2). Additional measurements were made on these same plots to examine the effects of factory lime on phosphorus (P) availability. To test the effects on P, soil samples were collected and Olsen soil test P (STP) (Olsen et al, 1954) was determined and several parameters of production were measured on the non-sugar beet crops that were part of this trial. Correlation between factory lime rate and STP level was strong and positive the first growing season after the lime was field applied (Sims et al, 2010). Two growing seasons after lime was applied there was still a strong positive correlation between STP and factory lime rates. However, these trials were established on fields with high STP levels and the grower-cooperators continued to fertilize the experimental area as they fertilized the surrounding commercial field. Therefore, no crop response to increased P levels was expected and none was observed. That is, the crop had sufficient P available before factory lime was applied. Since there was no plant response to factory lime and the STP determination is simply a bench top laboratory chemical extraction process correlated with a crop response to the application of fertilizer, we could not determine the proportion of factory lime P that might actually be available to a growing crop. However, Sailsbery and Hills (1987) reported that sugar beet factory lime did supply P to a sugar beet crop grown on a 'non-acidic, low organic matter' soil in California.

Sims et al (2010) measured P in sugar beet factory lime from the seven Minnesota and North Dakota sugar beet processing factories at three different times during the 2004-05 processing season. They reported average P concentrations ranging from 3500 ppm P to 7000 ppm P. This is equivalent to 16 to 32 lbs P_2O_5 per dry ton of factory lime. In recent years, commercial phosphorus fertilizer prices have equated to about $1 per pound of P_2O_5. Several attempts have been made to directly compare commercial fertilizer P and factory lime P based on commercial fertilizer prices. However, commercial fertilizer has a guaranteed analysis and solubility and is fairly consistent from batch to batch. Factory lime can vary depending on the factory from which it was produced and when it was produced (Sims et al, 2010). Direct comparisons between commercial fertilizer P and factory lime P requires the analysis of P content of the factory lime being delivered to the grower and some knowledge of the proportion of that factory lime P that is readily available to a crop. Given that commercial fertilizer has a guaranteed P content and solubility, it is impossible to apply the same economic measuring stick to factory lime P. The research reported here was conducted to address this issue and determine the proportion of the factory lime P that is plant available or will become plant available once applied to the field. Specifically we were interested in soils with an alkaline pH (at or above 8.0) where lime solubility is very low.

Objectives:

To determine the proportion of field applied sugar beet factory lime phosphorus that is potentially available to a growing crop.

1. Determine P availability from factory lime P the first year after lime application
2. Determine if P availability from factory lime P changes with time after lime application.

Materials and Methods:

This trial is being conducted in two components, a greenhouse component and a field component. Both are separate trials, but are designed in roughly the same way to address the same objectives. Both trials use corn as the monitoring crop. Soil for both trials were selected because they have alkaline pH greater than 8.0 and STP levels of Low to Very Low. A response to the addition of P is expected whether it be from fertilizer or factory lime P if it is plant available. However, it is also understood that at this high soil pH the solubility of the factory lime is quite low and lime activity may be limited.

<u>Greenhouse Trial:</u>

In the spring of 2008 a site on the premises of the Northwest Research and Outreach center was found to have a STP of 2 ppm P. Three adjacent strips 25 ft. wide and 125 long were established. Each strip was subdivided into five 25 ft. plots. On May 15, 2008 sugar beet factory lime recently produced at the American Crystal Sugar Co. factory in Crookston, Minnesota was applied at rates of 0, 1, and 2 ton A^{-1} on a dry weight basis. Measured amounts of factory lime were hand spread to each 25 by 25 ft. plot to ensure uniform distribution and incorporated with a rototiller. Throughout the entire growing season the plots were frequently tilled with a rototiller in an attempt to uniformly incorporate the factory lime to the depth of tillage, approximately 6 inches. In late August 2008 soil was collected to a six inch depth from one 25 ft. by 25 ft. plot of each lime rate strip. The soil was sieved through quarter inch opening screen and stored in plastic tote tubs. Enough soil was collected to conduct two greenhouse experiments during the winter months. Periodically the soil was stirred and mixed to promote air drying.

During the 2010-2011 winter months a pot experiment was conducted in the greenhouse facility at the Northwest Research and Outreach Center. The experiment was a 3 by 6 factorial randomized complete block with four replications. The first factor was the three rates of factory lime applied in the spring of 2008. This trial would represent third year after lime application. The second factor on the experiment was six P fertilizer rates ranging from 0 to the equivalent of 75 lbs.P_2O_5 A^{-1} in 15 lbs increments. Corn was grown for several weeks and harvested at the V8 growth stage. Plants were harvested by cutting them at the soil surface then dried at 60^{o} C to estimate dry matter accumulation. Dried plant samples were ground in a Wiley mill and analyzed for P concentration. The P concentration combined with dry matter accumulation estimates total P accumulation in the plant. Each pot was soil sampled after plants were harvested and analyzed for Olsen STP.

When this trial was initiated, based on results of earlier trials (Sims et al., 2010) we assumed most of the factory lime P might be readily available to a growing crop. Thus we used low rates of factory lime that applied 14 and 28 lbs. P_2O_5 A^{-1} equivalent. However, greenhouse trials from previous years suggested this assumption may be false and that low factory lime rates were too low. New field plots were established in fall 2010 with 0, 3, and 6 dry tons factory lime A^{-1}. Soils from these plots were collected in August 2011 and a greenhouse trial using this soil is currently underway at this writing. Results of this trial will be reported next year.

<u>Field Trial</u>

Two field trials were conducted in the SMBSC growing area in 2011. One trial represented the second growing season after fall (2009) application of 0, 1, and 2 dry tons factory lime A^{-1}. In the fall of 2010 it was decided that these factory lime rates were too low (see greenhouse discussion) and a new trial using 0, 3, and 6 dry tons factory lime A^{-1} was established. The second field trial represents the first growing season after the higher rates of factory lime were applied.

In both trials, corn was planted in the spring of 2011. At about the V6-V7 growth stage, eight plants from each plot were harvested, dried, weighted, ground, and will be analyzed for P concentration. In addition, plant stands were also counted in each plot. At maturity, eight additional plants from each plot were harvested and separated into stover, grain, and cob. There plant parts will also be analyzed for P concentration. The laboratory analysis of these plants materials will be completed before March 2012. At the same time, all ears from 20 ft. of the two middle rows of each plot were hand-picked and shelled to estimate grain yield. After harvest each plot was soil sampled and those samples will be analyzed for Olsen STP during the winter months.

Results:

Initial soils used in both the greenhouse and field experiments were selected because of Low to Very Low STP levels and alkaline pH of 8.0 or greater. The factory lime used in these experiments varied in P content. Factory lime from the American Crystal factory in Crookston and used in the greenhouse component contained 0.3% P which is equivalent to 14 lbs. P_2O_5 per dry ton of factory lime.   Factory lime treatments for the greenhouse component applied 0, 14, and 28 lbs P_2O_5 A^{-1} in the three factory lime rates. Factory lime from the Southern Minn processing factory and used in the field component contained 0.6% P which is equivalent to 28 kg P_2O_5 per dry ton of factory lime. Factory lime treatments in the field component applied the equivalent of 0, 28 and 56 kg P_2O_5 A^{-1} in the three factory lime rates. In both the greenhouse and field components of this trial, Low to Very Low STP would suggest the need for more P than would be supplied by the factory lime for corn production. The higher rates of factory lime applied this past year applied the equivalent of 42 and 84 lbs P_2O_5 A^{-1} in the greenhouse trials and 84 and 168 lbs. P_2O_5 A^{-1} in the field trials.

<u>Greenhouse</u>

The greenhouse trial conduced in the winter months of 2010-2011 revealed a response to both P fertilizer and factory lime rates three growing seasons after 0, 1, and 2 dry tons factory lime A^{-1} was applied and incorporated into the field plots.

Total Dry Matter Accumulation: There was a strong total dry matter accumulation response to P fertilizer rates (Table 1). Total dry matter accumulation increases throughout the entire range of P fertilizer rates with all factory lime rates (Fig. 1a). One of the contrasts describing an interaction between P fertilizer rates and factory lime rates was significant (Table 1), but this interaction is difficult to interpret. At the 0 P fertilizer rate, factory lime increased total dry matter. As P fertilizer rate increased, total dry matter increased to a greater extent at the 0 lime rate and least at the 1 ton factory lime rate (Fig. 1a).

Table 1. Statistical analysis for the 2010-2011greenhouse factory lime study.

Source	Total DM	Total P	Olsen STP
	---------- Pr > F[§] -------		
Lime Rate	ns	***	***
Linear	ns	***	***
Quad	ns	Ns	***
P Fert. Rate	***	***	***
Linear	***	***	***
Quad	ns	ns	ns
Lime Rate by P Rate	ns	ns	*
Lime lin by P lin	ns	+	ns
Lime lin by P quad	ns	ns	ns
Lime quad by P lin	*	ns	*
Lime quad by P quad	ns	ns	+

§ ***, **, *, +, and ns represent significance at the 0.001, 0.01, 0.05, 0.10, and Non-significance levels, respectively.

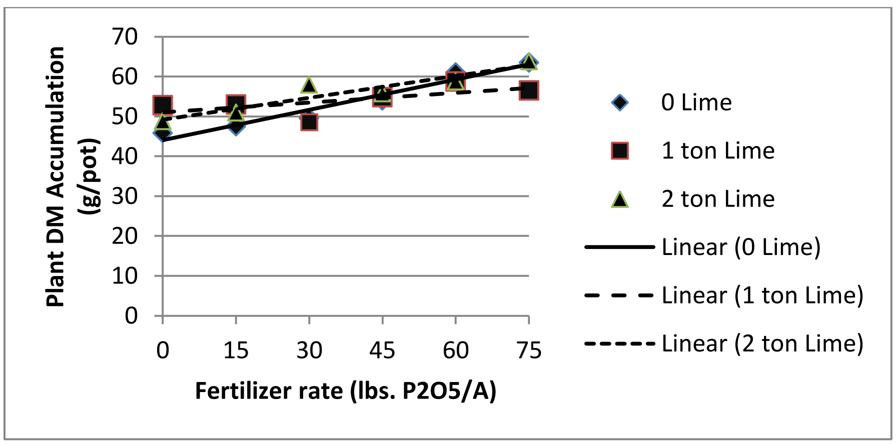


Figure 1a. Total dry matter accumulation response to P fertilizer and factory lime rates in the 2010-2011 greenhouse trial.

Total P Accumulation: There was a strong total P accumulation response to both P fertilizer and factory lime rates (Table 1). The interaction between P fertilizer rates and factory lime rates observed in Fig 1b was significant at the 0.10 level. At the 0 P fertilizer rate, total P accumulation was similar with all factory lime rates. As P fertilizer rates increased total P accumulation increased similarly with both 0 and 1 ton factory lime. With 2 ton factory lime, the increase in total P accumulation was greater from 0 to 30 lbs P_2O_5 A^{-1} fertilizer than with the other two factory lime rates, but then P accumulation tended to level off at higher P fertilizer rates.

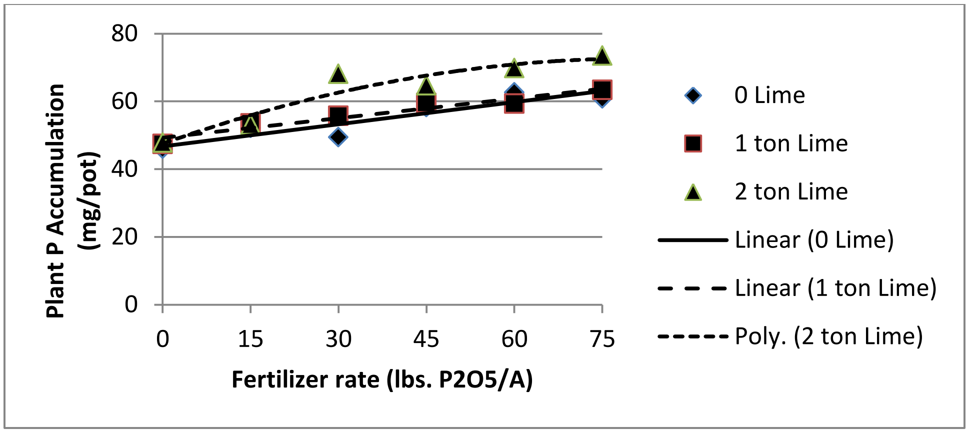


Figure 1b. Total P accumulation response to P fertilizer and factory lime rates in the 2010-2011 greenhouse trial.

Olsen STP: Olsen STP increased as P fertilizer rates increased, but this response was different depending on the factory lime rate (significant factory lime and P fertilizer interaction illustrated in Table 1). Olsen STP response to increasing P fertilizer was similar for both the 1 and 2 ton factory lime rates and both were different than that observed with the 0 factory lime rate (Fig 1c).

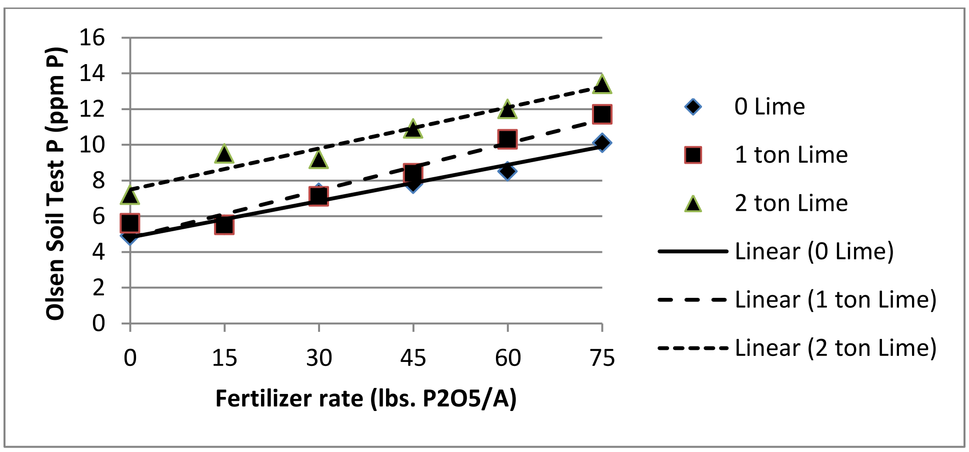


Figure 1c. Olsen Soil Test P response to P fertilizer and factory lime rates in the 2010-2011 greenhouse trial.

<u>Field Trial</u>

Grain yield has been analyzed for both field trials conducted in the 2011 growing season. Even though both trials were on soils with Low STP levels and a response to applied P was expected, none was observed. In the first trial (2nd year after low rates of factory lime), there was neither a grain yield response to P fertilizer rates nor factory lime rates. Overall average grain yield for this trial was 232 bu. A^{-1}. In the second field trial (1st year after higher rates of lime), there was no response to P fertilizer rates, but there may have been a response to factory lime rates. The significance level had to be raised to 0.10 level for this response to be indicated as significant. This is shown in Figure 2.

The laboratory data will be complete in the coming months after this writing. At that time we will have estimates of total dry matter accumulation and combined with P concentration, we will have an estimate of total P accumulation. These data may reveal some information about P contribution of factory lime to the crop. However, the grain yield data suggest there may be a response to the factory lime, but it cannot be attributed to P from the factory lime.

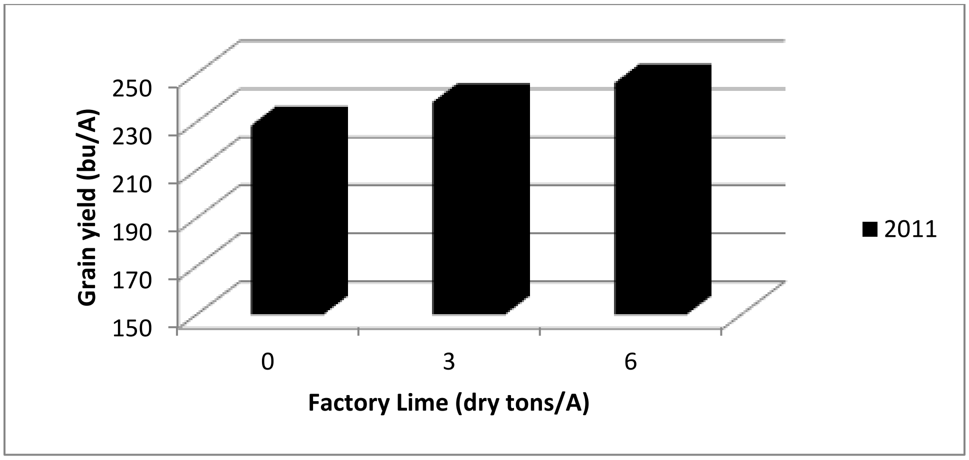


Figure 2. 2011 Grain yield response to factory lime rates applied in fall 2010.

Summary:

The contribution of P from the factory lime is difficult to determine from these trials. The Olsen STP from the greenhouse trial indicates there may be factory lime P being extracted in the laboratory procedure. However, plant response is more puzzling. In the greenhouse, some contribution of factory lime P may be indicated when total dry matter accumulation was greater at the 0 P fertilizer rate when factory lime was applied verses the 0 factory lime rate, however, there was no difference between the 1 and 2 ton factory lime rate. This was not the case with total P accumulation where we thought the difference should have been present. In the field, there is no evidence of P contribution from the factory lime, but the lack of response to P fertilizer was not expected based on the initial soil test P levels. Nevertheless, there was a response to the greater rates of factory lime used in 2011 that cannot be attributed to factory lime P. We are requesting funding for an additional year to run both the greenhouse and field components of this trial in 2012. The field site targeted for the 2012 trial has had the factory lime rates applied this last October.

Acknowledgements:

The authors wish to thank the Minnesota and North Dakota Sugarbeet Research and Education Board, American Crystal Sugar Company, and Southern Minnesota Beet Sugar Cooperative for partially funding this research. The authors also express their profound appreciation to the Mark Bredehoeft, Chris Dunsmore, Kim Hoff and Todd Cymbaluk for their help and assistance in conducting these trials. Without their assistance these trials would not be possible.

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NITROGEN MANAGEMENT STRATEGIES FOR INCREASING SUGAR BEET ROOT QUALITY

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Justification of Research: Sugar beet growers are concerned about sugar beet root yield and quality. To remain competitive, the growers must fine tune their nitrogen fertilizer management to increase sugar beet quality and thus making a better economic situation for sugar production. Since 2002, the Southern Minnesota Beet Sugar Cooperative has had a goal of better quality. The purity of the root has increased from 87 % to 92 % during this time. This has occurred from a combination of refined varieties, harvest management, and nitrogen fertilizer application. The nitrogen fertilizer recommendation for this area has been reduced 50 lb/A since this time. This reduction has not reduced root yields. In fact, average root yields have increased from a cooperative average of 21 ton/A to 28 ton/A. The increase in percent sucrose in the root has not occurred. The reasons for this include, the large amount of soil organic matter (N) in this area, rainfall occurring just before harvest that increases N mineralization from the organic matter, and frost occurrence during the early harvest that causes the plant to re-grow and thus using the sucrose accumulated in the beet for an energy source. There is a need to explore and review other nitrogen fertilizer management practices. This proposed project will look at the effect of 'feeding' nitrogen to the sugar beet during the growing season by using a slow release nitrogen source or split applications. The slow release products may be able to supply enough nitrogen for root growth while not reducing the sucrose in the beet.

Summary of Literature Review: The current fertilizer guideline for growing sugar beet is a total of 130 lb N/A as soil nitrate-N to a depth of four feet and fertilizer nitrogen applied (Lamb et. al 2001a). This guideline was revised for the southern Minnesota and published in the 2010 Sugarbeet Production Guide to 100 lb N/A. There has been a considerable amount of research that has been done with nitrogen management since 1996, Lamb et al. 2006a, 2006b, 2005, 2004, 2003, 2001b, 2000, and 1999). Most of that work was to determine the optimum nitrogen rate for economic sugar beet production.
Lamb and Moraghan 1993 reported on the effect of foliar applications during the growing season in addition to the initial pre-plant soil applications on sugar beet root yield and quality. They concluded that the later the foliar N application was made, the more the root quality reduced. Root yield was not affected.

Sims, 2010 reported new work on the use of a slow release nitrogen product called ESN by Agrium. The release of nitrogen is controlled by coating a urea prill with a polymer. The speed of release is governed by the polymer coating, amount moisture and temperature in the soil. It is thought that the slower release may be beneficial to sugar beet root growth and quality. In 2009, the use of ESN in the RRV did not perform any better than urea. This was one year of data.

Split applications of nitrogen to the soil have been investigated in the RRV and SMBSC growing areas in Minnesota, Lamb, 1986, 1987, 1988, and 1989. The results were neutral for root yield and quality when the nitrogen fertilizer was split applied a pre-plant and four weeks after emergence. The sugar beet varieties have changed since that time.

Objectives:

1. Determine if split applications of nitrogen or the use of slow release forms of nitrogen (ESN), can increase root quality.

Materials and Methods: An experiment was established at two locations in the Southern Minnesota Beet Sugar Cooperative growing area to meet the objective. One of the locations was abandoned because of wet planting conditions causing poor earlier growth. Location 1176 had the follow initial soil test results; pH = 8.1, soil nitrate-N 0 to 4 feet = 70 lb. N/A, Olsen-P = 18 ppm, and soil test K = 421 ppm. The study included the factorial combination of six nitrogen application rates (0, 30, 60, 90, 120, and 150 lb N/A) and two nitrogen sources (urea and ESN). The split applications of nitrogen at pre-plant, May 14, and July 7 of urea at 60 and 120 lb N/A and split treatment of 60 and 120 lb N/A with the pre-plant, May 14, split applied as ESN and the July 7 application as urea. Another method used was to split apply nitrogen as a liquid. Two nitrogen liquid products, NaChurs SRN and Kugler KQ-XRN were used as treatments. The preplant application was with 30 or 60 lb. N/A as urea or ESN and the liquid applications occurred at the 10 and 20 leaf stage, July 8 and August 20, 2011, respectively. The liquids were applied at a rate of 2 gallons per acre delivering a total of 12 lb. N/A. The SRN product is a 28 % liquid nitrogen product that is 7.8% urea-N and 20.2% slowly available water soluble nitrogen derived from urea triazone solution. Kugler KQ-XRN is a 28 % liquid nitrogen product with 72 % of its nitrogen as proprietary formulation slow release nitrogen.

A summary of the treatments are in Table 1. The study had five replications. Petiole samples were taken mid-July from the each treatment and analyzed for nitrate-N. The sugar beet roots were harvested in October for root yield and quality determination. Root quality was determined at the Southern Minnesota Beet Sugar Cooperative quality laboratory in Renville, Minnesota.

Table 1. Treatments for ESN and Split N application trial in 2011.

Trt	Pre-plant N (lb N/A)	Split application (lb N/A)	Total application (lb N/A)
1	0	0	0
2	Urea 30	0	30
3	Urea 60	0	60
4	Urea 90	0	90
5	Urea 120	0	120
6	Urea 150	0	150
7	0	0	0
8	ESN 30	0	30
9	ESN 60	0	60
10	ESN 90	0	90
11	ESN 120	0	120
12	ESN 150	0	150
13	ESN 30 + Urea 30	0	60
14	ESN 60 + Urea 60	0	120
15	ESN 15 + Urea 15	Urea 30	60
16	ESN 30 + Urea 30	Urea 60	120
17	Urea 30	SRN 12 lb. N/A foliar	42
18	Urea 60	SRN 12 lb. N/A foliar	72
19	ESN 30	SRN 12 lb. N/A foliar	42
20	ESN 60	SRN 12 lb. N/A foliar	72
21	Urea 30	KQ-XRN 12 lb. N/A foliar	42
22	Urea 60	KQ-XRN 12 lb. N/A foliar	72

Results and Discussion:

N Rate study with urea and ESN: Root yield, extractable sucrose per ton, extractable sucrose per acre, and petiole nitrate-N in mid-July were significantly affected by nitrogen application rate, Table 2. Root yield was increased with 60 lb. /A of N applied, Figure 1. With the soil test of 70 lb. N/A, then the total N needed was 130 lb. N/A for optimum root yield. The effect on root yield was similar whether we used urea or ESN as the preplant N source.

Extractable sucrose per ton was reduced from 290 lb. /ton to 255 lb. /ton with the addition of nitrogen fertilizer, Figure 1. The source of preplant N did not affect this decline in quality.

Because of the effect of N application on quality the optimum extractable sucrose per acre occurred with 30 to 60 lb. N/A applied, Table 1. The source of N did not affect the extractable sucrose per acre. The total N need for optimum extractable sucrose per acre was between 100 and 130 lb. /A. This falls well in line with the current guidelines for Southern Minnesota Beet Sugar Cooperative growing area.

The most recently matured sugar beet petiole was sampled from 15 plants in each plot during mid-July in 2011. The addition of preplant applied nitrogen, either as urea or ESN, increased the amount of nitrate-N in the petiole at that time of sampling, Figure 1. This increase is an indicator that more nitrogen is getting into the plant for the addition of more fertilizer N. Since nitrogen is a purity, it also indicates why the extractable sucrose per ton was reduced with the N application.

Table 2. Statistical analysis of N rate and N source on root yield, extractable sucrose per ton, extractable sucrose per acre, and petiole nitrate-N concentration in mid-July at site 1176 in 2011.

	Root yield	Extractable sucrose per ton	Extractable sucrose per acre	Petiole nitrate-N
Statistic	---------------------- P > F ------------------------			
N rate	0.0006	0.001	0.03	0.0001
N source	0.21	0.81	0.42	0.54
N rate X N source	0.05	0.57	0.15	0.07
C.V. (%)	5.4	4.6	6.9	23.7

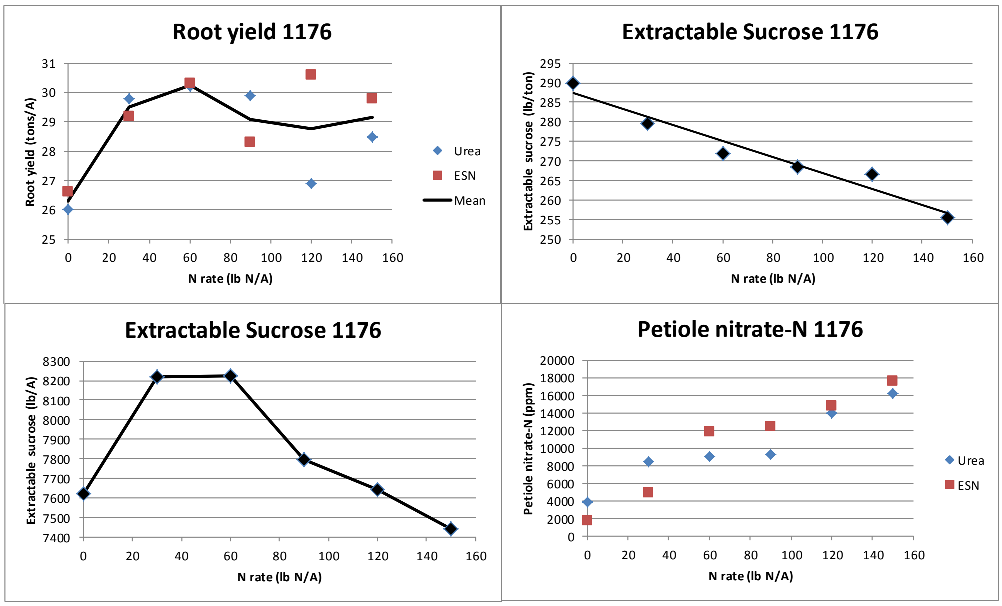

Figure 1. Root yield, extractable sucrose per ton, extractable sucrose per acre, and petiole nitrate-N concentration in mid-July 2011 at site 1176.

<u>Evaluation of split applications</u>: The use of split applications of nitrogen has been suggested as a way to grown large sugar beet roots while minimizing the detrimental effects of nitrogen on root quality. This evaluation was done using the 60 lb. N/A treatments. The slow availability split applications of SRN and EXN actually had 72 lb. N/A applied. The statistical analysis indicates that there was no difference in root yield, extractable sucrose per ton, and extractable sucrose per acre caused by the different products and split application management, Table 3 and Figure 2. Petiole nitrate-N concentration was affected by the treatments, Table 3 and Figure 2. The petiole nitrate-N concentration was the least with the split application of urea, preplant May 14 and July 7, 2011. The plants treated with preplant ESN did have the greatest petiole nitrate-N concentration. This was caused by the N in this treatment being all from ESN and the slow release characteristic of this product. The lower petiole nitrate-N concentration in the plants treated with the split application urea show a possible strategy to increase quality, but the root yield was not increased by the treatment.

Table 3. Statistical analysis of split applications with several N sources at the 60 lb. N/A rate for root yield, extractable sucrose per ton, extractable sucrose per acre, and petiole nitrate-N concentration in mid-July at site 1176 in 2011.

	Root yield	Extractable sucrose per ton	Extractable sucrose per acre	Petiole nitrate-N
Statistic	---------------------- P > F ------------------------			
Product	0.33	0.58	0.28	0.008
C.V. (%)	4.7	4.4	5.5	31.0

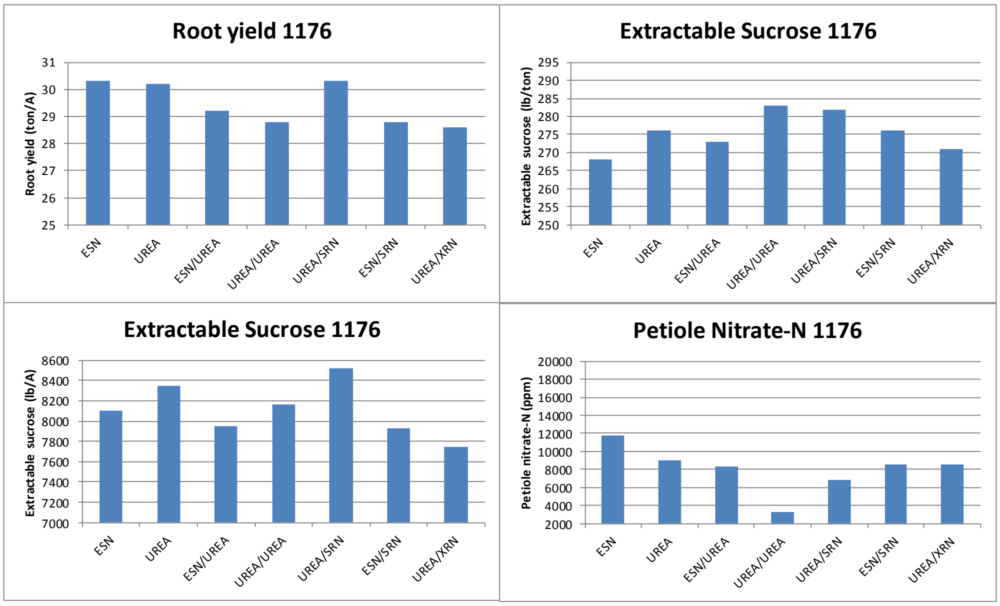

Figure 2. Root yield, extractable sucrose per ton, extractable sucrose per acre, and petiole nitrate-N concentration in mid-July 2011 at site 1176 as affected by different split applications and products at 60 lb. N/A.

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USE OF NITROGEN PRODUCTS FOR CORN PRODUCTION BEFORE SUGUR BEET IN SOUTHERN MINNESOTA

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Justification: Nitrogen management for corn in a sugar beet production rotation has been difficult. Concern arise about having too much residual nitrate-N after the corn crop going into sugar beet production versus not having enough nitrogen for optimum economic corn production. Too much residual nitrate-N in the soil before sugar beet production makes it difficult to manage the nitrogen fertilizer applications for optimum sucrose production. A large amount of nitrate-N will cause reduction in sucrose concentration and an increase if impurities. With corn productions, there is little penalty for over application of nitrogen and a large grain yield penalty for under fertilization. Also entering into the management is the potential losses of nitrogen applied before corn from denitrification and leaching out of the tile drainage system.

Several newer products have been introduced to agriculture intended to control the release of nitrogen during the growing season. The goal of the controlled release is to have the nitrogen in the soil system and available to the plant when the plant needs it. The idea is to increase the efficiency of use of the fertilizer nitrogen material.

Objectives: There are two major objectives to this study; 1. To evaluate three nitrogen use efficiency products for corn production in heavy textured soils in the Southern Minnesota Beet Sugar Cooperative growing area, and 2. Determine the effect of the use of these produces on sugar beet production in the year following their use in corn production.

Methods and Materials

To accomplish the objectives in 2011, corn was grown at two locations in Renville County, Minnesota. The treatments listed in Table 1 include an N rate evaluation with two nitrogen products, urea and ESN. Another set of treatments compare the time of application of ESN and urea and also the effect of using a mixture at preplant of the two products. The set of treatments compare the use of urea, ESN, SRN, and KQ-XRN at different N rates. Most of the treatments were applied in the spring before planting. When there was a split application or urea, it was applied at V6. The split application with the SRN and KQ-XRN products were applied in two split applications, one at V6 and the other at V10. The application rates of the SRN and KQ-XRN were 2 gallon per acre or approximately 6 pounds N/A each application. This made of a total of 12 lb. N/A application. The slow release nitrogen products were ESN, a polymer coated urea from Agrium, SRN, a nitrogen product offered by NaChurs, and KQ-XRN, a product offered by Kugler Company. The SRN product is a 28 % N product that is derived from urea triazone solution. This solution is 72 % slow release nitrogen. The KQ-XRN is also a 28 % N product. The N in this product is 72 % slow release nitrogen from a proprietary formulation.

The corn was hand harvested in October, 2011 for grain yield. After harvest, soil nitrate-N samples were obtained and will be used to determine the amount of nitrogen that will be applied in the second year of the study. The second year will be sugar beet production. The nitrogen application will occur in the spring and the rate will be based on soil nitrate-N to four foot plus fertilizer N applied equal 100 lb. /A. The sugar beets will be harvested in the fall of 2012 for root yield and quality.

Table 1. List of treatments

Treatment	Preplant source	Preplant N rate	Split application source	Split application N rate	Total N applied
		lb. N/A		lb. N/A	lb. N/A
1	Check	0	N/A	0	0
2	Urea	30	N/A	0	30
3	Urea	60	N/A	0	60
4	Urea	90	N/A	0	90
5	Urea	120	N/A	0	120
6	Urea	150	N/A	0	150
7	Check	0	N/A	0	0
8	ESN	30	N/A	0	30
9	ESN	60	N/A	0	60
10	ESN	90	N/A	0	90
11	ESN	120	N/A	0	120
12	ESN	150	N/A	0	150
13	ESN/Urea	30+30	N/A	0	60
14	ESN/Urea	60+60	N/A	0	120
15	ESN	30	Urea	30	60
16	ESN	60	Urea	60	120
17	Urea	30	SRN	12	42
18	Urea	60	SRN	12	72
19	ESN	30	SRN	12	42
20	ESN	30	SRN	leaf samples	60
21	Urea	30	KQ-XRN	leaf samples	42
22	Urea	30	KQ-XRN	leaf samples	72

Results:

Initial soil test results: The soil test results for the each site are reported in Table 2. The soil nitrate-N results were similar at both locations. The pH at both sites was 7.8. The West 1175 site had a greater Olsen-P value than the East 1174 site. The organic matter at both sites was close to 5.5 %. The soil test zinc values were very high.

Table 2. Soil test results for the two sites in 2011.

Soil test	East 1174	West 1175
Nitrate-N 0-2 ft. (lb./A)	39	50
pH	7.8	7.8
Olsen- P (ppm)	8	16
K (ppm)	140	188
Organic matter (%)	5.5	5.6
Zinc (ppm)	2.4	3.1

Corn grain yields:

The corn grain yield at each site responded to the application of nitrogen fertilizer. The optimum amount using the University of Minnesota nitrogen guidelines for corn using the soil nitrate-N test would be 116 lb. N/A at the East 1174 site and 110 lb. N/A at the West 1175 site.

Figure 1 shows the nitrogen response at the East 1174 site. Urea was applied in the spring preplant and incorporated in the soil. At the East 1174, the optimum N rate for a 0.10 price ratio was 74 lb. N/A. The corn grain yield at the economic optimum N rate was 203 bu/A. This was less than the suggested rate of 116 lb. /A. For the preplant ESN application the optimum N rate for a 0.10 price ratio was 85 lb. N/A with an economic optimum corn grain yield of 207 bu/A. This was also less than the suggested for East 1174. At this site in 2011, preplant ESN and Urea preformed similarly for corn grain yield.

The response to N at the West 1175 site was different than at East 1174 in 2011. Figure 3 shows the response to urea and ESN preplant applications at the West 1175 site. The corn grain yield response to nitrogen applied as urea was optimized at 37 lb. N/A with an economic optimum grain yield of 168 bu/A. This was considerable less than the suggested 110 lb. N/A. The corn grain yield response to the ESN treatments was not optimized at this location and the response cannot be characterized.

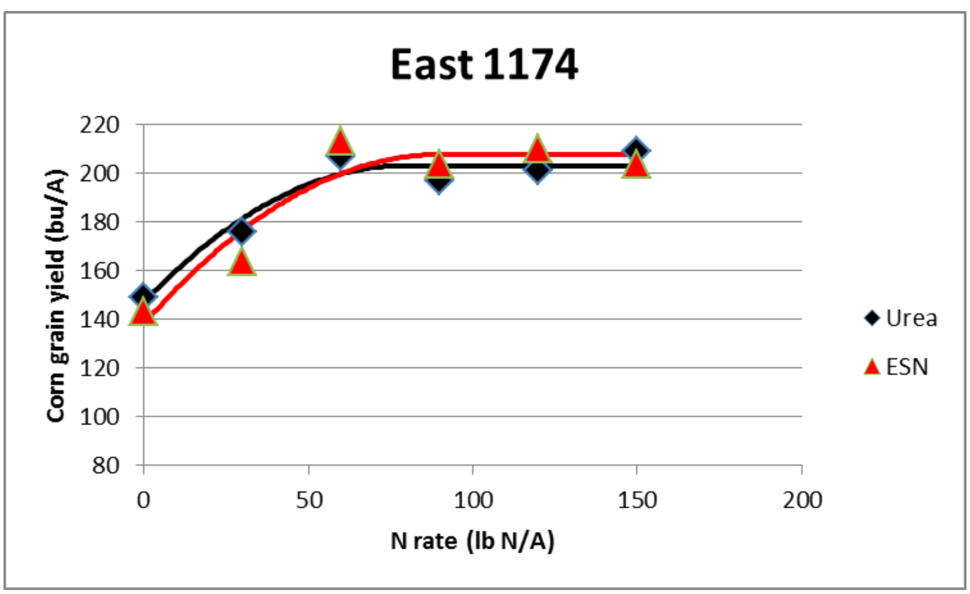


Figure 1. The corn grain yield response to preplant applications of urea and ESN at East 1174 in 2011.

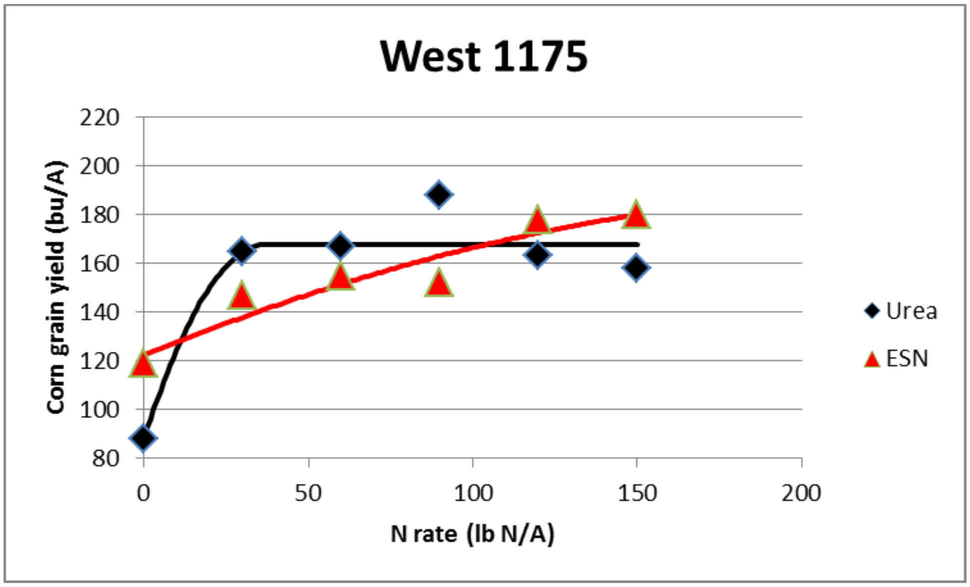


Figure 2. The corn grain yield response to preplant applications of urea and ESN at West 1175 in 2011.

A set of treatments were compared at the 60 lb. N/A rate to determine if different products and management of them would enhance nitrogen fertilizer use efficiency. The 60 lb. N/A rate was chosen because it was near are right at the optimum nitrogen rate for optimum corn grain yield. The treatments included a preplant application of ESN and urea and a 50/50 mix of these products, a 50/50 mix of 30 lb. N/A of urea and ESN plus 30 lb. N/A as urea as at sidedress, 60 lb. N/A as either ESN or urea at preplant plus 12 lb. N/A of SRN, and 60 lb. N/A as urea preplant plus 12 lb. N/A as KQ-XRN. The corn grain yields were similar at both locations for each of the treatments, Table 2. In 2011 there was no significant advantage using any product compared to urea.

Table 2. Corn grain yields for several nitrogen use efficiency products and management practices in 2011.

Treatment	Preplant rate	Sidedress rate	East 1174	West 1175
Product	lb. N/A - product		Corn grain yield (bu/A)	
ESN	60 ESN	0	213	155
ESN-SRN	60 ESN	12 SRN	194	168
Urea-KQ-XRN	60 Urea	12 KQ-XRN	200	162
Urea/ESN	30 Urea/30 ESN	0	213	184
Urea/ESN-Urea	15 Urea/15 ESN	30 Urea	198	175
Urea-SRN	60 Urea	12 SRN	210	161
Urea	60	0	207	167
Mean			205	167

Summary: In 2011 corn grain yields responded to the application of nitrogen. At the two locations, the optimum grain yield response occurred below the suggested N application rates. The use of products that are supposed to increase nitrogen use efficiency did not increase corn grain yields at these two Renville County sites in 2011.

SMBSC Evaluation of Late Season Boron Influence on Sugarbeet Growth 2010-2011

In recent years Boron deficiencies have been identified in problem areas of sugarbeet fields. Boron has been identified as a key component in disease defense mechanism of plants. Transport of sugar has also been linked to Boron in the plant. These characteristics associated have led to the investigation of Boron in sugarbeet production.

Methods

Table 1 shows the specifics of activities conducted at all four sites. Sugarbeets were planted at four locations two in 2010 and two in 2011 to test Micronutrient application influence on sugarbeet production. The locations were at Maynard and Renville MN, 2010 and Lake Lillian and Sacred Heart MN, 2011. Sugarbeets were planted by SMBSC research with a 6 row planter. Plots were not thinned as the sugarbeet stands did not warrant thinning. Plots were 11 ft. (6 rows) wide and 35 feet long. Applications of products containing Boron were applied on August 17th and September 21st in 2010 and 2011. Research trials were harvested with a 2 row research harvester at all sites. The weights were collected and weighed on the harvester for yield calculation and a subsample was analyzed in the SMBSC quality lab.

Table 2-5 shows the influence of foliar Boron application on Sugarbeets in 2010 and 2011. Statistical analysis of the data was conducted for homogeneity of combinability and determined that the data could be combined across locations and years.

Conclusions

The check early and late treatment was not treated with a Boron product, thus was untreated. All the data collected at the Maynard location in 2010 was statistically non-significant. Data collected from the testing conducted at the Renville site in 2010 was statistically non-significant for tons per acre and sugar percent and significantly different for purity, extractable sucrose per acre and revenue percent of mean. However, the check treatment performed equal to the best performing treatment. Sugar percent was the only variable that was statistically non-significant in 2011 at the Lake Lillian location. Tons per acre, purity, extractable sucrose per acre, and revenue percent of mean were significantly different between treatments. Tetrabor applied at the early timing (August 17th) gave significantly higher revenue percent of mean compared to the early check. Treatments applied at the late application date were not different from the late check. All variables presented were significantly influenced by the treatments in 2011 at the Sacred Heart site. Boron treatment did not significantly increase sugarbeet production compared to early check. Max-in significantly increased sugarbeet production compared to the late check for all variables presented. Individual site data was inconsistent for variables presented. Presentation of data from all research sites combined lead us to smoothing out the data. All variables presented were not significantly influenced by treatments when compared to the check for the coinciding application timing. Time of application did not influence the affect of the Boron product treatment. Figure 1 and 2 are presented for the reader's visual view of the data.

Table 1. Site Specifics for Late Season Boron Application, Combined Data 2010-2011

Location	Planting Date	Soil Condition
Maynard, 2010	5/7/2010	Moist
Renville, 2010	4/21/2010	Moist
Lake Lillian, 2011	5/4/2011	Wet/Soft
Sacred Heart, 2011	5/19/2011	Lumpy

Table 2. Late Season Boron Application Influence on Sugarbeet Yield and Quality Maynard, 2010

Trt	Boron Type	August 17 app.	September 1 app.	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check early	No	No	23.4	16.40	92.35	6624	92.32
2	Lucrose	16 oz.	No	22.0	16.54	92.75	6318	95.16
3	Max In	16 oz.	No	26.5	16.52	92.95	7622	109.19
4	Tetra bor	16 oz.	No	26.2	16.42	92.79	7465	104.07
5	Check Late	No	Yes	23.8	16.46	91.95	6732	98.95
6	Lucrose	16 oz.	16 oz.	25.7	16.34	91.93	7204	105.80
7	Max In	16 oz.	16 oz.	24.3	16.53	92.71	6971	103.47
8	Tetra bor	16 oz.	16 oz.	23.2	16.13	91.12	6338	91.04
			C.V	18.0	2.23	1.03	19	20.81
			LSD (0.05)	NS	NS	NS	NS	NS

Table 3. Late Season Boron Application Influence on Sugarbeet Yield and Quality
Renville, 2010

Trt	Boron Type	August 17 app.	September 1 app.	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check early	No	No	35.3	13.64	89.19	7848	107.17
2	Lucrose	16 oz.	No	34.8	12.79	86.16	6891	88.17
3	Max In	16 oz.	No	35.0	13.43	87.29	7438	107.22
4	Tetra bor	16 oz.	No	35.2	13.42	88.96	7665	98.32
5	Check Late	No	Yes	36.5	13.28	87.74	7714	103.64
6	Lucrose	16 oz.	16 oz.	37.0	13.56	87.09	7904	113.17
7	Max In	16 oz.	16 oz.	30.1	13.57	87.42	6491	93.85
8	Tetra bor	16 oz.	16 oz.	30.2	13.36	86.49	6303	88.46
			C.V	9.1	4.15	0.73	6	8.15
			LSD (0.05)	NS	NS	NS	NS	NS

Table 4. Late Season Boron Application Influence on Sugarbeet Yield and Quality
Lake Lillian, 2011

Trt	Boron Type	August 17 app.	September 1 app.	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check early	No	No	22.9	13.85	86.08	4921	79.46
2	Lucrose	16 oz.	No	26.2	14.14	85.84	5732	96.57
3	Max In	16 oz.	No	22.7	14.47	86.01	5115	89.93
4	Tetra bor	16 oz.	No	28.5	14.15	86.93	6365	107.60
5	Check Late	No	Yes	30.7	14.06	85.91	6688	109.04
6	Lucrose	16 oz.	16 oz.	23.7	14.22	86.95	5328	91.00
7	Max In	16 oz.	16 oz.	29.7	14.51	87.21	6851	119.80
8	Tetra bor	16 oz.	16 oz.	26.3	14.43	87.41	6053	106.60
			C.V	15.6	5.74	1.23	17	21.45
			LSD (0.05)	6.0	NS	NS	1457	31.25

Table 5. Late Season Boron Application Influence on Sugarbeet Yield and Quality

Sacred Heart, 2011

Trt	Boron Type	August 17 app.	September 1 app.	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check early	No	No	17.3	14.55	86.75	3970	107.87
2	Lucrose	16 oz.	No	16.3	14.08	86.54	3595	93.26
3	Max In	16 oz.	No	17.1	14.50	86.50	3875	103.69
4	Tetra bor	16 oz.	No	15.7	14.51	86.72	3527	93.74
5	Check Late	No	Yes	14.6	14.33	86.82	3298	87.79
6	Lucrose	16 oz.	16 oz.	16.1	14.66	86.05	3698	100.09
7	Max In	16 oz.	16 oz.	17.8	15.02	87.29	4259	120.30
8	Tetra bor	16 oz.	16 oz.	15.5	14.23	87.09	3500	93.25
			C.V	4.4	1.02	30.76	8	10.62
			LSD (0.05)	0.9	NS	40.37	416	15.61

Table 6. Late Season Boron Application Influence on Sugarbeet Yield and Quality

Combined, 2010-2011

Trt	Boron Type	August 17 app.	September 1 app.	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check early	No	No	24.7	14.61	88.59	5841	96.70
2	Lucrose	16 oz.	No	24.8	14.39	87.82	5634	93.29
3	Max In	16 oz.	No	25.3	14.73	88.19	6013	102.51
4	Tetra bor	16 oz.	No	26.4	14.63	88.85	6255	100.94
5	Check Late	No	Yes	26.4	14.53	88.11	6108	99.86
6	Lucrose	16 oz.	16 oz.	25.6	14.70	88.00	6034	102.52
7	Max In	16 oz.	16 oz.	25.5	14.91	88.66	6143	109.36
8	Tetra bor	16 oz.	16 oz.	23.8	14.54	88.03	5548	94.84
			C.V	14.8	4.09	1.09	16	18.76
			LSD (0.05)	2.6	NS	NS	NS	NS

Fig.1 **Late Season Boron Application Influence on Sugarbeet Yield and Quality Combined Data 2010-2011**

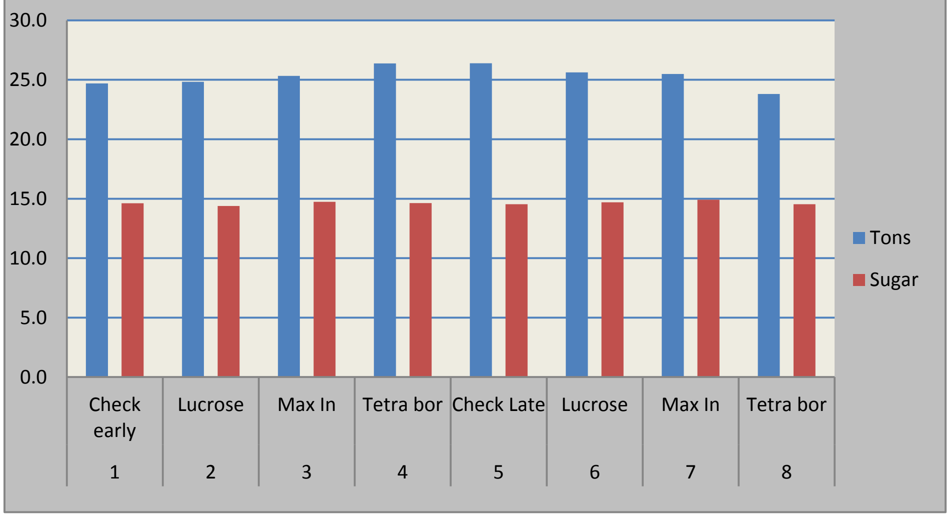
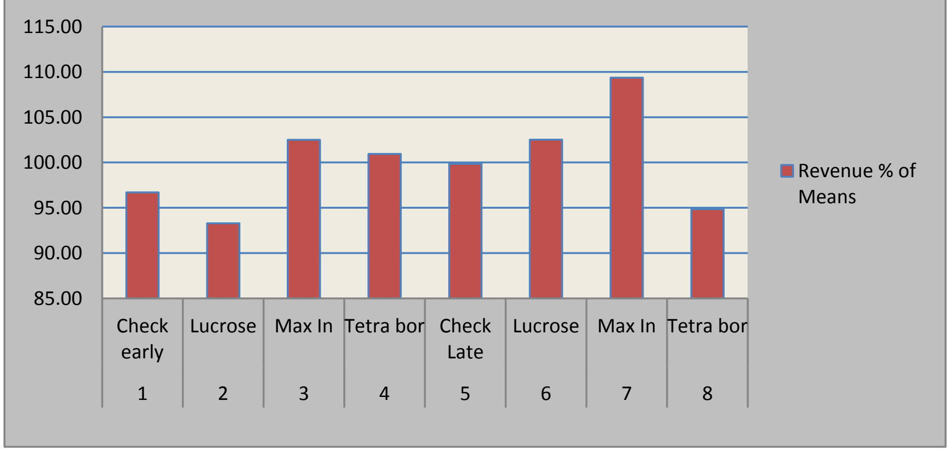


Fig.2 **Late Season Boron Application Influence on Revenue % of Mean Combined Data 2010-2011**



Evaluation of LCO Products to Enhance Sugar Beet Production - 2011

LCO (lipo-chitooligosaccharide) is a molecule that shown in other research to enhance nutritional assimilation that drives natural growth processes. The patented LCO signal molecule may provide an increase in photosynthesis and sugar production in sugarbeet.

Methods

Ratchet is Novozymes' patented LCO Promoter Technology for foliar applications. Testing was initiated in 2011 to investigate if LCO technology will enhance sugar production in sugarbeet.

In 2011 the tests were conducted in Lake Lillian and Sacred Heart, MN. Table 1 shows the production specifics for the Sacred Heart location. Table 3-5 show the activities with table 5 being combined data for both locations. Plots were 11 ft. (6 rows) wide and 35 ft. long. At both locations sugar beets were planted with a 6 row planter. 3 gpa of 10-34-0 liquid fertilizer was applied in-furrow at planting. Plots were not thinned as the sugarbeet stands did not warrant thinning. Both plots were harvested with a 2 row research harvester and the whole plot length was harvested. One sub-sample was collected from each plot and analyzed at the SMBSC Tare Lab for quality. The data is presented by site and combined across locations since statistical analysis of the data was conducted for homogeneity of combinability and determined that the data could be combined across environments or locations.

Results and Discussion

The results will be discussed considering the combined data since the analysis determined the data could be combined since the results were homogeneous. None of the treatments showed a statistical significant advantage over the untreated check. LCO applied at 45 days after planting appeared to increase tons. LCO applied 87 and 108 days after planting at 4 and 8 oz. rates, respectively gave a slight benefit to revenue percent of the mean. Further research will be conducted to further test rate and timing of application. The use of this product is in the investigation stages to determine the previously mentioned application factors. Other possibilities may be to combine the product with other products or in-furrow applications. Figures 1-6 are presented for the readers visual observation of the results.

Table 1. Site specifics for LCO Product Testing Combined, 2011

Location	Planting Timing	Soil Condition
Sacred Heart, 2011	5/19/2011	Lumpy
Lake Lillian, 2011	5/4/2011	Wet/Soft

Table 2. LCO Product Testing
Sacred Heart, 2011

Trt	Lco Rate/oz	Timing	Tons/ Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	NA	Untreated	19.1	14.97	86.73	4524	103.96
2	4	45 DAP	18.4	14.75	86.74	4275	97.12
3	8	45 DAP	20.2	14.14	86.77	4494	95.09
4	4	66 DAP	19.9	14.47	86.86	4543	99.83
5	8	66 DAP	19.2	15.17	88.11	4708	112.08
6	4	87 DAP	18.8	14.12	86.21	4140	87.70
7	8	87 DAP	19.1	14.45	87.35	4396	97.99
8	4	108 DAP	17.9	14.55	89.09	4256	99.36
9	8	108 DAP	19.6	14.84	87.39	4645	106.87
		C.V	11.9	4.68	1.12	13	17.10
		LSD(0.05)	NS	NS	1.41	NS	NS

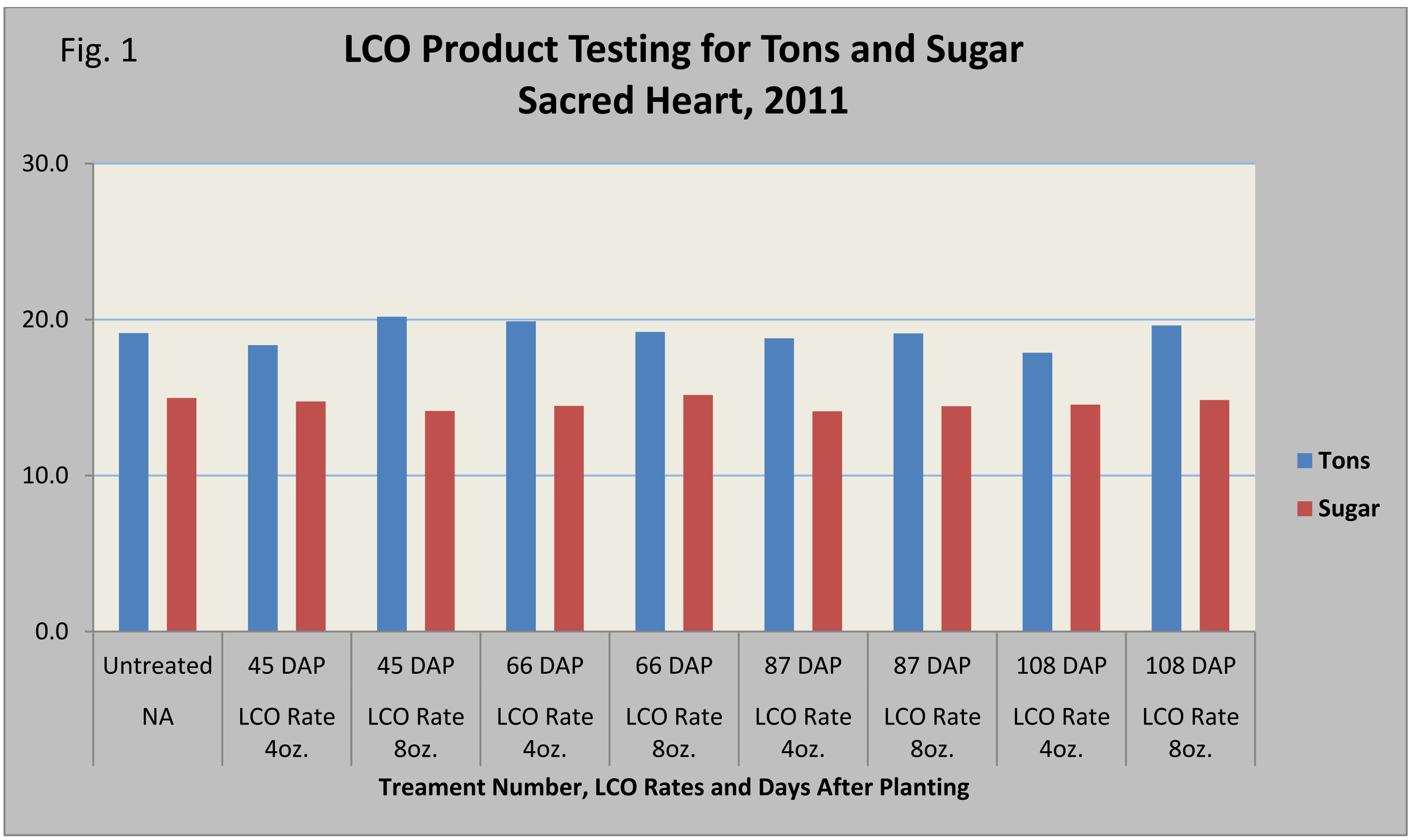
Table 3. Evaluation of LCO (lipo-chitooligosaccharide) for Enhancement of Sugarbeet Production. Lake Lillian, 2011

Trt	Lco Rate/oz	Timing	Tons/ Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	NA	Untreated	26.4	14.50	85.98	5957	107.51
2	4	45 DAP	29.2	14.73	86.80	6797	125.87
3	8	45 DAP	25.1	14.27	84.87	5450	92.97
4	4	66 DAP	24.1	13.75	86.46	5178	85.51
5	8	66 DAP	27.1	13.97	85.82	5852	102.11
6	4	87 DAP	29.3	14.06	85.67	6356	109.57
7	8	87 DAP	24.3	13.72	85.08	5096	87.64
8	4	108 DAP	22.8	13.69	85.16	4769	77.38
9	8	108 DAP	25.1	14.93	86.18	5861	111.44
		C.V	13.9	5.96	1.31	15	20.64
		LSD(0.05)	NS	NS	NS	NS	NS

Table 4. Evaluation of LCO (lipo-chitooligosaccharide) for Enhancement of Sugarbeet Production. Combined Data, 2011

Trt	Lco Rate/oz	Timing	Tons/ Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	NA	Untreated	22.8	14.74	86.35	5241	105.74
2	4	45 DAP	23.8	14.74	86.77	5536	111.50
3	8	45 DAP	22.6	14.21	85.82	4972	94.03
4	4	66 DAP	22.0	14.11	86.66	4860	92.67
5	8	66 DAP	23.1	14.57	86.97	5280	107.10
6	4	87 DAP	24.0	14.09	85.94	5248	98.64
7	8	87 DAP	21.7	14.08	86.22	4746	92.82
8	4	108 DAP	20.3	14.12	87.13	4512	88.37
9	8	108 DAP	22.4	14.89	86.78	5253	109.16
		C.V	21.7	5.01	1.39	21	18.17
		LSD(0.05)	NS	NS	NS	NS	NS

Fig. 1



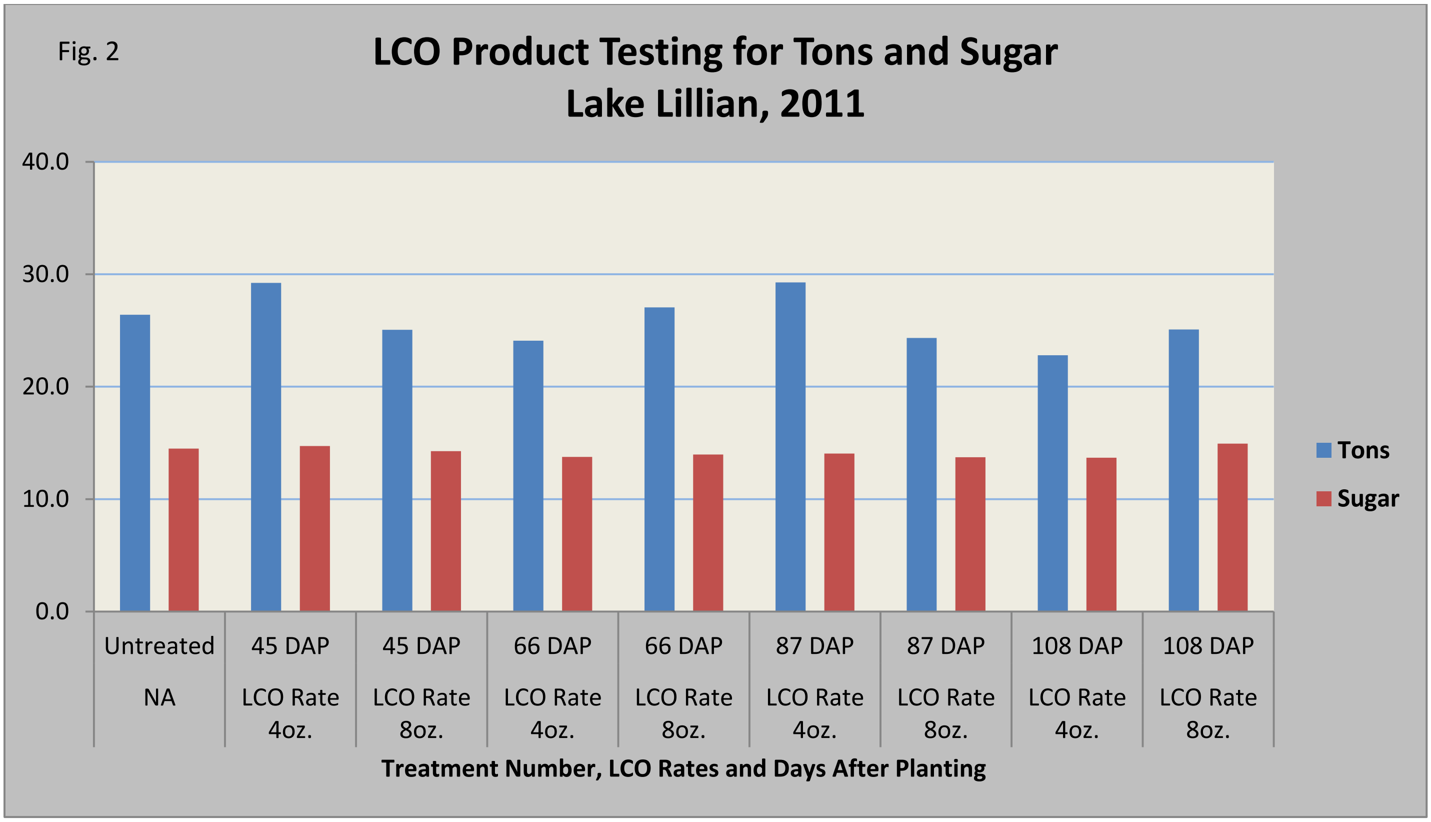


Fig. 2
LCO Product Testing for Tons and Sugar
Lake Lillian, 2011
40.0
30.0
20.0
10.0
0.0
Untreated
NA
45 DAP
LCO Rate
4oz.
45 DAP
LCO Rate
8oz.
66 DAP
LCO Rate
4oz.
66 DAP
LCO Rate
8oz.
87 DAP
LCO Rate
4oz.
87 DAP
LCO Rate
8oz.
108 DAP
LCO Rate
4oz.
108 DAP
LCO Rate
8oz.
Treatment Number, LCO Rates and Days After Planting
Tons
Sugar

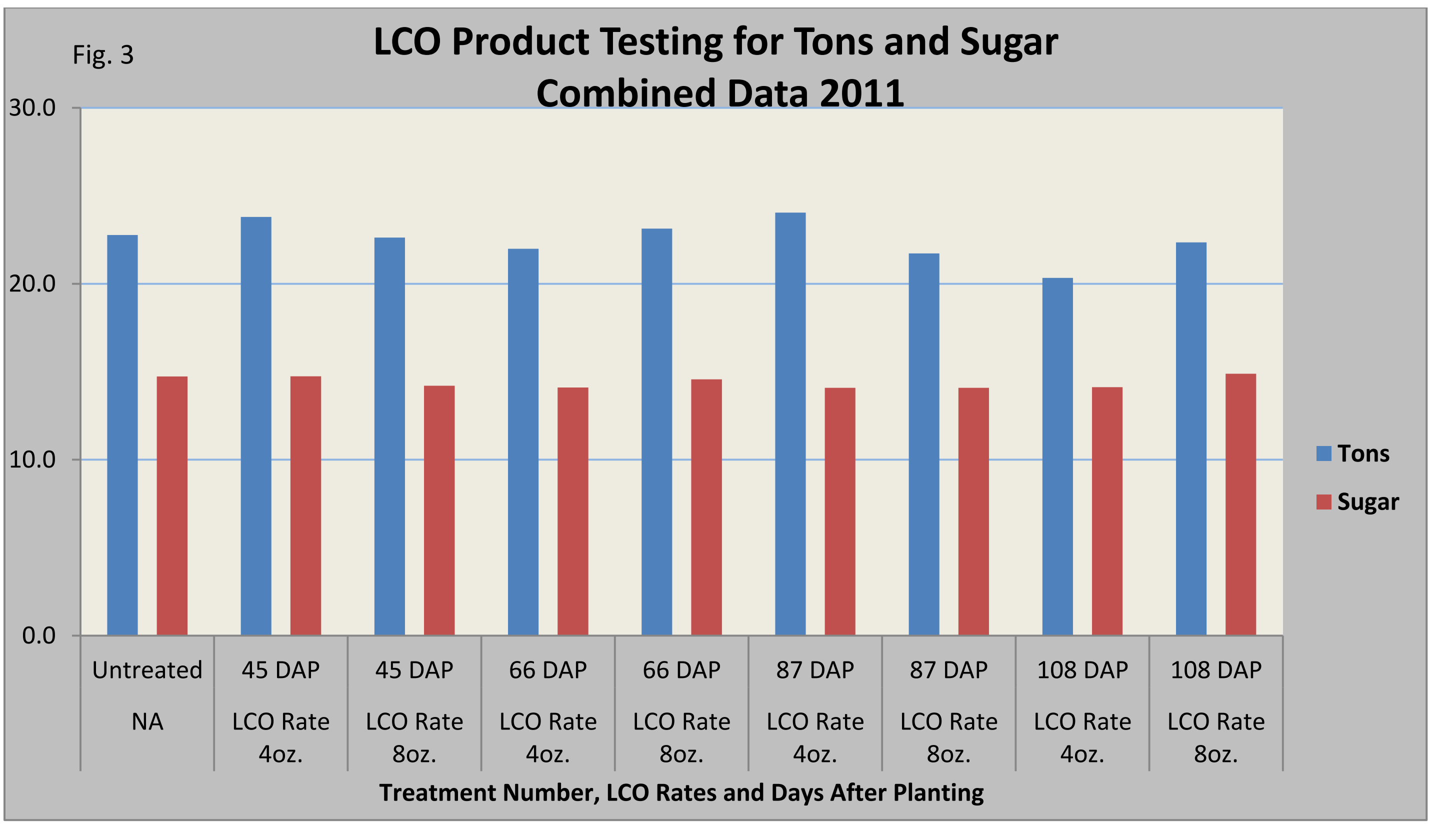


Fig. 3
LCO Product Testing for Tons and Sugar
Combined Data 2011
30.0
20.0
10.0
0.0
Untreated
NA
45 DAP
LCO Rate
4oz.
45 DAP
LCO Rate
8oz.
66 DAP
LCO Rate
4oz.
66 DAP
LCO Rate
8oz.
87 DAP
LCO Rate
4oz.
87 DAP
LCO Rate
8oz.
108 DAP
LCO Rate
4oz.
108 DAP
LCO Rate
8oz.
Treatment Number, LCO Rates and Days After Planting
Tons
Sugar

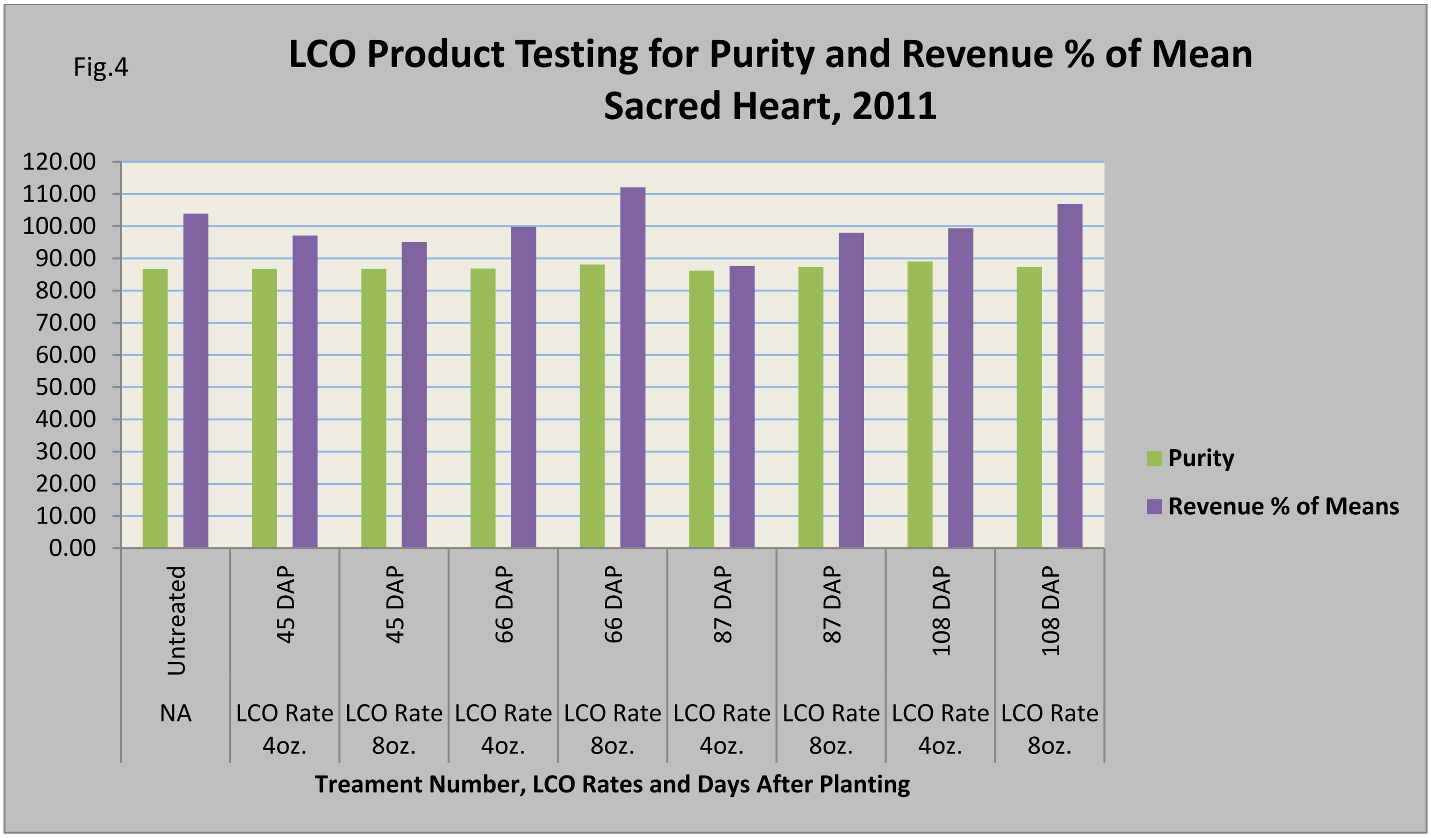


Fig.4
LCO Product Testing for Purity and Revenue % of Mean
Sacred Heart, 2011
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Untreated
45 DAP
45 DAP
66 DAP
66 DAP
87 DAP
87 DAP
108 DAP
108 DAP
NA
LCO Rate 4oz.
LCO Rate 8oz.
LCO Rate 4oz.
LCO Rate 8oz.
LCO Rate 4oz.
LCO Rate 8oz.
LCO Rate 4oz.
LCO Rate 8oz.
Treament Number, LCO Rates and Days After Planting
Purity
Revenue % of Means

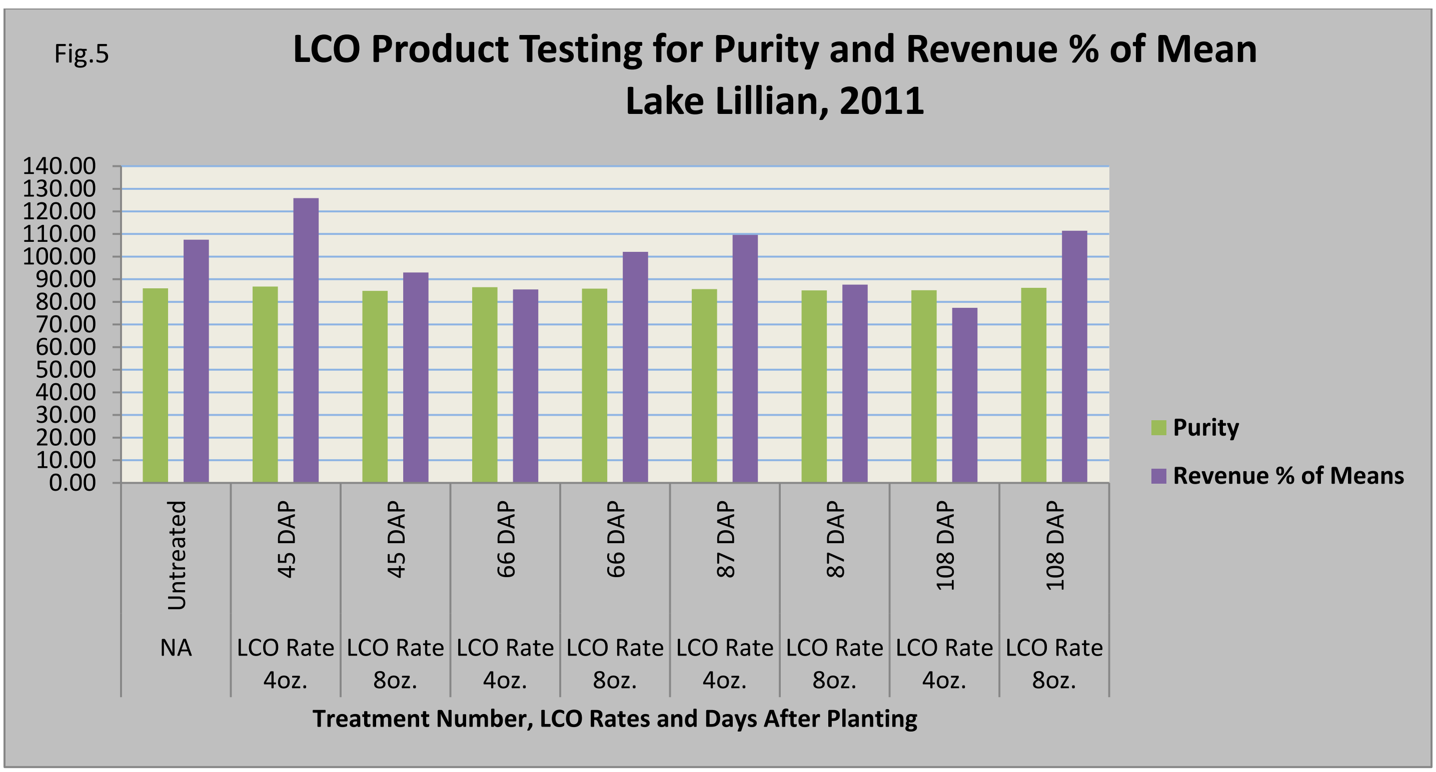


Fig.5
LCO Product Testing for Purity and Revenue % of Mean
Lake Lillian, 2011
140.00
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Untreated
45 DAP
45 DAP
66 DAP
66 DAP
87 DAP
87 DAP
108 DAP
108 DAP
NA
LCO Rate 4oz.
LCO Rate 8oz.
LCO Rate 4oz.
LCO Rate 8oz.
LCO Rate 4oz.
LCO Rate 8oz.
LCO Rate 4oz.
LCO Rate 8oz.
Treatment Number, LCO Rates and Days After Planting
Purity
Revenue % of Means

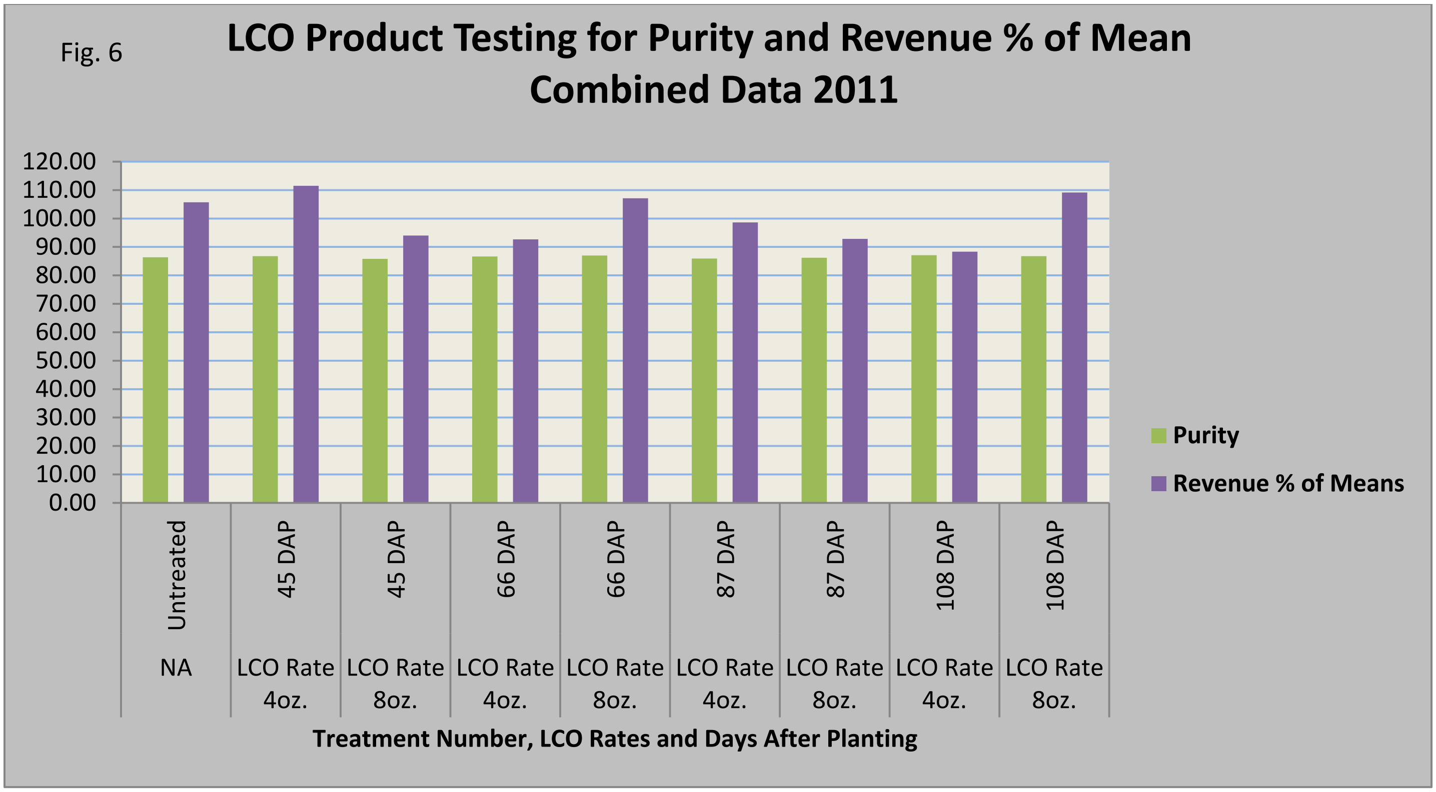


Fig. 6
LCO Product Testing for Purity and Revenue % of Mean
Combined Data 2011
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Untreated
NA
45 DAP
LCO Rate 4oz.
45 DAP
LCO Rate 8oz.
66 DAP
LCO Rate 4oz.
66 DAP
LCO Rate 8oz.
87 DAP
LCO Rate 4oz.
87 DAP
LCO Rate 8oz.
108 DAP
LCO Rate 4oz.
108 DAP
LCO Rate 8oz.
Treatment Number, LCO Rates and Days After Planting
Purity
Revenue % of Means

SMBSC Evaluation of Sulfur Influence on Sugarbeet Growth, 2011

Sugarbeets were planted at two locations to test sulfur application influence on sugarbeet production. The locations were at Glenwood and Clara City, MN.

Methods

Table 1 shows the specifics of activities. Plots were 11 ft. (6 rows) wide and 35 feet long. Shown in tables 2-3, sulfur was incorporated prior to planting, in-furrow and then in June, July, August and September. Sugarbeets were planted by SMBSC research with a 6 row planter in Glenwood and Clara City. Plots were not thinned as the sugarbeet stands did not warrant thinning. Research trials were harvested at Glenwood with a 1 row research harvester and at Clara City with a 2 row research harvester. At Glenwood two quality sub-samples were collected from each plot and analyzed for quality and weighed for yield calculation. Each sample was collected from 10 feet of row. At Clara City the weights were collected and weighed on the harvester for yield calculation and a sub-sample was analyzed in the SMBSC quality lab. Analysis of the data was conducted for homogeneity of combinability and determined that the data could not be combined across environments or locations.

Results and Discussion

Sugarbeet yield and quality were not statistically influenced by the addition of sulfur at the Clara City location. Tons per acre and extractable sucrose per acre were significantly influenced by the addition of Sulfur at the Glenwood location. The influence of sulfur on tons per acre drove the influence on extractable sucrose per acre. The influence sulfur had on tons per acre also influenced the revenue percent of mean. This caused a significant difference in how the addition of sulfur influenced revenue percent of mean. The addition of sulfur significantly influenced sugarbeet productivity and revenue at the Glenwood site in which the soil characteristics were light or course. However the addition of sulfur at the Clara City location did not statistically enhance sugar beet production. The soils at the Clara City location are a heavy soil. The test will be replicated again in 2012.

Table 1. Site Specifics for Sulfur Micronutrient Products Testing Combined, 2011

Location	Planting Date	Soil Condition
Glenwood, 2011	5/2/2011	Damp
Clara City, 2011	5/16/2011	Damp

TABLE 2. Micronutrient, Sulfur, Influence on Sugarbeet Production
Glenwood, 2011

Trt	Product	Application	Product Rate	Stand	Tons/Acre	% Sugar	Purity	Ext. Suc.Per Acre (Lbs.)	Revenue % of Mean
1	Untreated			213	16.3	13.57	90.19	3652	89.92
2	Ammonium Sulfate (AMS)	Broadcast incorporated	10 lb/ac	239	18.9	13.41	89.79	4169	100.74
3	Ammonium Sulfate (AMS)	Broadcast incorporated	15 lb/ac	210	17.3	13.60	90.11	3893	95.96
4	Ammonium Sulfate (AMS)	Broadcast incorporated	20 lb/ac	213	20.5	13.50	89.65	4533	109.92
5	Urea	Broadcast incorporated	70 lb/ac	214	18.7	13.61	89.81	4200	102.95
6	Ammonium Sulfate (AMS)	Infurrow	5 lb/ac	219	20.0	13.30	89.52	4356	103.83
7	Ammonium Sulfate (AMS)	Infurrow	10 lb/ac	193	19.0	13.19	89.76	4122	107.10
8	Ammonium Sulfate (AMS)	Foliar June 1	10 lb/ac	255	20.9	13.56	90.13	4695	115.30
9	Ammonium Sulfate (AMS)	Foliar July 1	10 lb/ac	223	15.6	13.39	89.95	3448	82.91
10	Ammonium Sulfate (AMS)	Foliar August 1	10 lb/ac	238	19.3	13.54	89.77	4295	104.38
11	Ammonium Sulfate (AMS)	Foliar September 1	10 lb/ac	234	16.7	13.24	89.91	3647	86.97
		C.V		16	14.9	2.81	0.72	16	18.61
		LSD (0.05)		NS	4.0	NS	NS	969	NS

TABLE 3. Micronutrient, Sulfur,Influence on Sugarbeet Production
Clara City, 2011

Trt	Product	Application	Product Rate	Stand	Tons/Acre	% Sugar	Purity	Ext. Suc.Per Acre (Lbs.)	Revenue % of Mean
1	Untreated			128	26.9	17.27	90.32	7824	97.68
2	Ammonium Sulfate (AMS)	Broadcast incorporated	10 lb/ac	125	27.8	17.32	90.19	8086	100.85
3	Ammonium Sulfate (AMS)	Broadcast incorporated	15 lb/ac	123	28.5	17.35	90.04	8304	103.88
4	Ammonium Sulfate (AMS)	Broadcast incorporated	20 lb/ac	108	28.3	17.27	90.10	8191	102.01
5	Urea	Broadcast incorporated	70 lb/ac	95	26.1	17.52	90.95	7781	98.79
6	Ammonium Sulfate (AMS)	Infurrow	5 lb/ac	125	26.9	17.35	90.91	7936	100.00
7	Ammonium Sulfate (AMS)	Infurrow	10 lb/ac	135	26.7	17.52	91.19	7974	101.46
8	Ammonium Sulfate (AMS)	Foliar June 1	10 lb/ac	123	26.4	17.27	90.58	7707	96.48
9	Ammonium Sulfate (AMS)	Foliar July 1	10 lb/ac	120	27.3	17.40	90.77	8044	101.61
10	Ammonium Sulfate (AMS)	Foliar August 1	10 lb/ac	123	26.5	17.32	90.54	7742	96.95
		C.V		10	5.8	2.18	0.74	6	6.30
		LSD (0.05)		NS	NS	NS	NS	NS	NS

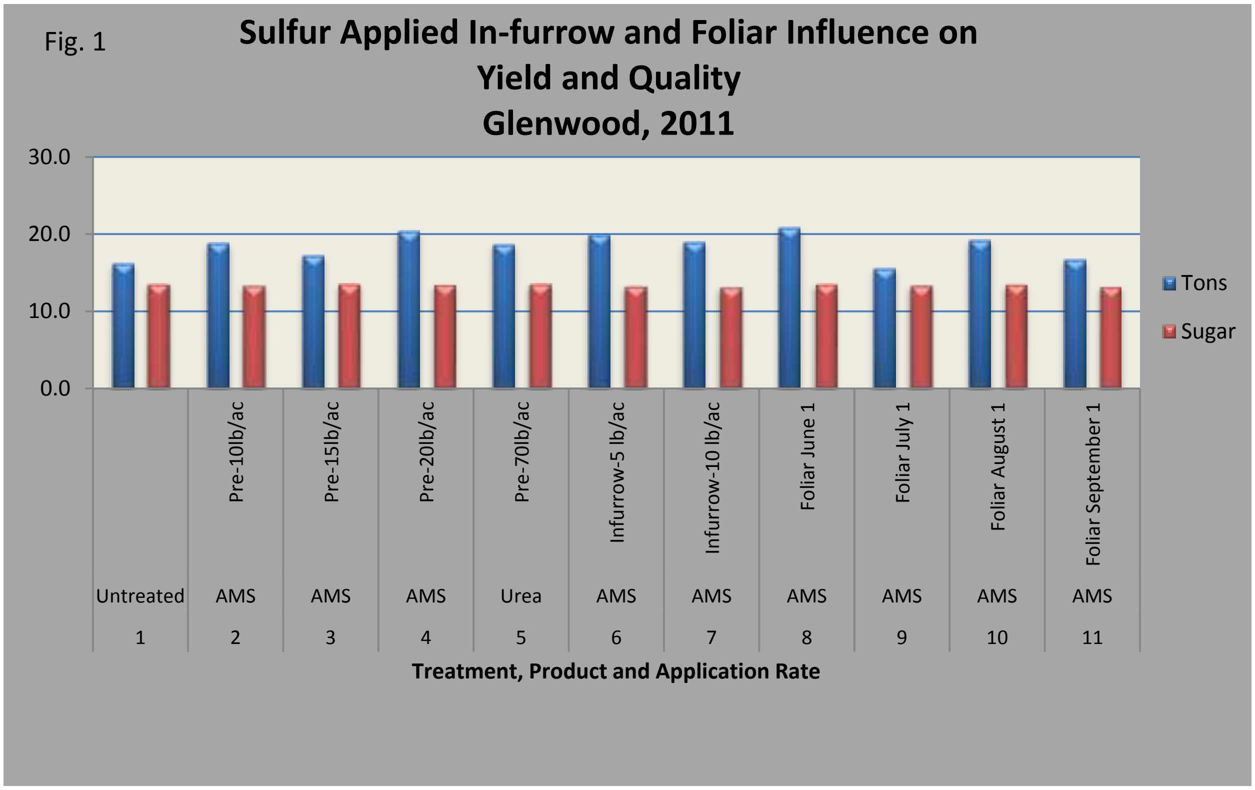


Fig. 1
Sulfur Applied In-furrow and Foliar Influence on
Yield and Quality
Glenwood, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Untreated
1
Pre-10lb/ac
AMS
2
Pre-15lb/ac
AMS
3
Pre-20lb/ac
AMS
4
Pre-70lb/ac
Urea
5
Infurrow-5 lb/ac
AMS
6
Infurrow-10 lb/ac
AMS
7
Foliar June 1
AMS
8
Foliar July 1
AMS
9
Foliar August 1
AMS
10
Foliar September 1
AMS
11
Treatment, Product and Application Rate

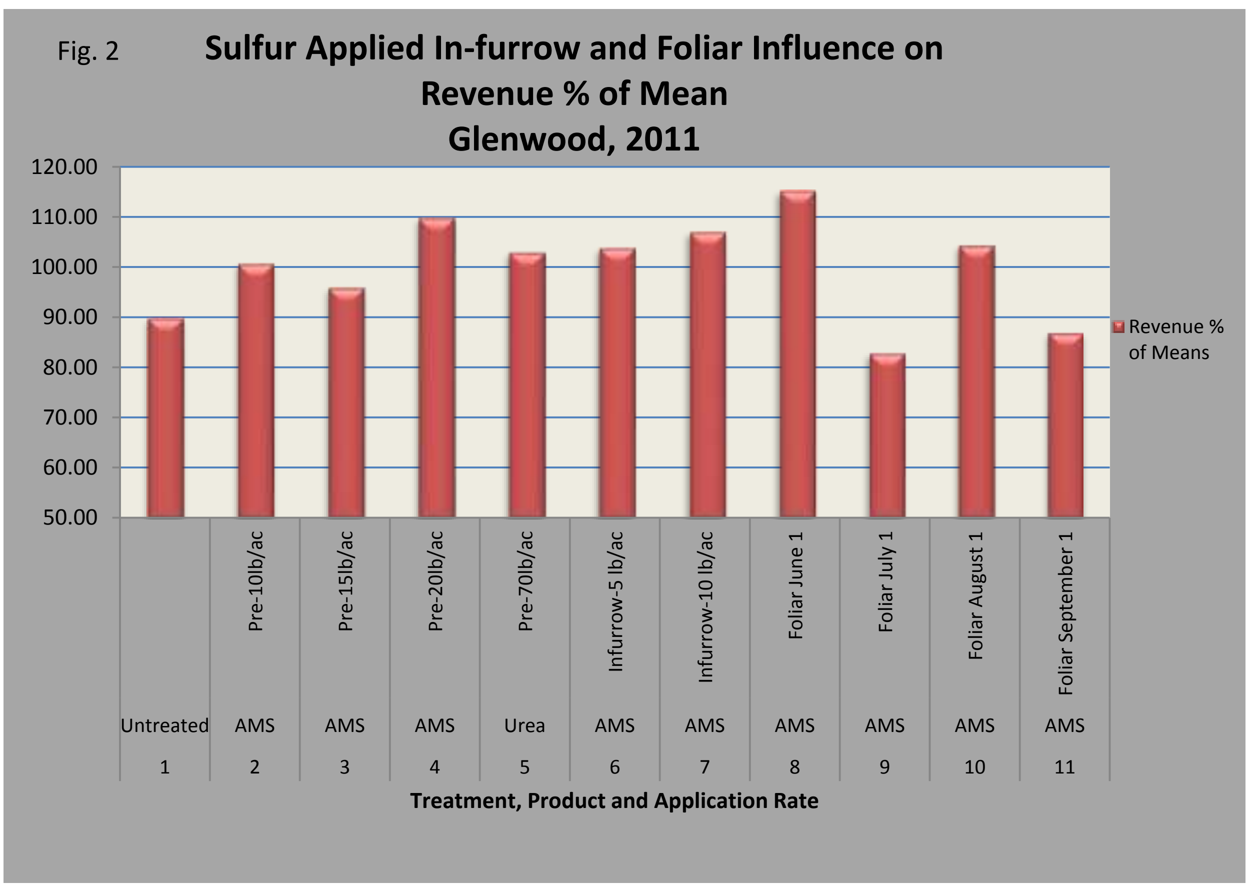


Fig. 2
Sulfur Applied In-furrow and Foliar Influence on
Revenue % of Mean
Glenwood, 2011
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
Revenue % of Means
Untreated
1
Pre-10lb/ac
AMS
2
Pre-15lb/ac
AMS
3
Pre-20lb/ac
AMS
4
Pre-70lb/ac
Urea
5
Infurrow-5 lb/ac
AMS
6
Infurrow-10 lb/ac
AMS
7
Foliar June 1
AMS
8
Foliar July 1
AMS
9
Foliar August 1
AMS
10
Foliar September 1
AMS
11
Treatment, Product and Application Rate

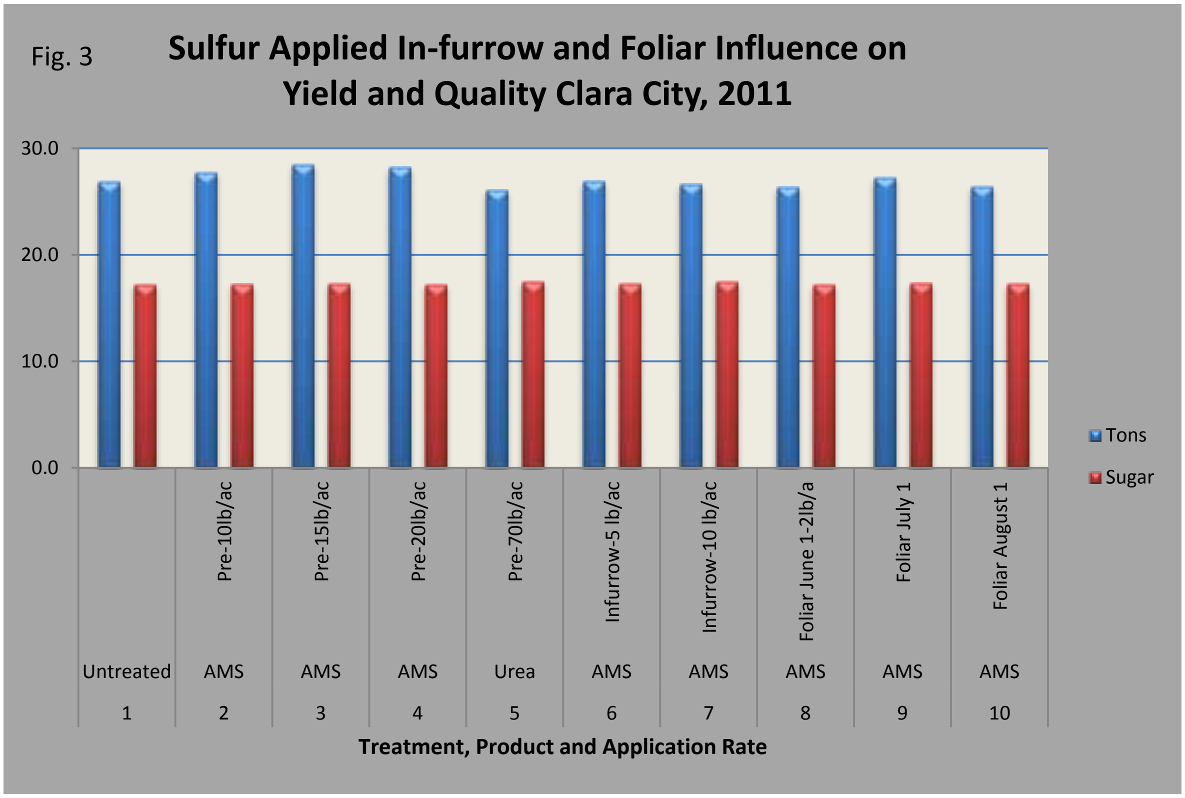


Fig. 3
Sulfur Applied In-furrow and Foliar Influence on Yield and Quality Clara City, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Pre-10lb/ac
Pre-15lb/ac
Pre-20lb/ac
Pre-70lb/ac
Infurrow-5 lb/ac
Infurrow-10 lb/ac
Foliar June 1-2lb/a
Foliar July 1
Foliar August 1
Untreated
AMS
AMS
AMS
Urea
AMS
AMS
AMS
AMS
AMS
1
2
3
4
5
6
7
8
9
10
Treatment, Product and Application Rate

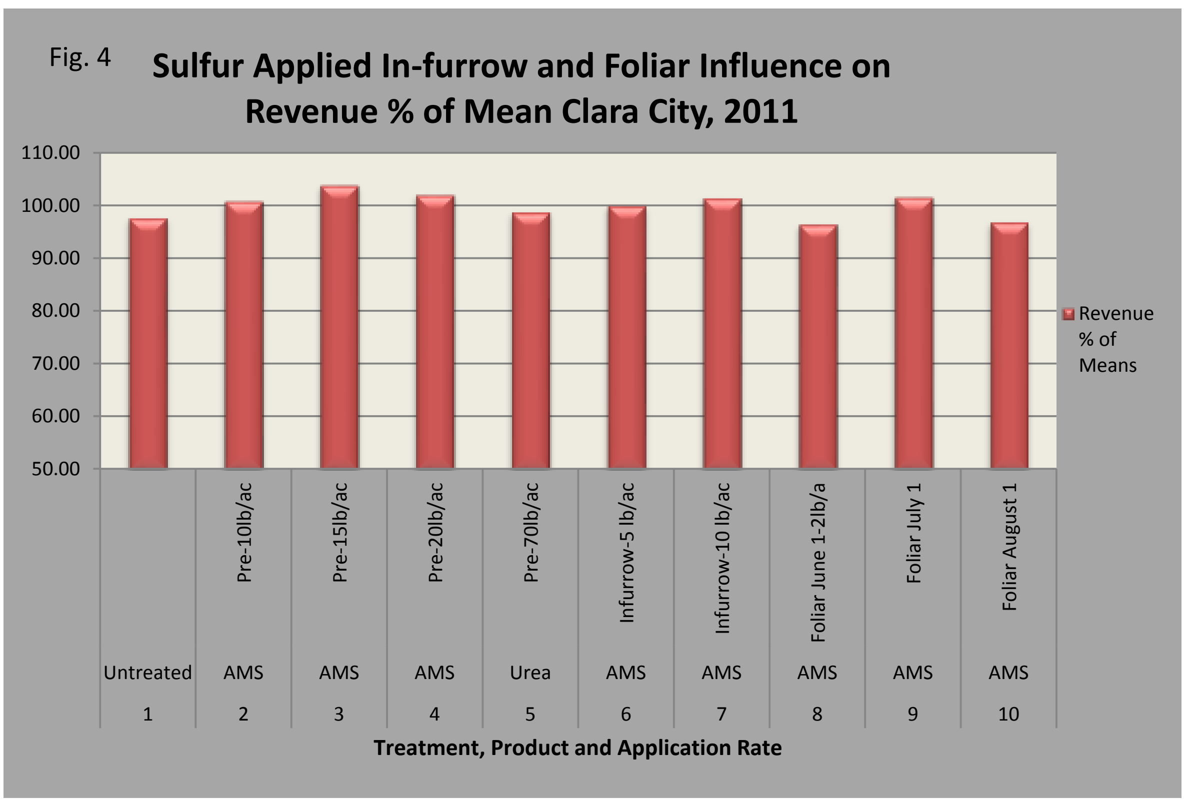


Fig. 4
Sulfur Applied In-furrow and Foliar Influence on Revenue % of Mean Clara City, 2011
110.00
100.00
90.00
80.00
70.00
60.00
50.00
Revenue % of Means
Pre-10lb/ac
Pre-15lb/ac
Pre-20lb/ac
Pre-70lb/ac
Infurrow-5 lb/ac
Infurrow-10 lb/ac
Foliar June 1-2lb/a
Foliar July 1
Foliar August 1
Untreated
AMS
AMS
AMS
Urea
AMS
AMS
AMS
AMS
AMS
1
2
3
4
5
6
7
8
9
10
Treatment, Product and Application Rate

SMBSC Evaluation of Boron Influence on Sugarbeet Growth, **2011**

Sugarbeets were planted at three locations in 2011 to test boron application influence on sugarbeet production. The locations were at Glenwood, Clara City and Bird Island, MN.

Methods

Table 1 shows the specifics of activities conducted at all sites. Plots were 11 ft. (6 rows) wide and 35 feet long. Tables 2-4 show boron was incorporated prior to planting, in-furrow and at the 1st of June, July, August and September. Sugarbeets were planted by SMBSC research with a 6 row planter in Glenwood, Clara City and Bird Island. Plots were not thinned as the sugarbeet stands did not warrant thinning. Research trials were harvested at Glenwood and Bird Island with a 1 row research harvester and at Clara City with a 2 row research harvester. At Glenwood and Bird Island two quality sub-samples were collected from each plot and analyzed for quality and weighed for yield calculation. Each sample was collected from 10 feet of row. At Clara City the weights were collected and weighed on the harvester for yield calculation and a sub-sample was analyzed in the SMBSC quality lab. Statistical analysis of the data was conducted for homogeneity of combinability and determined that the data could not be combined across locations.

Results and Discussion

At Glenwood the 4 and 6 lb. incorporated and the July 1st foliar treatments had a significant advantage over other boron treatments (Table 2). All boron treatments at the Glenwood site showed a significant advantage over the untreated check. At Clara City there was no significant advantage to boron applications when comparing boron applications (Table 3). However, Boron applied broadcast at 6 lbs. per acre enhanced sugarbeet production significantly greater than the untreated check and tended to give higher sugarbeet production than other boron applications. At Bird Island all foliar and 2 lb. incorporated treatments showed a significant advantage over the non-treated check. The boron tested in 2011 showed a benefit that varied across research locations. Figures 1-6 are presented for the reader to have a visual perspective of the results. The test will be replicated again in 2012.

Table 1. Site Specifics for Boron Micronutrient Product Testing. Combined-2011

Location	Planting Timing	Soil Condition
Glenwood, 2011	5/2/2010	Damp
Clara City, 2011	5/16/2011	Damp
Bird Island, 2011	5/19/2011	Muddy

TABLE 2. Boron Application Influence on Yield and Quality of Sugarbeets Glenwood, 2011

Trt	Product	Application	Product Rate	Stand	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Untreated None			206	11.9	12.96	89.36	2523	80.35
2	Boron	Preplant	2 lb/ac	181	18.9	13.29	89.58	4104	98.12
3	Boron	Preplant	4 lb/ac	226	21.7	13.32	90.98	4828	137.63
4	Boron	Preplant	6 lb/ac	219	19.4	13.17	90.11	4209	118.70
5	Boron	In-furrow	.5 pt/ac	224	17.2	13.32	89.83	3768	98.97
6	Boron	In-furrow	1 pt/ac	234	14.5	12.83	89.09	3008	76.43
7	Boron	Foliar June 1	1 pt/ac	226	14.5	12.33	88.15	2844	74.16
8	Boron	Foliar July 1	1 pt/ac	221	18.6	12.95	88.33	3870	119.33
9	Boron	Foliar August 1	1 pt/ac	199	14.6	12.82	89.59	3063	89.96
10	Boron	Foliar September 1	1 pt/ac	191	18.0	13.01	89.23	3803	106.35
		C.V		11	13.2	4.34	1.50	11	14.38
		LSD (0.05)		NS	3.6	NS	NS	629	20.86

TABLE 3. Micronutrient Product Testing for Boron
Clara City, 2011

Trt	Product	Application	Product Rate	Stand	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Untreated None	none		128	24.3	17.78	90.69	7319	99.88
2	Boron (granular)	Broadcast incorporated	2 lb/ac	90	25.0	17.46	90.45	7376	99.18
3	Boron (granular)	Broadcast incorporated	4 lb/ac	143	25.6	17.50	90.54	7568	102.18
4	Boron (granular)	Broadcast incorporated	6 lb/ac	138	26.9	17.55	90.43	7972	106.95
5	Boron (Max-In)	In-furrow	.5 pt/ac	138	24.6	17.64	91.23	7402	101.20
6	Boron (Max-In)	In-furrow	1 pt/ac	133	24.8	17.84	90.49	7478	101.92
7	Boron (Max-In)	Foliar June 1	1 pt/ac	145	24.6	17.49	90.93	7312	98.92
8	Boron (Max-In)	Foliar July 1	1 pt/ac	133	23.8	17.61	91.08	7132	97.04
9	Boron (Max-In)	Foliar August 1	1 pt/ac	110	22.9	17.88	90.51	6909	94.98
10	Boron (Max-In)	Foliar September 1	1 pt/ac	108	24.3	17.60	90.59	7233	97.76
		C.V		17	6.7	2.34	0.65	8	8.78
		LSD (0.05)		NS	2.4	NS	NS	NS	NS

TABLE 4. Boron Application on Yield and Quality of Sugarbeets
Bird Island, 2011

Trt	Product	Application	Product Rate	Stand	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Untreated None			168	15.1	14.65	88.77	3616	78.62
2	Boron	Preplant	2 lb/ac	169	15.8	14.74	89.49	3827	108.32
3	Boron	Preplant	4 lb/ac	206	14.4	14.19	88.77	3319	90.51
4	Boron	Preplant	6 lb/ac	216	15.3	14.25	89.33	3582	96.27
5	Boron	In-furrow	.5 pt/ac	164	16.1	14.27	89.58	3784	90.01
6	Boron	In-furrow	1 pt/ac	173	16.7	14.41	88.58	3894	93.21
7	Boron	Foliar June 1	1 pt/ac	195	18.7	14.40	89.40	4417	106.18
8	Boron	Foliar July 1	1 pt/ac	174	19.9	15.08	90.27	5004	128.49
9	Boron	Foliar August 1	1 pt/ac	193	13.7	14.72	89.73	3343	107.50
10	Boron	Foliar September 1	1 pt/ac	170	18.1	14.16	89.49	4201	100.88
		C.V		20	14.5	5.01	1.38	15	17.77
		LSD (0.05)		NS	3.7	NS	NS	874	25.78

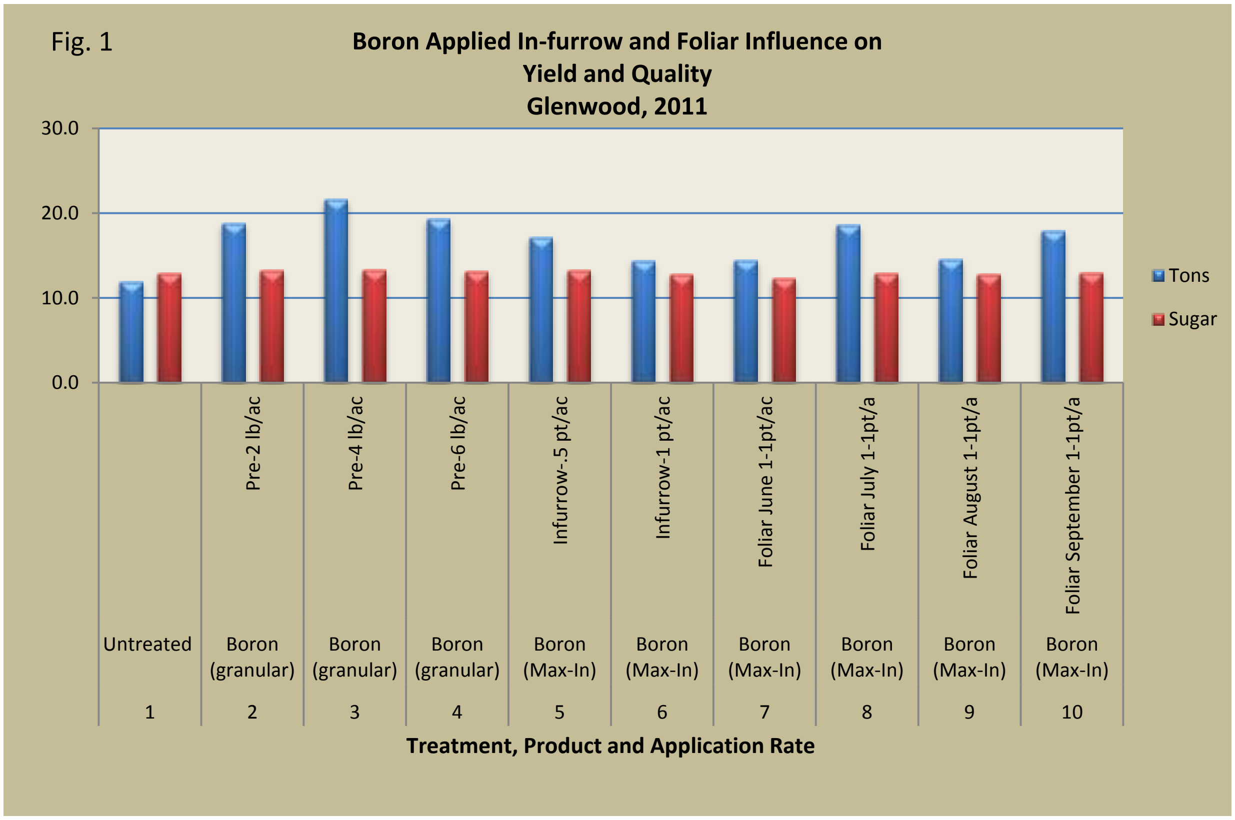


Fig. 1
Boron Applied In-furrow and Foliar Influence on
Yield and Quality
Glenwood, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Pre-2 lb/ac
Pre-4 lb/ac
Pre-6 lb/ac
Infurrow-.5 pt/ac
Infurrow-1 pt/ac
Foliar June 1-1pt/ac
Foliar July 1-1pt/a
Foliar August 1-1pt/a
Foliar September 1-1pt/a
Untreated
Boron (granular)
Boron (granular)
Boron (granular)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
1
2
3
4
5
6
7
8
9
10
Treatment, Product and Application Rate

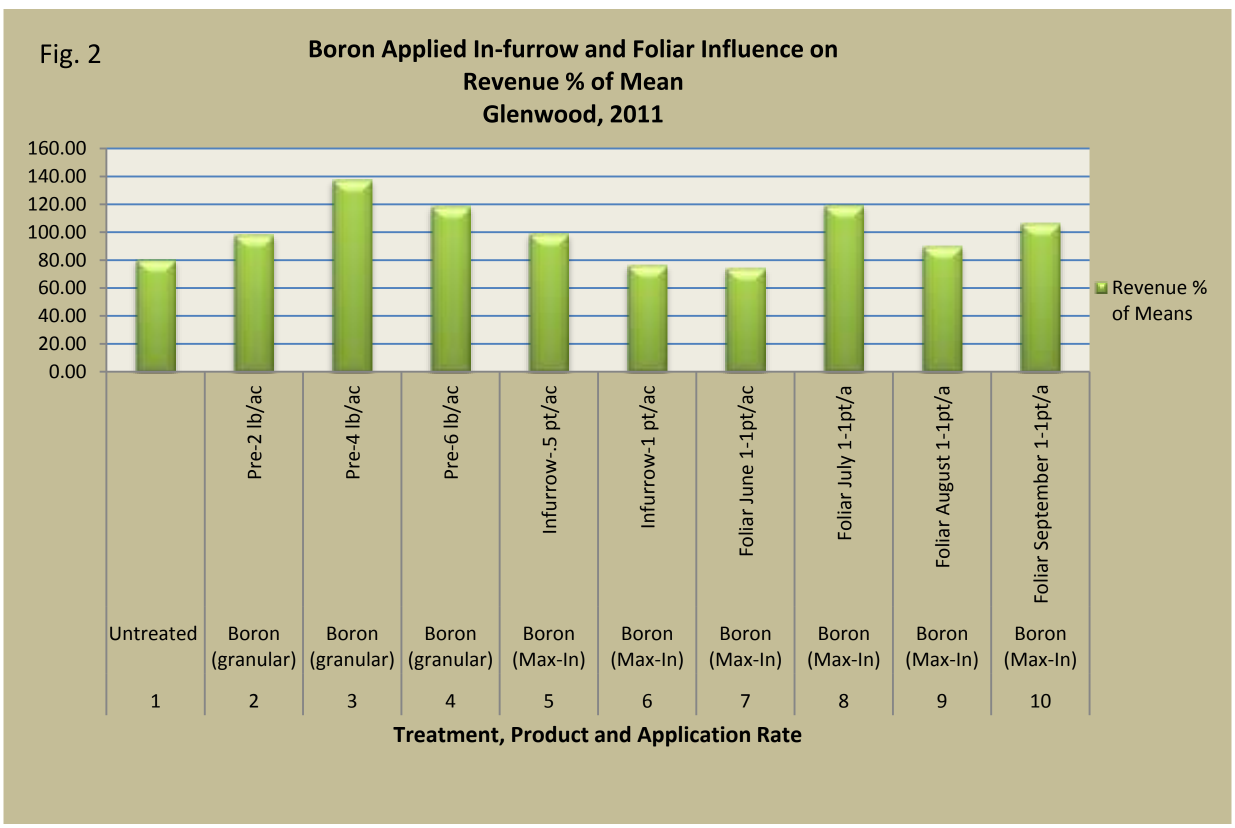


Fig. 2
Boron Applied In-furrow and Foliar Influence on
Revenue % of Mean
Glenwood, 2011
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
Pre-2 lb/ac
Pre-4 lb/ac
Pre-6 lb/ac
Infurrow-.5 pt/ac
Infurrow-1 pt/ac
Foliar June 1-1pt/ac
Foliar July 1-1pt/a
Foliar August 1-1pt/a
Foliar September 1-1pt/a
Untreated
Boron (granular)
Boron (granular)
Boron (granular)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
1
2
3
4
5
6
7
8
9
10
Treatment, Product and Application Rate

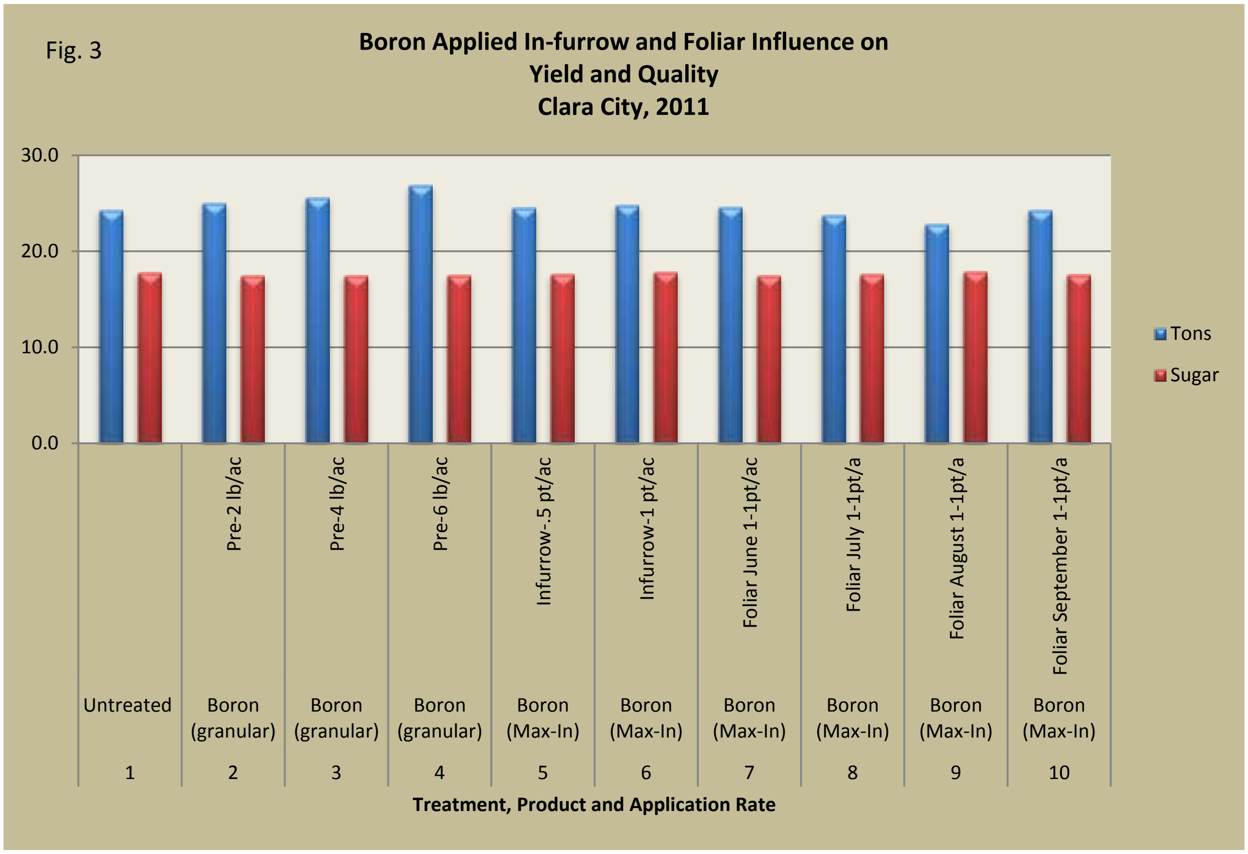


Fig. 3
Boron Applied In-furrow and Foliar Influence on
Yield and Quality
Clara City, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Pre-2 lb/ac
Pre-4 lb/ac
Pre-6 lb/ac
Infurrow-.5 pt/ac
Infurrow-1 pt/ac
Foliar June 1-1pt/ac
Foliar July 1-1pt/a
Foliar August 1-1pt/a
Foliar September 1-1pt/a
Untreated
Boron (granular)
Boron (granular)
Boron (granular)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
1
2
3
4
5
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7
8
9
10
Treatment, Product and Application Rate

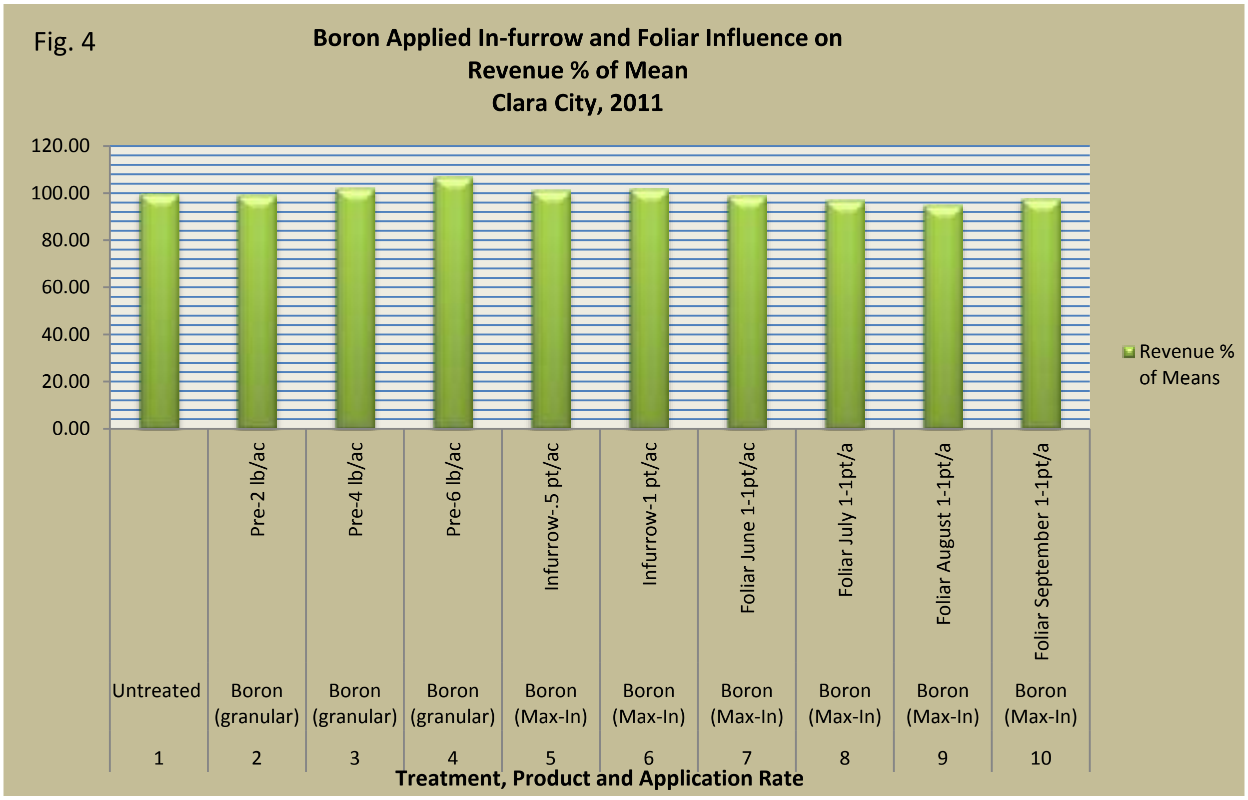
Fig. 4
Boron Applied In-furrow and Foliar Influence on
Revenue % of Mean
Clara City, 2011
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
Pre-2 lb/ac
Pre-4 lb/ac
Pre-6 lb/ac
Infurrow-.5 pt/ac
Infurrow-1 pt/ac
Foliar June 1-1pt/ac
Foliar July 1-1pt/a
Foliar August 1-1pt/a
Foliar September 1-1pt/a
Untreated
Boron (granular)
Boron (granular)
Boron (granular)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
1
2
3
4
5
6
7
8
9
10
Treatment, Product and Application Rate

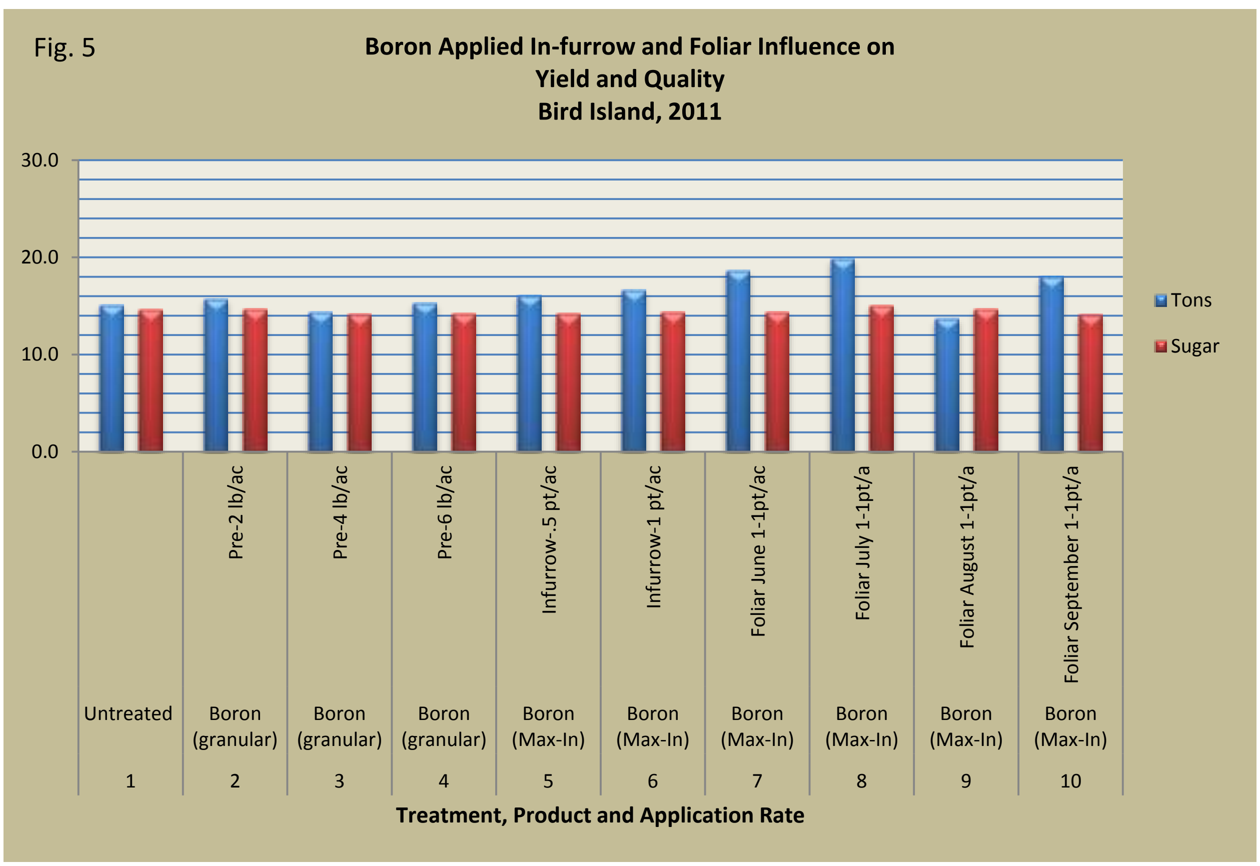
Fig. 5
Boron Applied In-furrow and Foliar Influence on
Yield and Quality
Bird Island, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Pre-2 lb/ac
Pre-4 lb/ac
Pre-6 lb/ac
Infurrow-.5 pt/ac
Infurrow-1 pt/ac
Foliar June 1-1pt/ac
Foliar July 1-1pt/a
Foliar August 1-1pt/a
Foliar September 1-1pt/a
Untreated
Boron (granular)
Boron (granular)
Boron (granular)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
Boron (Max-In)
1
2
3
4
5
6
7
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Treatment, Product and Application Rate

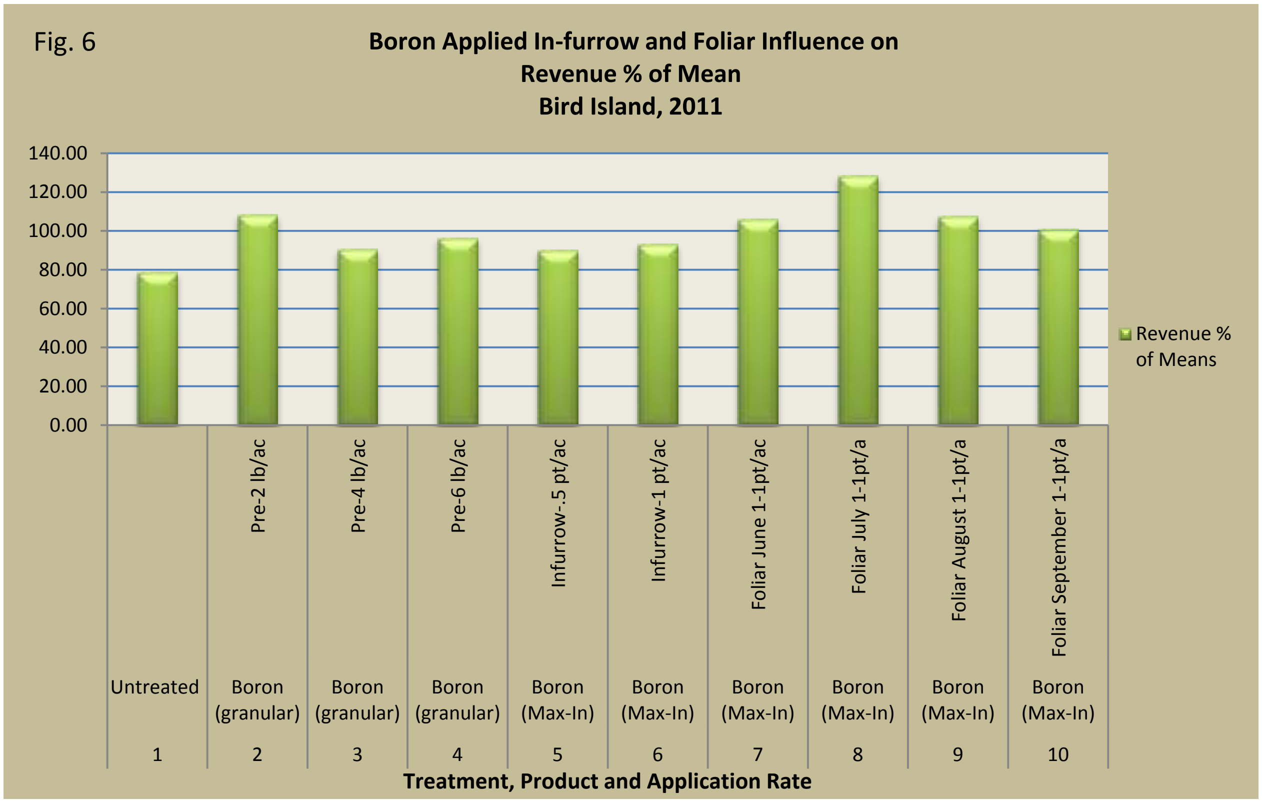

Fig. 6
Boron Applied In-furrow and Foliar Influence on
Revenue % of Mean
Bird Island, 2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
Untreated
Pre-2 lb/ac
Pre-4 lb/ac
Pre-6 lb/ac
Infurrow-.5 pt/ac
Infurrow-1 pt/ac
Foliar June 1-1pt/ac
Foliar July 1-1pt/a
Foliar August 1-1pt/a
Foliar September 1-1pt/a
Boron (granular)
Boron (Max-In)
1
2
3
4
5
6
7
8
9
10
Treatment, Product and Application Rate

SMBSC Evaluation of Manganese Influence on Sugarbeet Growth, 2011

Methods

Sugarbeets were planted at three locations to test manganese application influence on sugarbeet production. The locations were at Glenwood, Clara City and Bird Island, MN.

Table 1 shows the specifics of activities. Plots were 11 ft. (6 rows) wide and 35 feet long. Manganese was incorporated prior to planting, in- furrow and then at the 1st of June, July, August and September. Sugarbeets were planted by SMBSC research with a 6 row planter at all locations. Plots were not thinned as the sugarbeet stands did not warrant thinning. Research trials were harvested at Glenwood and Bird Island with a 1 row research harvester and at Clara City with a 2 row research harvester. At Glenwood and Bird Island two quality sub-samples were collected from each plot and analyzed for quality and weighed for yield calculation. Each sample was collected from 10 feet of row. At Clara City the weights were collected and weighed on the harvester for yield calculation and a subsample was analyzed in the SMBSC quality lab. Analysis of the data was conducted for homogeneity of combinability and determined that the data could not be combined across environments or locations.

Results and Discussion

At the Clara City and Bird Island locations sugarbeet yield and quality were not influenced by the soil incorporated or foliar applied manganese treatments. Manganese applications at the Glenwood location influenced the yield and quality at the 15 lb./acre broadcast incorporated rate and the August 1st foliar application These data indicate that the addition of manganese may be advantageous to sugarbeet production on sandy soils and not advantageous in heavy soils such as those at the Clara City and Bird Island site. However, there were tendencies for the manganese to influence the tons per acre at the heavier textured soil sites. The enhanced yield was specifically observed when the manganese was applied Infurrow and not so much as a foliar or broadcast application. The difference in how the manganese influenced sugarbeet production at the sites with different soil characteristics indicates that there might be a tie up of the manganese in the heavier soil. The inability of the foliar applications to enhance production could be due to the inability of the sugarbeet plant to properly absorb and translocate the manganese in a Round-up ready variety. Testing will be replicated in 2012.

Table 1. Application Specifics for Manganese Micronutrient Product Treatments
Glenwood, 2011

Location	Planting Timing	Soil Condition
Glenwood, 2011	5/2/2010	Damp
Clara City, 2011	5/16/2011	Damp
Bird Island, 2011	5/19/2011	Damp

TABLE 2. Micronutrient Product Testing for Manganese
Glenwood, 2011

Trt	Product	Application	Rate	Stand	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Untreated			248	17.3	13.06	89.87	3701	100.06
2	Manganese	Broadcast incorporated	5 lb/ac	218	17.0	13.04	90.23	3653	99.05
3	Manganese	Broadcast incorporated	10 lb/ac	246	15.5	12.91	89.77	3290	87.30
4	Manganese	Broadcast incorporated	15 lb/ac	229	22.0	13.43	90.83	4928	140.10
5	Manganese (Mangrow)	In-furrow	3 lb/ac	243	15.2	13.18	90.01	3308	90.93
6	Manganese (Mangrow)	In-furrow	5 lb/ac	223	15.3	13.06	89.88	3277	88.35
7	Manganese (Max-In)	Foliar June 1	1.5 qt/ac	223	15.6	12.71	89.38	3236	83.01
8	Manganese (Max-In)	Foliar July 1	1.5 qt/ac	223	16.4	12.82	89.45	3425	89.71
9	Manganese (Max-In)	Foliar August 1	1.5 qt/ac	229	19.8	13.58	90.55	4465	127.38
10	Manganese (Max-In)	Foliar September 1	1.5 qt/ac	236	17.4	12.79	89.45	3628	94.13
		C.V		9	10.4	2.61	0.63	10	11.52
		LSD (0.05)		NS	2.6	0.49	0.82	553	16.72

TABLE 3. Micronutrient Product Testing for Manganese
Clara City, 2011

Trt	Product	Application	Rate	Stand	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Untreated			130	23.5	17.82	90.74	7093	104.24
2	Manganese	Broadcast incorporated	5 lb/ac	130	22.2	17.61	90.53	6616	96.12
3	Manganese	Broadcast incorporated	10 lb/ac	130	23.4	17.64	90.53	6978	101.91
4	Manganese	Broadcast incorporated	15 lb/ac	130	23.5	17.32	90.11	6839	97.78
5	Manganese (Mangrow)	In-furrow	3 lb/ac	133	24.7	16.91	90.47	7046	98.33
6	Manganese (Mangrow)	In-furrow	5 lb/ac	125	24.9	17.75	90.57	7473	109.09
7	Manganese (Max-In)	Foliar June 1	1.5 qt/ac	130	23.9	17.52	90.40	7073	102.54
8	Manganese (Max-In)	Foliar July 1	1.5 qt/ac	125	23.6	17.42	89.76	6879	98.28
9	Manganese (Max-In)	Foliar August 1	1.5 qt/ac	135	23.0	17.35	90.57	6757	97.36
10	Manganese (Max-In)	Foliar September 1	1.5 qt/ac	145	22.7	17.30	90.12	6594	94.34
		C.V		12	9.7	2.90	0.61	9	9.24
		LSD (0.05)		NS	NS	NS	NS	NS	NS

TABLE 4. Micronutrient Product Testing for Manganese
Bird Island, 2011

Trt	Product	Application	Rate	Stand	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Untreated			128	17.8	14.59	89.04	4260	92.88
2	Manganese	Broadcast incorporated	5 lb/ac	146	17.9	14.72	89.99	4385	92.22
3	Manganese	Broadcast incorporated	10 lb/ac	140	18.4	15.03	90.06	4610	97.85
4	Manganese	Broadcast incorporated	15 lb/ac	135	19.0	15.00	90.12	4738	100.94
5	Manganese (Mangrow)	In-furrow	3 lb/ac	129	20.6	15.20	89.97	5202	112.02
6	Manganese (Mangrow)	In-furrow	5 lb/ac	133	21.2	14.84	89.83	5201	109.94
7	Manganese (Max-In)	Foliar June 1	1.5 qt/ac	153	17.6	14.79	89.69	4309	89.08
8	Manganese (Max-In)	Foliar July 1	1.5 qt/ac	146	18.4	15.04	90.02	4593	100.17
9	Manganese (Max-In)	Foliar August 1	1.5 qt/ac	130	18.9	14.69	90.21	4629	96.83
10	Manganese (Max-In)	Foliar September 1	1.5 qt/ac	116	19.8	15.21	89.94	5011	108.09
		C.V		29	15.4	3.25	0.82	15	15.54
		LSD (0.05)		NS	NS	NS	NS	NS	NS

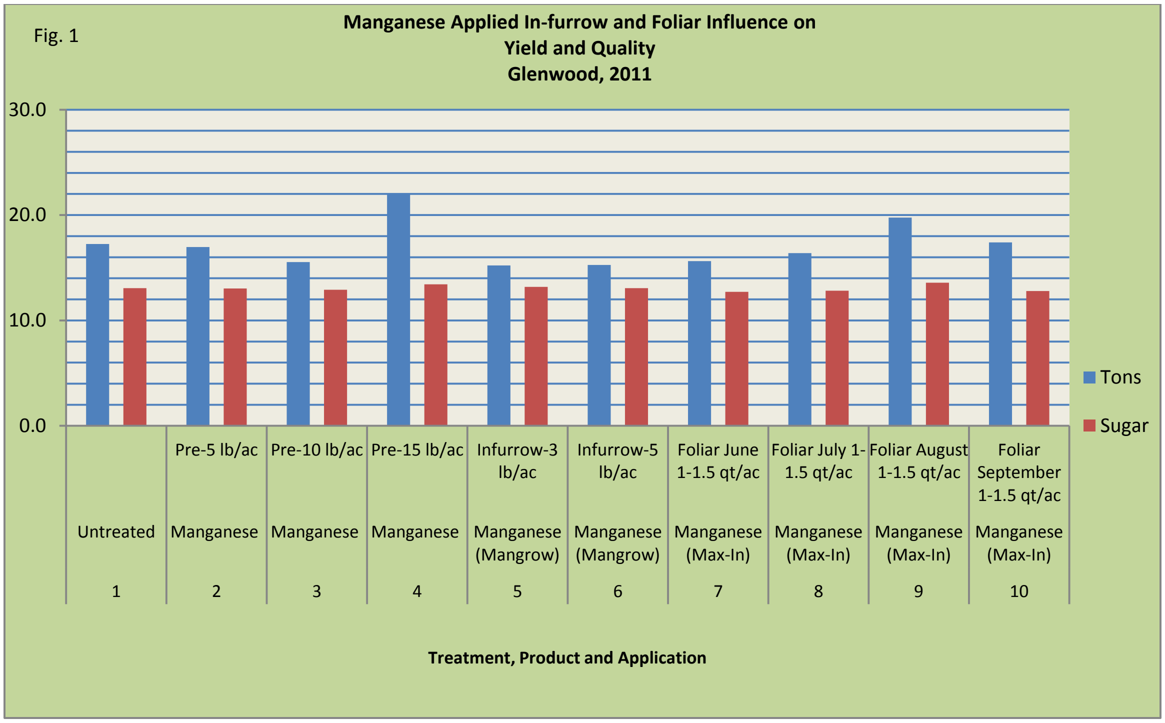
Fig. 1
Manganese Applied In-furrow and Foliar Influence on
Yield and Quality
Glenwood, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Pre-5 lb/ac
Pre-10 lb/ac
Pre-15 lb/ac
Infurrow-3 lb/ac
Infurrow-5 lb/ac
Foliar June 1-1.5 qt/ac
Foliar July 1-1.5 qt/ac
Foliar August 1-1.5 qt/ac
Foliar September 1-1.5 qt/ac
Untreated
Manganese
Manganese
Manganese
Manganese (Mangrow)
Manganese (Mangrow)
Manganese (Max-In)
Manganese (Max-In)
Manganese (Max-In)
Manganese (Max-In)
1
2
3
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10
Treatment, Product and Application

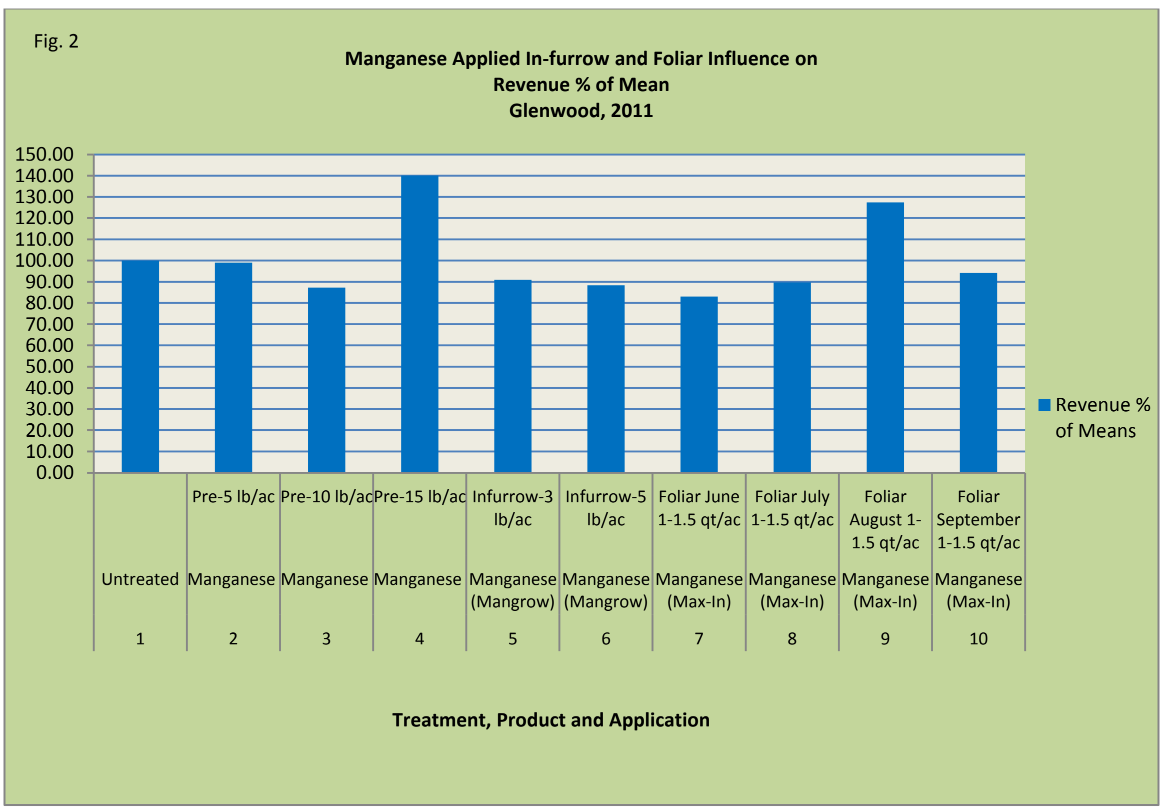
Fig. 2
Manganese Applied In-furrow and Foliar Influence on
Revenue % of Mean
Glenwood, 2011
150.00
140.00
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Revenue % of Means
Pre-5 lb/ac
Pre-10 lb/ac
Pre-15 lb/ac
Infurrow-3 lb/ac
Infurrow-5 lb/ac
Foliar June 1-1.5 qt/ac
Foliar July 1-1.5 qt/ac
Foliar August 1-1.5 qt/ac
Foliar September 1-1.5 qt/ac
Untreated
Manganese
Manganese
Manganese
Manganese (Mangrow)
Manganese (Mangrow)
Manganese (Max-In)
Manganese (Max-In)
Manganese (Max-In)
Manganese (Max-In)
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6
7
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9
10
Treatment, Product and Application

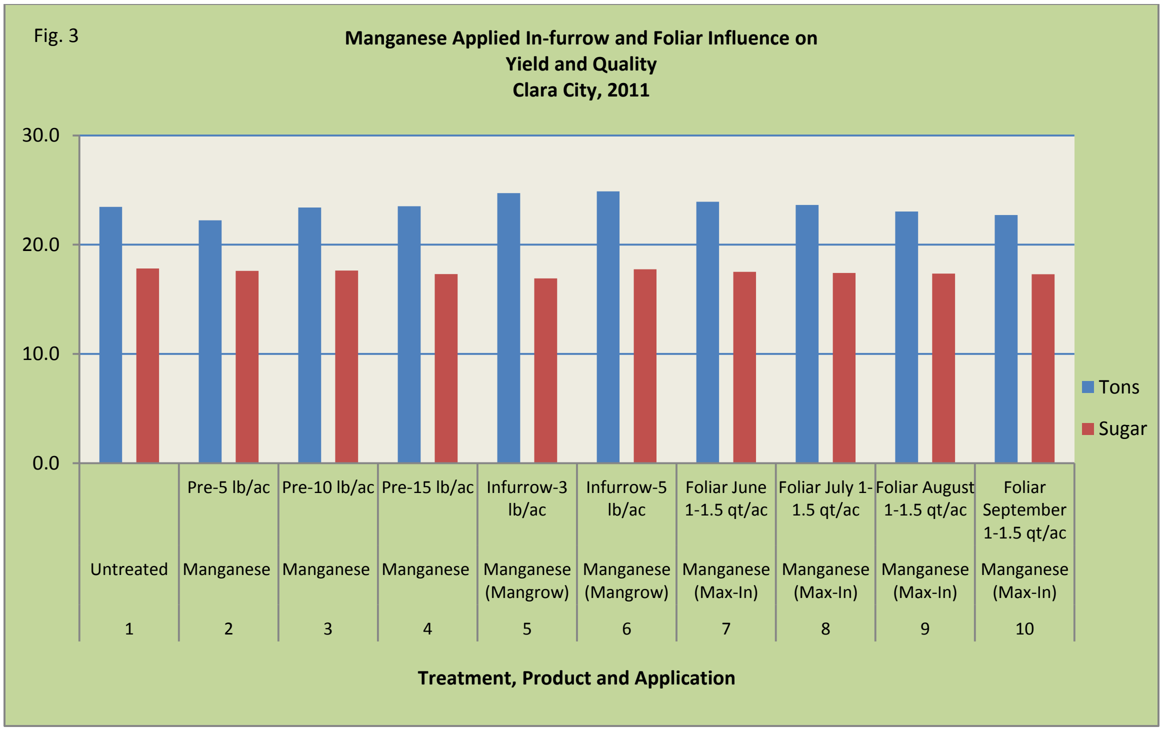
Fig. 3
Manganese Applied In-furrow and Foliar Influence on
Yield and Quality
Clara City, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Untreated
Pre-5 lb/ac Manganese
Pre-10 lb/ac Manganese
Pre-15 lb/ac Manganese
Infurrow-3 lb/ac Manganese (Mangrow)
Infurrow-5 lb/ac Manganese (Mangrow)
Foliar June 1-1.5 qt/ac Manganese (Max-In)
Foliar July 1-1.5 qt/ac Manganese (Max-In)
Foliar August 1-1.5 qt/ac Manganese (Max-In)
Foliar September 1-1.5 qt/ac Manganese (Max-In)
1
2
3
4
5
6
7
8
9
10
Treatment, Product and Application

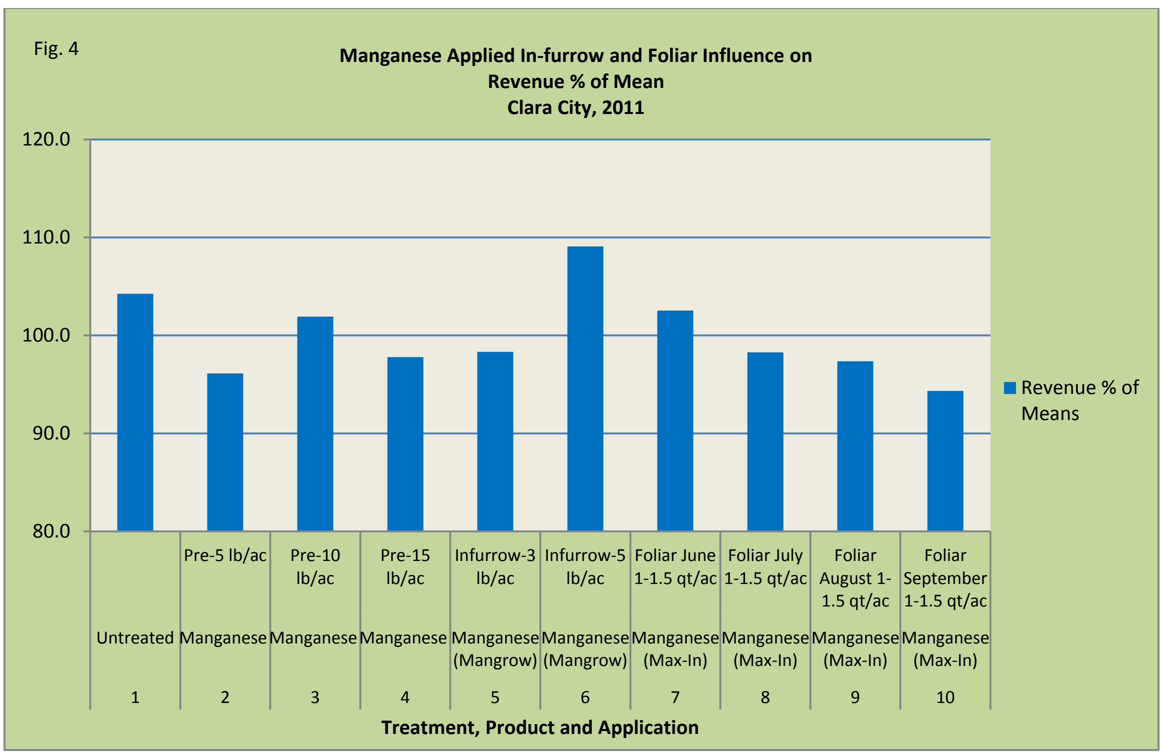
Fig. 4
Manganese Applied In-furrow and Foliar Influence on
Revenue % of Mean
Clara City, 2011
120.0
110.0
100.0
90.0
80.0
Revenue % of Means
Untreated
Pre-5 lb/ac Manganese
Pre-10 lb/ac Manganese
Pre-15 lb/ac Manganese
Infurrow-3 lb/ac Manganese (Mangrow)
Infurrow-5 lb/ac Manganese (Mangrow)
Foliar June 1-1.5 qt/ac Manganese (Max-In)
Foliar July 1-1.5 qt/ac Manganese (Max-In)
Foliar August 1-1.5 qt/ac Manganese (Max-In)
Foliar September 1-1.5 qt/ac Manganese (Max-In)
1
2
3
4
5
6
7
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9
10
Treatment, Product and Application

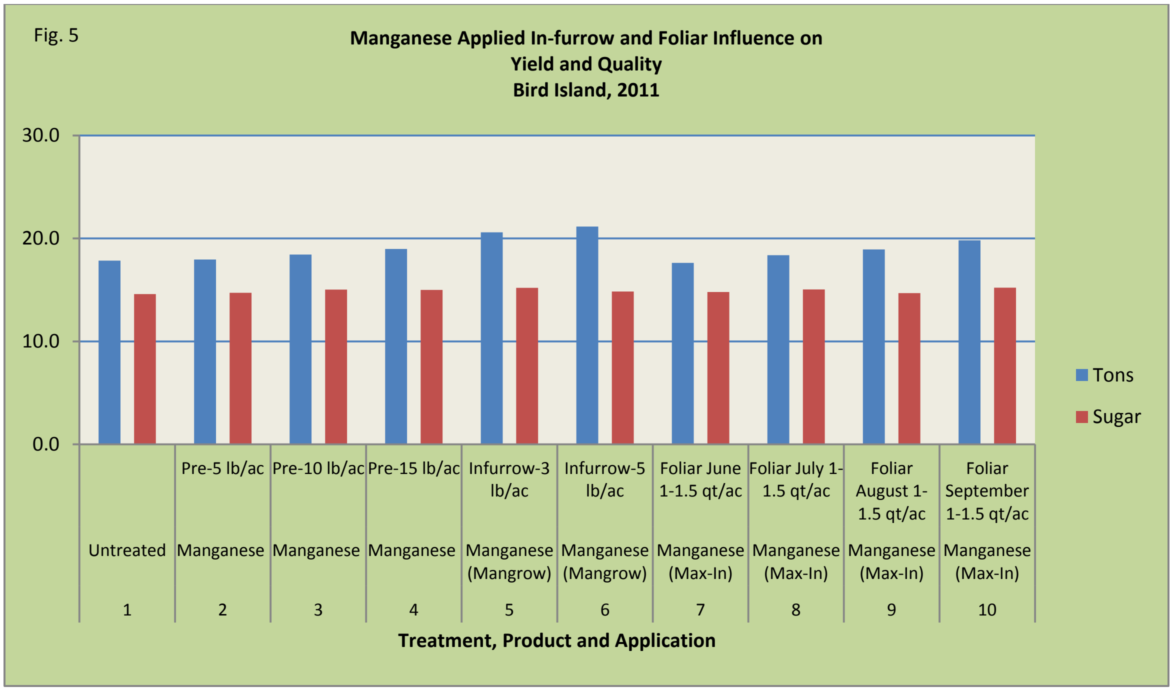
Fig. 5
Manganese Applied In-furrow and Foliar Influence on
Yield and Quality
Bird Island, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Pre-5 lb/ac
Pre-10 lb/ac
Pre-15 lb/ac
Infurrow-3 lb/ac
Infurrow-5 lb/ac
Foliar June 1-1.5 qt/ac
Foliar July 1-1.5 qt/ac
Foliar August 1-1.5 qt/ac
Foliar September 1-1.5 qt/ac
Untreated
Manganese
Manganese
Manganese
Manganese (Mangrow)
Manganese (Mangrow)
Manganese (Max-In)
Manganese (Max-In)
Manganese (Max-In)
Manganese (Max-In)
1
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10
Treatment, Product and Application

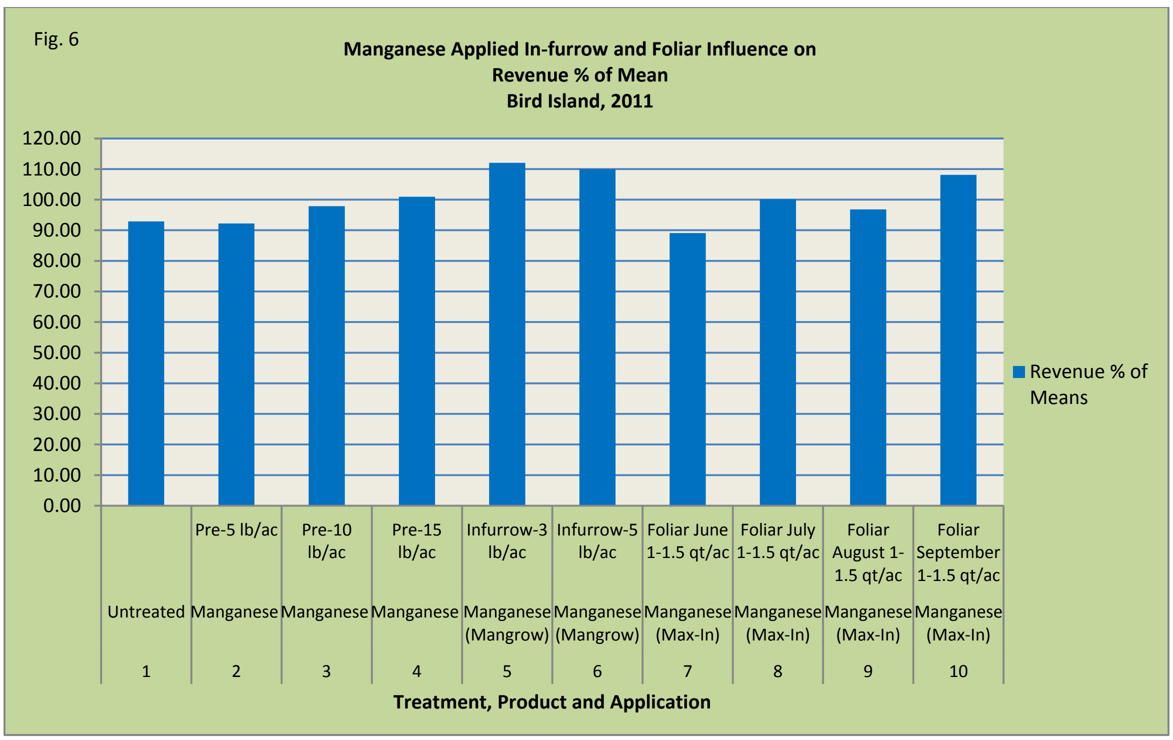
Fig. 6
Manganese Applied In-furrow and Foliar Influence on
Revenue % of Mean
Bird Island, 2011
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Revenue % of Means
Pre-5 lb/ac
Pre-10 lb/ac
Pre-15 lb/ac
Infurrow-3 lb/ac
Infurrow-5 lb/ac
Foliar June 1-1.5 qt/ac
Foliar July 1-1.5 qt/ac
Foliar August 1-1.5 qt/ac
Foliar September 1-1.5 qt/ac
Untreated
Manganese
Manganese
Manganese
Manganese (Mangrow)
Manganese (Mangrow)
Manganese (Max-In)
Manganese (Max-In)
Manganese (Max-In)
Manganese (Max-In)
1
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5
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Treatment, Product and Application

Fungicide Application Combined with Micronutrients for Enhancement of Sugarbeet Production 2010 - 2011

Objectives

The objective of this testing was to evaluate fungicide control combined with micronutrient products. The focus of the research was to test if micronutrients impacted the fungicide control of cercospora leaf spot and if the addition of micronutrients enhanced sugarbeet production.

Methods

Table 1 shows the specifics of activities conducted at Renville in 2010 and 2011. Plots were 11 ft. (6 rows) wide and 35 ft. long. Sugarbeet stands were not thinned. Sugarbeets were harvested with a 2 row research harvester at both testing sites. Two rows of the six row plot were harvested with weights for yield calculation collected on the harvester and a sub sample collected for quality analysis in the SMBSC tare lab. The tests were replicated 4 times and conducted in a randomized complete block experimental design. Evaluation of fungicide control was conducted at different timings and averaged upon completion of the test.

Results and Discussion

Data was analyzed for homogeneity and determined that the data could be combined. The discussion on this data concentrates on the combined results in table 4. All treatments gave significantly lower cercospora leaf spot than the untreated check showing the influence of the fungicides for control of cercospora leaf spot. Proline applied with Tetra Bor or Max In Manganese gave significantly better control of cercospora leaf spot compared to other fungicide and micronutrient combinations. Tons per acre, sugar percent and extractable sucrose per acre were significantly increase by the application of fungicides. Proline applied with Tetra Bor or Max In Manganese either tended to or did increase tons per acre more than the other fungicide and micronutrient mixes. This translated into an effect on revenue percent of mean relative to the fungicide and micronutrient influence on tons per acre and sugar percent. A clear trend was observed when the micronutrient was applied with fungicides showing the effect on cercospora leaf spot control and sugarbeet production. The trend was for higher enhancement of sugarbeet production when the micronutrient was included in the spray mix at the first application with Proline compared to the last application with Supertin. Thus, if micronutrients are included in a fungicide program they are most effective when added to the first fungicide application.

Table 1. Site Specifics for Fungicide by Micronutrients Testing, 2010-2011

Location	Planting Date	Soil Condition
Renville, 2010	4/21/2010	Moist
Renville, 2011	5/11/2011	Wet

Table 2. Fungicide Applied with Micronutrients Influence on Control of Cercospora Leafspot and Sugarbeet Yield and Quality Renville, 2010

TRT	FUNGICIDE	Rate oz/acre	Interval Days	Appl Code	CLS Rating	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	UNTREATED CHECK 1st app		14	******	5.6	32.3	15.13	90.57	8189	76.59
2	PROLINE SC + Induce XL + Pro Zinc	5oz /A+0.125% V/V + 24 oz	first appl.	B	3.1	34.5	16.34	92.19	9717	106.64
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
3	PROLINE SC + Induce XL + EB Mix	5oz /A+0.125% V/V + 64 oz	first appl.	B	2.6	36.4	16.27	91.62	10125	110.27
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
4	PROLINE SC + Induce XL + Tetra Bor	5oz /A+0.125% V/V + 16 oz.	first appl.	B	2.7	37.0	16.44	91.97	10453	115.11
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
5	PROLINE SC + Induce XL + Max-In Manganeese	5oz /A+0.125% V/V + 96 oz.	first appl.	B	3.1	37.2	16.25	91.75	10348	106.27
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
6	PROLINE SC + Induce XL + Max In Ultra ZMB	5oz /A+0.125% V/V + 64 oz.	first appl.	B	4.3	35.1	16.35	90.48	9646	104.48
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
7	PROLINE SC + Induce XL + Max In Boron	5oz /A+0.125% V/V + 24 oz.	first appl.	B	3.5	37.8	15.97	90.59	10147	96.42
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
8	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	4.0	32.6	16.24	92.58	9159	100.46
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP + Pro Zinc	5 oz + 24 oz.	14	E						
9	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	4.4	34.8	15.39	92.44	9236	96.32
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP+ EB Mix	5 oz.+ 64 oz	14	E						
10	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	3.8	31.7	16.08	93.33	8918	98.30
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP+ Tetra Bor	5 oz.+ 16 oz.	14	E						
11	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	4.2	34.7	15.99	92.16	9535	102.27
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP+ Max-In Manganeese	5 oz.+ 96 oz.	14	E						
12	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B						
	SUPER-TIN 80WP	5oz/A	14	C	4.5	32.8	16.07	93.90	9289	88.06
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP + Max In Ultra ZMB	5 oz+ 64 oz.	14	E						
13	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B						
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D	4.6	34.0	16.27	93.21	9660	97.30
	SUPER-TIN 80WP + Max In Boron	5 oz.+ 24 oz.	14	E						
14	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B						
	SUPER-TIN 80WP	3.75oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D	4.3	35.6	15.81	91.49	9583	101.52
	SUPER-TIN 80WP	5 oz	14	E						
				C.V	20.9	9.3	3.02	2.29	12	15.86
				LSD (0.05)	1.2	4.6	0.69	2.99	1648	22.68

Notes:

Methods will be conducted on two separate dates:

approx. July 2 and July 10, pending on sugarbeet growth

-control

Table 3. Fungicide Applied with Micronutrients Influence on Control of Cercospora Leafspot and Sugarbeet Yield and Quality
Renville, 2011

TRT	FUNGICIDE	Rate oz/acre	Interval Days	Appl Code	CLS Rating 8/30/11	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Means
1	UNTREATED CHECK 1st app		14	******	8.1	12.6	14.62	84.69	2781	57.99
2	PROLINE SC + Induce XL + Pro Zinc	5oz /A+0.125% V/V + 24 oz	first appl.	B	3.2	18.2	16.00	86.86	4648	111.01
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
3	PROLINE SC + Induce XL + EB Mix	5oz /A+0.125% V/V + 64 oz	first appl.	B	5.3	18.0	15.64	85.63	4383	100.69
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
4	PROLINE SC + Induce XL + Tetra Bor	5oz /A+0.125% V/V + 16 oz.	first appl.	B	3.0	18.1	16.06	86.43	4551	107.66
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
5	PROLINE SC + Induce XL + Max-In Manganeese	5oz /A+0.125% V/V + 96 oz.	first appl.	B	2.6	21.9	15.63	86.38	5374	124.26
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
6	PROLINE SC + Induce XL + Max In Ultra ZMB	5oz /A+0.125% V/V + 64 oz.	first appl.	B	4.3	18.2	16.02	87.58	4680	112.88
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
7	PROLINE SC + Induce XL + Max In Boron	5oz /A+0.125% V/V + 24 oz.	first appl.	B	3.1	18.9	15.88	86.11	4723	110.91
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
8	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	3.7	15.0	16.02	86.11	3742	87.90
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP + Pro Zinc	5 oz + 24 oz.	14	E						
9	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	4.5	17.3	15.64	85.98	4240	97.72
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP+ EB Mix	5 oz.+ 64 oz	14	E						
10	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	3.5	20.4	15.83	84.63	4931	112.27
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP+ Tetra Bor	5 oz.+ 16 oz.	14	E						
11	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	4.7	16.3	15.64	85.64	3953	90.58
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP+ Max-In Manganeese	5 oz.+ 96 oz.	14	E						
12	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B						
	SUPER-TIN 80WP	5oz/A	14	C	4.5	17.0	16.01	86.39	4281	101.34
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP + Max In Ultra ZMB	5 oz+ 64 oz.	14	E						
13	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B						
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D	3.2	17.3	15.76	85.43	4207	96.59
	SUPER-TIN 80WP + Max In Boron	5 oz.+ 24 oz.	14	E						
14	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B						
	SUPER-TIN 80WP	3.75oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D	4.3	16.7	15.27	85.48	3947	88.19
	SUPER-TIN 80WP	5 oz	14	E						
				C.V	39.6	16.4	4.35	1.60	17	19.54
				LSD (0.05)	2.4	4.1	0.98	1.96	1057	27.95

Notes:

Methods will be conducted on two separate dates:
approx. July 2 and July 10, pending on sugarbeet growth

-control

Table 4. Fungicide Applied with Micronutrients Influence on Control of Cercospora Leafspot and Sugarbeet Yield and Quality
Combined Data 2010-2011

TRT	FUNGICIDE	Rate oz/acre	Interval Days	Appl Code	CLS Rating 8/30/11	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	UNTREATED CHECK 1st app		14	******	6.8	22.4	14.87	87.63	5485	67.29
2	PROLINE SC + Induce XL + Pro Zinc	5oz /A+0.125% V/V + 24 oz	first appl.	B	3.1	26.4	16.17	89.52	7183	108.82
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
3	PROLINE SC + Induce XL + EB Mix	5oz /A+0.125% V/V + 64 oz	first appl.	B	4.0	27.2	15.96	88.63	7254	105.48
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
4	PROLINE SC + Induce XL + Tetra Bor	5oz /A+0.125% V/V + 16 oz.	first appl.	B	2.9	27.5	16.25	89.20	7502	111.39
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
5	PROLINE SC + Induce XL + Max-In Manganeese	5oz /A+0.125% V/V + 96 oz.	first appl.	B	2.8	29.5	15.94	89.06	7861	115.27
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
6	PROLINE SC + Induce XL + Max In Ultra ZMB	5oz /A+0.125% V/V + 64 oz.	first appl.	B	4.3	26.6	16.19	89.03	7163	108.68
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
7	PROLINE SC + Induce XL + Max In Boron	5oz /A+0.125% V/V + 24 oz.	first appl.	B	3.3	28.3	15.92	88.35	7435	103.67
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP	5oz/A	14	E						
8	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	3.9	23.8	16.13	89.34	6450	94.18
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP + Pro Zinc	5 oz + 24 oz.	14	E						
9	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	4.4	26.1	15.52	89.21	6738	97.02
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP+ EB Mix	5 oz.+ 64 oz	14	E						
10	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	3.7	26.1	15.95	88.98	6924	105.28
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP+ Tetra Bor	5 oz.+ 16 oz.	14	E						
11	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B	4.4	25.5	15.81	88.90	6744	96.43
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP+ Max-In Manganeese	5 oz.+ 96 oz.	14	E						
12	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B						
	SUPER-TIN 80WP	5oz/A	14	C	4.5	24.9	16.04	90.14	6785	94.70
	GEM 500 SC	3.5oz/A	14	D						
	SUPER-TIN 80WP + Max In Ultra ZMB	5 oz+ 64 oz.	14	E						
13	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B						
	SUPER-TIN 80WP	5oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D	3.9	25.6	16.01	89.32	6934	96.95
	SUPER-TIN 80WP + Max In Boron	5 oz.+ 24 oz.	14	E						
14	PROLINE SC + Induce XL	5oz /A+0.125% V/V	first appl.	B						
	SUPER-TIN 80WP	3.75oz/A	14	C						
	GEM 500 SC	3.5oz/A	14	D	4.3	26.1	15.54	88.49	6765	94.86
	SUPER-TIN 80WP	5 oz	14	E						
				C.V	32.3	11.7	3.73	2.00	14	17.80
				LSD (0.05)	1.7	3.3	0.50	2.46	830	18.77

Notes:

Methods will be conducted on two separate dates:
approx. July 2 and July 10, pending on sugarbeet growth

-control

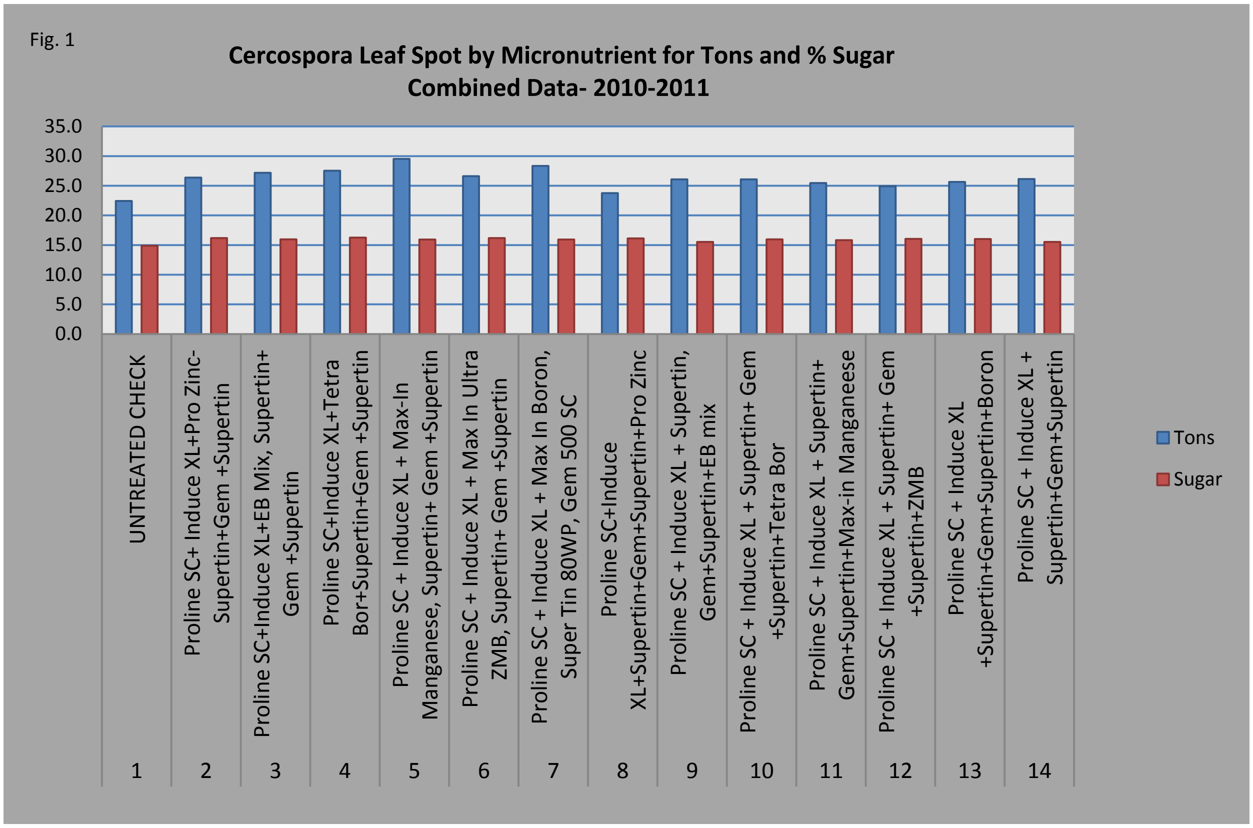


Fig. 1
Cercospora Leaf Spot by Micronutrient for Tons and % Sugar
Combined Data- 2010-2011
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
UNTREATED CHECK
Proline SC+ Induce XL+Pro Zinc-Supertin+Gem +Supertin
Proline SC+Induce XL+EB Mix, Supertin+ Gem +Supertin
Proline SC+Induce XL+Tetra Bor+Supertin+Gem +Supertin
Proline SC + Induce XL + Max-In Manganese, Supertin+ Gem +Supertin
Proline SC + Induce XL + Max In Ultra ZMB, Supertin+ Gem +Supertin
Proline SC + Induce XL + Max In Boron, Super Tin 80WP, Gem 500 SC
Proline SC+Induce XL+Supertin+Gem+Supertin+Pro Zinc
Proline SC + Induce XL + Supertin, Gem+Supertin+EB mix
Proline SC + Induce XL + Supertin+ Gem +Supertin+Tetra Bor
Proline SC + Induce XL + Supertin+ Gem+Supertin+Max-in Manganeese
Proline SC + Induce XL + Supertin+ Gem +Supertin+ZMB
Proline SC + Induce XL +Supertin+Gem+Supertin+Boron
Proline SC + Induce XL + Supertin+Gem+Supertin
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Tons
Sugar

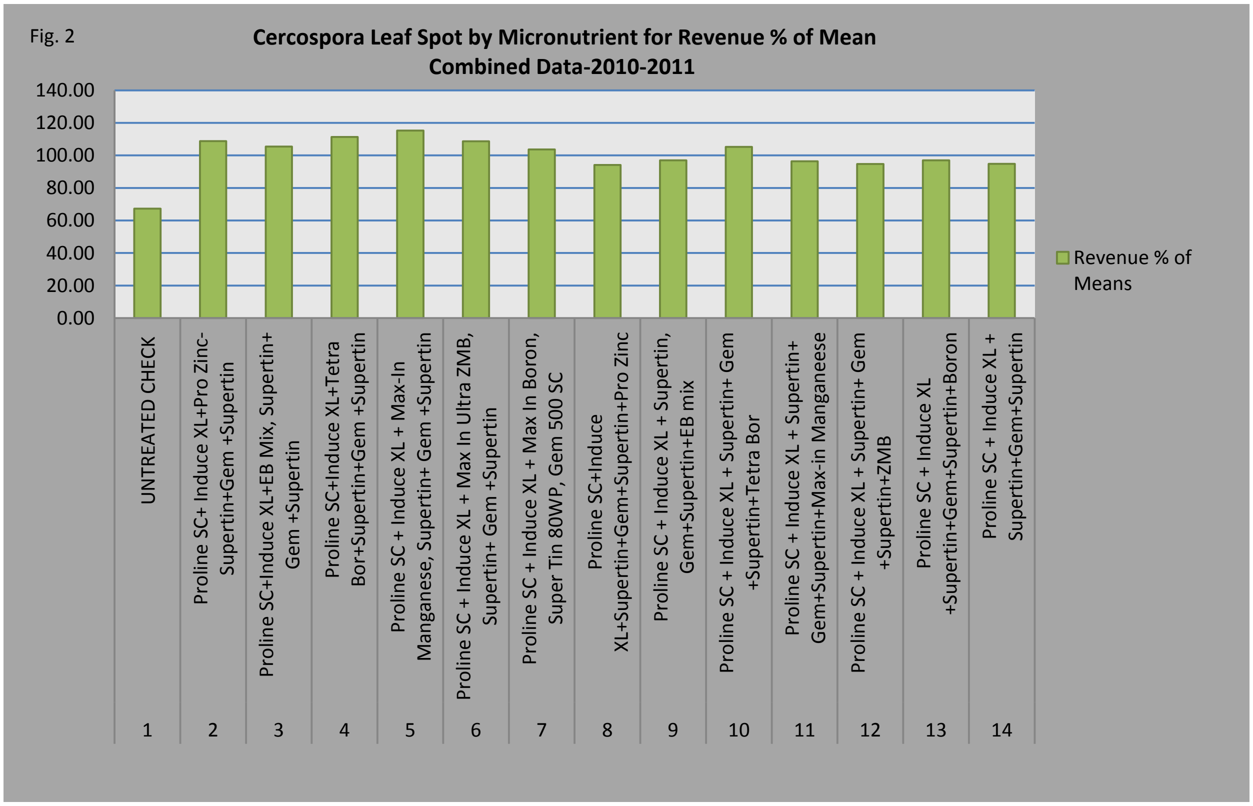


Fig. 2
Cercospora Leaf Spot by Micronutrient for Revenue % of Mean
Combined Data-2010-2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
UNTREATED CHECK
Proline SC+ Induce XL+Pro Zinc-Supertin+Gem +Supertin
Proline SC+Induce XL+EB Mix, Supertin+ Gem +Supertin
Proline SC+Induce XL+Tetra Bor+Supertin+Gem +Supertin
Proline SC + Induce XL + Max-In Manganese, Supertin+ Gem +Supertin
Proline SC + Induce XL + Max In Ultra ZMB, Supertin+ Gem +Supertin
Proline SC + Induce XL + Max In Boron, Super Tin 80WP, Gem 500 SC
Proline SC+Induce XL+Supertin+Gem+Supertin+Pro Zinc
Proline SC + Induce XL + Supertin, Gem+Supertin+EB mix
Proline SC + Induce XL + Supertin+ Gem +Supertin+Tetra Bor
Proline SC + Induce XL + Supertin+ Gem+Supertin+Max-in Manganeese
Proline SC + Induce XL + Supertin+ Gem +Supertin+ZMB
Proline SC + Induce XL +Supertin+Gem+Supertin+Boron
Proline SC + Induce XL + Supertin+Gem+Supertin
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Revenue % of Means

SMBSC Evaluation of Fungicides Influence on Sugar Beet Production in the Absence of Cercospora Leaf Spot

A Report of 2009 - 2011 Data Combined

The use of fungicides to enhance sugar beet production in the absence of cercospora leaf spot has been an issue of debate. Fungicide manufacturers have made claims to the enhancement of crop production with the application of fungicides. Most research has shown an advantage with fungicide applications but has not consistently shown a specific fungicide that enhances sugar beet production. However, with all the promotion of the fungicide application for crop production enhancement, SMBSC initiated research to evaluate the application of fungicides, normally used for control of cercospora leaf spot control, for enhancement of sugar beet production.

Objectives

The objectives of this test were to evaluate fungicide in the absence of cercospora leaf spot for enhancement of sugar beet production. The test measured two aspects influencing sugar beet production, nutrient availability to the plant by testing nutrient content in the sugar beet plant leaf and plant health.

Methods

Table 1 shows the specifics of activities conducted at test sites in 2009 - 2011. Plots were 11 ft. (6 rows) wide and 35 ft. long. The tests were replicated 4 times. Sugarbeets were not thinned since the stand did not warrant thinning. Normal production practices were conducted on the sugarbeets within the testing area. Sugarbeets were harvested on October 20th in 2009 and October 8th in 2010 and September 9th in 2011 with a 2 row research harvester. Sugar beets were weighed on the harvester for calculation of yield and a subsample was collected and analyzed in the SMBSC quality lab for sugar percent, purity and brie nitrate. Leaf samples were collected following application of the fungicides for analysis of nutrient presence.

Results and Discussion

Gem fungicide was not included in the 2009 testing, but added to the products tested in 2010. Data from each year will be discussed briefly. Data will also be discussed considering the 2009-2011 results where Gem fungicide was not included and 2010-2011 where Gem fungicide was included.

2009 data

Nutrient in sugar beet leaves (table 2) was not significantly influence by the fungicide treatment. Treatments with both early and late applications of fungicides tended to increase micronutrient levels in the leaf of sugar beet.

Fungicide treatments gave higher sugar percent, extractable sucrose per ton, extractable sucrose per acre and revenue. Revenue is presented as percent of the mean for revenue per acre (table 5). Overall the revenue percent was highest for Inspire XT, next highest for Eminent, Proline was the next highest and Headline was the lowest for the products tested.

2010 data

Nutrient in sugar beet leaves (table 3) was not significantly influenced by the fungicide treatment. There was no discrete or consistent trend to the treatment influence on nutrients in the sugar beet leaves.

Fungicide treatments gave higher sugar percent, tons per acre, extractable sucrose per ton, extractable sucrose per acre and revenue. Revenue is presented as percent of the mean for revenue per acre (table 6) There was no consistent trend relative to the timing of fungicide application. Overall the revenue percent was highest with Gem. However, Gem, Inspire XT, Proline, and Headline performed statistically similar at all treatment timings. Eminent applied separately at 90 and 45 days before harvest gave revenue percent statistically similar to all other fungicide treatments except when Eminent was applied at both 45 and 90 days before harvest.

2011 data

Fungicides tested in 2011 were Headline, Eminent, Proline, Inspire XT and Gem. Plant samples for nutrient analysis were not conducted in 2011 due to the cost of the analysis and the lack of consistency in the results. Tons per acre and Purity were not significantly influenced by the application of a fungicide in the absence of cercospora leaf spot. Although the fungicide influence on tons per acre was statistically non-significant there was some notable, incremental difference in treatment influences for tons per acre. Sugar percent and extractable sucrose per acre were influenced significantly by fungicide application. The influenced realized with the application of fungicides on sugar percent appears to be related to the incremental effect on tons per acre. The combined effect of tons and sugar percent resulted in a substantial increase in revenue percent of mean for the treatment showing the tons and sugar effect. However, the treatments expressing the effect explained were fungicides applied twice within a season and this would not be a recommended practice. These treatments were included in the testing as an academic comparison. In general no consistent benefits were realized for fungicides applied with the recommended use of the products.

Combined data 2009-2011

The testing of fungicides in absence of cercospora leaf spot in 2009-2011 included testing with Headline, Eminent, Proline, Inspire XT and Gem. However, Gem was not included in the testing in 2009, but was included in 2010 and 2011. Therefore the data was analyzed not including Gem fungicide data for the years 2009-2011 including (Tables 4 and 8) and for 2010-2011 with data including Gem (Table 5). Phosphorus (P), Sulfur (S), Magnesium (Mg), Copper (Cu) and Boron (B) were not significantly influenced by the application of Fungicides. Nitrogen (N), Potassium (K), Calcium (Ca), Sodium (Na), Zinc (Z), Iron (Fe) and Manganese (Mn) were significantly influenced by fungicide application. There was a lack of consistency to the fungicides influence on nutrient presence in the plant tissue, although there appeared to be a trend toward the triazole fungicides (Eminent, Proline and Inspire XT) enhancing nutrient presence in the sugarbeet leaves. Tons per acre and purity were not significantly influenced by the application of fungicides in the absence of cercospora leaf spot. Sugar percent was significantly influenced by the application of fungicides which influenced the effect on extractable sucrose per acre. The influence on sugar percent and extractable sucrose per acre translated into a significant effect on revenue expressed as a percent of the mean. The highest revenue percent of mean was observed when Eminent was applied early and late (A and B). Recommendations would not encourage the application of a triazole fungicide twice within a season. The trend for an overall benefit realized from a fungicide was best achieved by the application of Inspire XT regardless of the timing.

Combined data 2010-2011

The 2010-2011 data includes Gem fungicide and the primary comparison in this discussion will be relative to the strobilurin fungicides (Headline and Gem). The only sugarbeet production factor presented that was not influenced significantly by fungicide application in the absence of cercospora leaf spot was purity. The treatment giving the highest production was when Proline was applied twice within one season. Headline and Gem performed similarily regardless of the timing or frequency of fungicide applications. All fungicides except Eminent enhanced production of the sugarbeet to the greatest degree when the fungicide was applied twice within a season. Fungicides applied once within a season did not consistently enhance production of sugarbeets. As stated previously, applying a fungicide twice within a growing season is not recommended and should not be practiced.

General Conclusions

1. The application of fungicides for promotion of sugarbeet growth in the absence of disease is not a good practice.
2. Enhancement of sugarbeet production by fungicide application in the absence of cercospora leaf spot was realized more frequently when applied twice within a season. The application of the same fungicide within a season is not recommended and should not be practiced.
3. Triazole fungicides in general enhanced sugarbeet production more than strobilurin fungicides.

Table 1. Site Specifics for Fungicides Applied in Absence of Cercospora Leafspot. Combined 2009-2011

Location	Planting Timing	Soil Condition
Renville, 2009	5/9/2009	Moist
Renville, 2010	4/24/2010	Dry
Renville, 2011	5/11/2011	Wet

Table 2. Leaf Sample Analysis Results as Influenced by Fungicide Application in Absence of Cercospora Leafspot
Renville, 2009

Trt	FUNGICIDE	Rate oz/acre	Interval Sprays	Total N Percent	P Percent	K Percent	S Percent	Ca Percent	Mg Percent	Na Percent	Zn	Fe	Mn	Cu	B
1	Check	N/A	N/A	3	0	3	0	1	1	2	26	46	34	6	25
2	HEADLINE	9 OZ./A	A	2	0	4	0	1	0	2	20	40	19	5	26
3	HEADLINE	9 OZ./A	B	4	0	3	1	2	1	3	47	90	38	7	29
4	HEADLINE	9 OZ./A	A/B	2	0	5	0	1	0	2	28	88	43	7	28
5	EMINENT	13 OZ./A	A	2	0	4	1	1	1	2	40	81	54	9	26
6	EMINENT	13 OZ./A	B	2	0	4	1	1	1	2	41	86	48	4	30
7	EMINENT	13 OZ./A	A/B	2	0	4	1	1	1	3	37	91	48	7	37
8	PROLINE	5 OZ./A	A	2	0	3	1	2	1	3	49	485	77	3	21
	NIS	0.125 % V/V	A												
9	PROLINE	5 OZ./A	B	2	0	5	0	1	1	2	38	84	65	4	32
	NIS	0.125 % V/V	B												
10	PROLINE	5 OZ./A	A/B	2	0	4	1	3	1	3	60	197	106	3	27
	NIS	0.125 % V/V	A/B												
11	INSPIRE XT	7 OZ./A	A	3	0	5	0	1	1	2	33	76	69	7	34
12	INSPIRE XT	7 OZ./A	B	2	0	4	1	2	1	3	48	176	102	4	25
13	INSPIRE XT	7 OZ./A	A/B	2	0	5	0	1	1	2	34	104	52	7	23
			C.V	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			LSD(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 3. Leaf Sample Analysis Results as Influenced by Fungicide Application in Absence of Cercospora Leafspot
Renville, 2010

Trt	FUNGICIDE	Rate oz/acre	Interval Sprays	Total N Percent	P Percent	K Percent	S Percent	Ca Percent	Mg Percent	Na Percent	Zn	Fe	Mn	Cu	B
1	Check	N/A	N/A	490	37	410	35	59	52	93	31	103	29	10	20
2	HEADLINE	9 OZ./A	A	440	30	520	62	154	107	175	38	128	56	10	17
3	HEADLINE	9 OZ./A	B	470	38	490	46	90	86	128	49	110	52	11	22
4	HEADLINE	9 OZ./A	A/B	380	33	440	32	63	50	156	26	68	28	8	23
5	EMINENT	13 OZ./A	A	350	29	500	34	76	61	150	24	62	36	7	21
6	EMINENT	13 OZ./A	B	430	37	520	50	80	67	136	31	111	36	10	21
7	EMINENT	13 OZ./A	A/B	450	32	510	51	97	76	155	35	124	54	11	21
8	PROLINE	5 OZ./A	A	450	33	570	61	109	94	156	37	115	50	10	20
	NIS	0.125 % V/V	A	0	0	0	0	0	0	0					
9	PROLINE	5 OZ./A	B	440	41	390	31	41	35	102	27	76	23	9	19
	NIS	0.125 % V/V	B	0	0	0	0	0	0	0					
10	PROLINE	5 OZ./A	A/B	420	37	480	37	81	56	142	31	86	32	9	19
	NIS	0.125 % V/V	A/B	0	0	0	0	0	0	0					
11	INSPIRE XT	7 OZ./A	A	430	31	510	48	75	64	206	21	78	36	7	23
12	INSPIRE XT	7 OZ./A	B	370	34	540	46	91	69	213	28	92	38	8	22
13	INSPIRE XT	7 OZ./A	A/B	450	32	450	42	85	71	152	33	92	43	10	21
14	GEM	3.5 OZ./A	A	480	43	400	36	53	44	107	34	94	30	11	22
15	GEM	3.5 OZ./A	B	500	32	510	59	122	91	173	32	120	46	11	22
16	GEM	3.5 OZ./A	A/B	470	29	450	27	69	46	173	24	76	28	7	21
			C.V	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			LSD(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 4. Leaf Sample Analysis Results as Influenced by fungicide Application in Absence of Cercopora Leafspot Combined, 2009-2010

Trt	FUNGICIDE	Rate oz/acre	Interval Sprays	Total N Percent	P Percent	K Percent	S Percent	Ca Percent	Mg Percent	Na Percent	Zn	Fe	Mn	Cu	B
1	Check	N/A	N/A	246	19	206	18	30	26	48	29	75	32	8	23
2	HEADLINE	9 OZ./A	A	221	15	262	31	77	54	89	29	84	38	8	22
3	HEADLINE	9 OZ./A	B	237	19	247	23	46	44	65	48	100	45	9	26
4	HEADLINE	9 OZ./A	A/B	191	17	223	16	32	25	79	27	78	36	8	26
5	EMINENT	13 OZ./A	A	176	15	252	17	39	31	76	32	72	45	8	24
6	EMINENT	13 OZ./A	B	216	19	262	25	41	34	69	36	99	42	7	26
7	EMINENT	13 OZ./A	A/B	226	16	257	26	49	38	79	36	108	51	9	29
8	PROLINE	5 OZ./A	A	226	17	287	31	55	47	79	43	300	64	7	21
	NIS	0.125 % V/V	A												
9	PROLINE	5 OZ./A	B	221	21	198	16	21	18	52	33	80	44	7	26
	NIS	0.125 % V/V	B												
10	PROLINE	5 OZ./A	A/B	211	19	242	19	42	29	73	46	142	69	6	23
	NIS	0.125 % V/V	A/B												
11	INSPIRE XT	7 OZ./A	A	216	16	257	24	38	32	104	27	77	53	7	29
12	INSPIRE XT	7 OZ./A	B	186	17	272	23	46	35	108	38	134	70	6	24
13	INSPIRE XT	7 OZ./A	A/B	226	16	228	21	43	36	77	34	98	48	9	22
			C.V	**61**	**60**	**63**	**65**	**76**	**59**	**69**	**58**	**89**	**67**	**64**	**56**
			LSD(0.05)	**1**	**NS**	**2**	**NS**	**1**	**NS**	**1**	**13**	**75**	**21**	**NS**	**NS**

Table 5. Influence of Fungicides on Sugarbeet Production in the Absence of Cercospora Leaf Spot
Renville, 2009

Trt	FUNGICIDE	Rate oz/acre	Interval Sprays	Tons/Acre	% Sugar	Purity	Ext. Suc Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	N/A	23.9	13.64	92.04	5528	56.54
2	HEADLINE	9 OZ./A	A	29.4	15.36	92.98	7860	92.82
3	HEADLINE	9 OZ./A	B	32.0	15.33	92.26	8415	97.82
4	HEADLINE	9 OZ./A	A/B	29.2	15.43	92.99	7774	91.34
5	EMINENT	13 OZ./A	A	29.0	16.31	92.90	8233	102.12
6	EMINENT	13 OZ./A	B	34.1	15.49	93.56	9256	110.68
7	EMINENT	13 OZ./A	A/B	30.6	16.41	93.84	8838	110.90
8	PROLINE	5 OZ./A	A	29.4	15.86	93.17	8120	98.41
	NIS	0.125 % V/V	A					
9	PROLINE	5 OZ./A	B	28.1	15.79	93.31	7723	93.25
	NIS	0.125 % V/V	B					
10	PROLINE	5 OZ./A	A/B	29.2	16.08	93.19	8180	100.34
	NIS	0.125 % V/V	A/B					
11	INSPIRE XT	7 OZ./A	A	33.6	16.27	93.27	9518	117.82
12	INSPIRE XT	7 OZ./A	B	32.9	16.40	93.72	9489	118.89
13	INSPIRE XT	7 OZ./A	A/B	31.0	16.29	92.95	8805	109.07
			C.V	15	4.63	0.77	15	16.92
			LSD(0.05)	6	1.05	1.03	1827	24.27

Table 6. Influence of Fungicides on Sugarbeet Production in the Absence of Cercospora Leaf Spot
Renville, 2010

Trt	FUNGICIDE	Rate oz/acre	Interval Sprays	Tons/Acre	% Sugar	Purity	Ext. Suc Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	N/A	33.9	16.27	87.71	8919	81.35
2	HEADLINE	9 OZ./A	A	36.9	17.51	88.09	10530	102.65
3	HEADLINE	9 OZ./A	B	35.2	17.56	89.32	10240	101.34
4	HEADLINE	9 OZ./A	A/B	39.2	18.00	85.03	10942	104.94
5	EMINENT	13 OZ./A	A	36.0	17.64	88.95	10477	103.76
6	EMINENT	13 OZ./A	B	36.3	17.52	87.26	10161	97.55
7	EMINENT	13 OZ./A	A/B	35.8	17.74	83.23	9488	87.06
8	PROLINE	5 OZ./A	A	34.2	17.28	88.58	9639	93.02
	NIS	0.125 % V/V	A					
9	PROLINE	5 OZ./A	B	36.3	17.20	89.75	10398	101.77
	NIS	0.125 % V/V	B					
10	PROLINE	5 OZ./A	A/B	38.3	17.38	88.58	10891	105.93
	NIS	0.125 % V/V	A/B					
11	INSPIRE XT	7 OZ./A	A	36.4	17.55	85.95	10066	95.83
12	INSPIRE XT	7 OZ./A	B	37.9	17.83	87.42	10883	106.60
13	INSPIRE XT	7 OZ./A	A/B	38.1	17.86	86.01	10656	102.40
14	GEM	3.5 OZ./A	A	36.4	17.14	89.05	10321	100.07
15	GEM	3.5 OZ./A	B	36.0	17.77	88.99	10576	105.36
16	GEM	3.5 OZ./A	A/B	38.0	18.16	87.45	11107	110.37
			C.V	7.5	4.00	3.33	10	14.62
			LSD(0.05)	3.9	1.00	NS	1449	20.81

Table 7. Influence of Fungicides on Sugarbeet Production in the Absence of Cercospora Leaf Spot
Renville, 2011

Trt	FUNGICIDE	Rate oz/acre	Interval Sprays	Tons/Acre	% Sugar	Purity	Ext. Suc Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	N/A	16.1	14.69	86.11	3692	74.82
2	HEADLINE	9 OZ./A	A	16.4	14.64	86.41	3777	78.73
3	HEADLINE	9 OZ./A	B	20.8	15.62	85.36	5026	108.42
4	HEADLINE	9 OZ./A	A/B	21.1	15.95	86.43	5316	121.91
5	EMINENT	13 OZ./A	A	19.9	14.52	85.35	4443	88.24
6	EMINENT	13 OZ./A	B	20.9	15.72	86.27	5160	114.25
7	EMINENT	13 OZ./A	A/B	18.8	15.18	86.87	4520	100.86
8	PROLINE	5 OZ./A	A	18.0	15.37	86.34	4338	93.81
	NIS	0.125 % V/V	A					
9	PROLINE	5 OZ./A	B	16.7	15.11	84.99	3876	79.84
	NIS	0.125 % V/V	B					
10	PROLINE	5 OZ./A	A/B	25.1	16.46	87.16	6601	150.01
	NIS	0.125 % V/V	A/B					
11	INSPIRE XT	7 OZ./A	A	19.2	14.96	84.77	4374	88.69
12	INSPIRE XT	7 OZ./A	B	16.3	15.52	84.14	3830	80.34
13	INSPIRE XT	7 OZ./A	A/B	21.7	16.09	86.38	5498	124.79
14	GEM	3.5 OZ./A	A	18.5	15.21	85.79	4379	92.86
15	GEM	3.5 OZ./A	B	16.3	14.62	85.93	3696	78.34
16	GEM	3.5 OZ./A	A/B	23.0	15.72	86.01	5652	124.09
			C.V	20.7	2.44	0.94	22	24.27
			LSD(0.05)	NS	0.81	NS	2405	NS

Table 8. Influence of Fungicides on Sugarbeet Production in the Absence of Cercospora Leaf Spot Combined, 2009-2011

Trt	FUNGICIDE	Rate oz/acre	Interval Sprays	Tons/Acre	% Sugar	Purity	Ext. Suc Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	N/A	24.6	14.86	88.62	6046	70.90
2	HEADLINE	9 OZ./A	A	27.6	15.84	89.16	7389	91.40
3	HEADLINE	9 OZ./A	B	29.3	16.17	88.98	7894	102.53
4	HEADLINE	9 OZ./A	A/B	29.8	16.46	88.15	8011	106.07
5	EMINENT	13 OZ./A	A	28.3	16.16	89.06	7718	98.04
6	EMINENT	13 OZ./A	B	30.4	16.24	89.03	8192	107.49
7	EMINENT	13 OZ./A	A/B	28.4	16.44	87.98	7615	99.61
8	PROLINE	5 OZ./A	A	27.2	16.17	89.37	7366	95.08
	NIS	0.125 % V/V	A					
9	PROLINE	5 OZ./A	B	27.0	16.03	89.35	7332	91.62
	NIS	0.125 % V/V	B					
10	PROLINE	5 OZ./A	A/B	30.9	16.64	89.64	8557	118.76
	NIS	0.125 % V/V	A/B					
11	INSPIRE XT	7 OZ./A	A	29.7	16.26	88.00	7986	100.78
12	INSPIRE XT	7 OZ./A	B	29.1	16.58	88.43	8067	101.94
13	INSPIRE XT	7 OZ./A	A/B	30.3	16.75	88.45	8320	112.09
			C.V	30.1	7.83	4.40	36	23.66
			LSD(0.05)	NS	1.02	NS	2223	19.04

Table 9. Influence of Fungicides on Sugarbeet Production in the Absence of Cercospora Leaf Spot Combined Data, 2010-2011

Trt	FUNGICIDE	Rate oz/acre	Interval Sprays	Tons/Acre	% Sugar	Purity	Ext. Suc Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	N/A	25.0	15.5	86.9	6306	78.1
2	HEADLINE	9 OZ./A	A	26.7	16.1	87.2	7153	90.7
3	HEADLINE	9 OZ./A	B	28.0	16.6	87.3	7633	104.9
4	HEADLINE	9 OZ./A	A/B	30.2	17.0	85.7	8129	113.4
5	EMINENT	13 OZ./A	A	27.9	16.1	87.1	7460	96.0
6	EMINENT	13 OZ./A	B	28.6	16.6	86.8	7660	105.9
7	EMINENT	13 OZ./A	A/B	27.3	16.5	85.0	7004	94.0
8	PROLINE	5 OZ./A	A	26.1	16.3	87.5	6989	93.4
	NIS	0.125 % V/V	A					
9	PROLINE	5 OZ./A	B	26.5	16.2	87.4	7137	90.8
	NIS	0.125 % V/V	B					
10	PROLINE	5 OZ./A	A/B	31.7	16.9	87.9	8746	128.0
	NIS	0.125 % V/V	A/B					
11	INSPIRE XT	7 OZ./A	A	27.8	16.3	85.4	7220	92.3
12	INSPIRE XT	7 OZ./A	B	27.1	16.7	85.8	7356	93.5
13	INSPIRE XT	7 OZ./A	A/B	29.9	17.0	86.2	8077	113.6
14	GEM	3.5 OZ./A	A	27.5	16.2	87.4	7350	96.5
15	GEM	3.5 OZ./A	B	26.1	16.2	87.5	7136	91.9
16	GEM	3.5 OZ./A	A/B	30.5	16.9	86.7	8380	117.2
			C.V	**13.6**	**4.36**	**2.64**	**15**	**22.58**
			LSD(0.05)	**3.4**	**0.88**	**NS**	**1164**	**2.13**

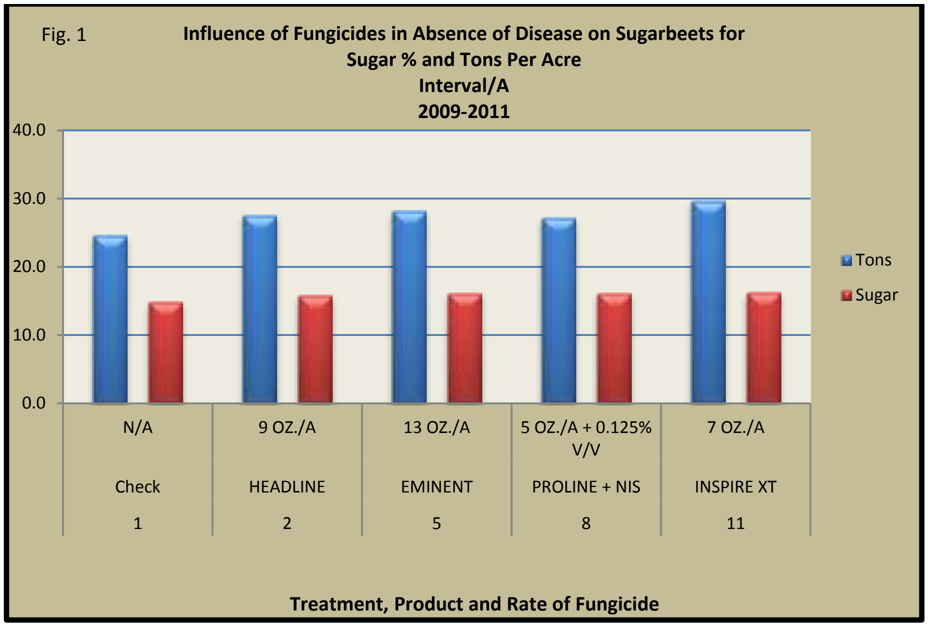


Fig. 1
Influence of Fungicides in Absence of Disease on Sugarbeets for Sugar % and Tons Per Acre
Interval/A
2009-2011
40.0
30.0
20.0
10.0
0.0
Tons
Sugar
N/A
9 OZ./A
13 OZ./A
5 OZ./A + 0.125% V/V
7 OZ./A
Check
HEADLINE
EMINENT
PROLINE + NIS
INSPIRE XT
1
2
5
8
11
Treatment, Product and Rate of Fungicide

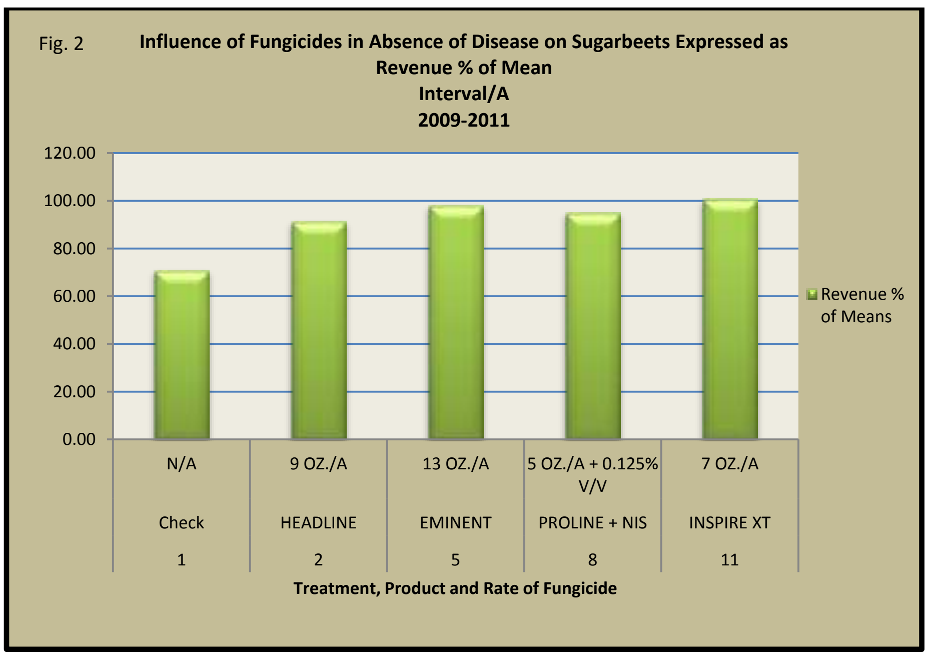
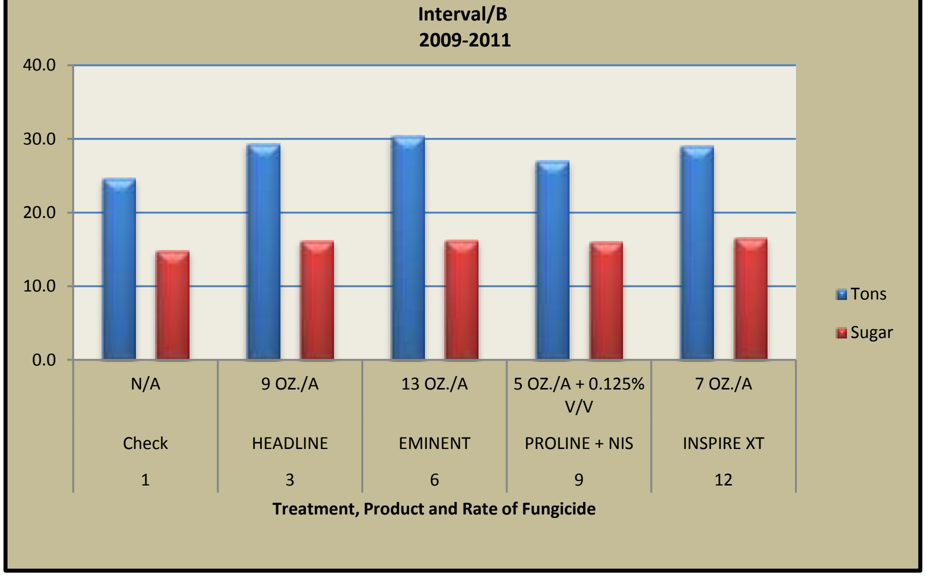


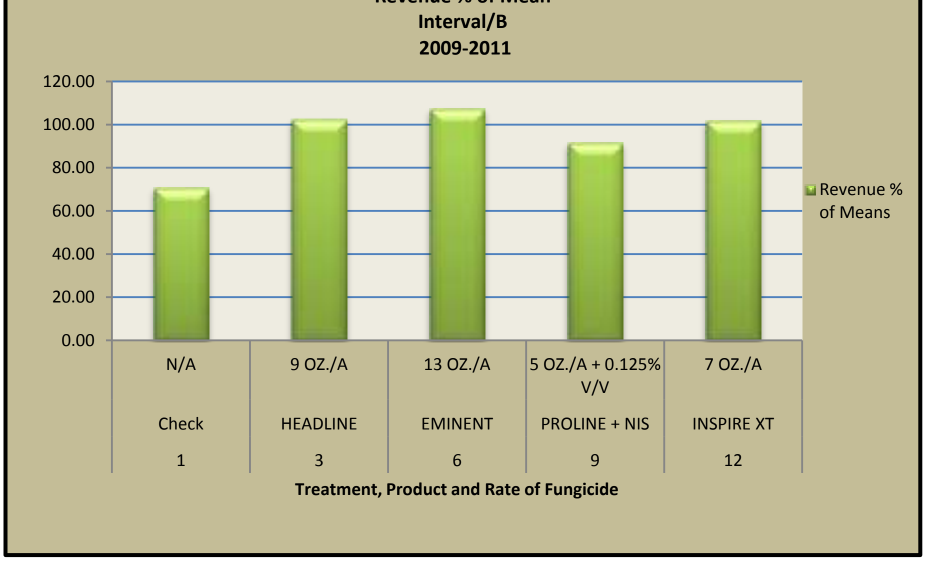
Fig. 2
Influence of Fungicides in Absence of Disease on Sugarbeets Expressed as Revenue % of Mean
Interval/A
2009-2011
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
N/A
9 OZ./A
13 OZ./A
5 OZ./A + 0.125% V/V
7 OZ./A
Check
HEADLINE
EMINENT
PROLINE + NIS
INSPIRE XT
1
2
5
8
11
Treatment, Product and Rate of Fungicide

Fig. 3



Influence of Fungicides in Absence of Disease on Sugarbeets for Sugar % and Tons Per Acre
Interval/B
2009-2011
40.0
30.0
20.0
10.0
0.0
Tons
Sugar
N/A
9 OZ./A
13 OZ./A
5 OZ./A + 0.125% V/V
7 OZ./A
Check
HEADLINE
EMINENT
PROLINE + NIS
INSPIRE XT
1
3
6
9
12
Treatment, Product and Rate of Fungicide

Fig. 4



Influence of Fungicides in Absence of Disease on Sugarbeets Expressed as Revenue % of Mean
Interval/B
2009-2011
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
N/A
9 OZ./A
13 OZ./A
5 OZ./A + 0.125% V/V
7 OZ./A
Check
HEADLINE
EMINENT
PROLINE + NIS
INSPIRE XT
1
3
6
9
12
Treatment, Product and Rate of Fungicide

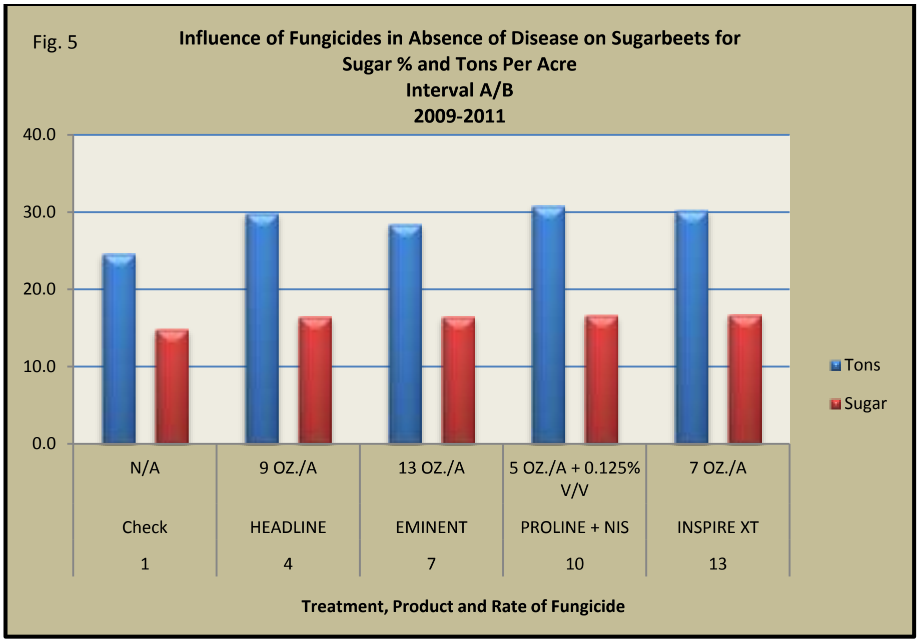


Fig. 5
Influence of Fungicides in Absence of Disease on Sugarbeets for Sugar % and Tons Per Acre
Interval A/B
2009-2011
40.0
30.0
20.0
10.0
0.0
Tons
Sugar
N/A
9 OZ./A
13 OZ./A
5 OZ./A + 0.125% V/V
7 OZ./A
Check
HEADLINE
EMINENT
PROLINE + NIS
INSPIRE XT
1
4
7
10
13
Treatment, Product and Rate of Fungicide

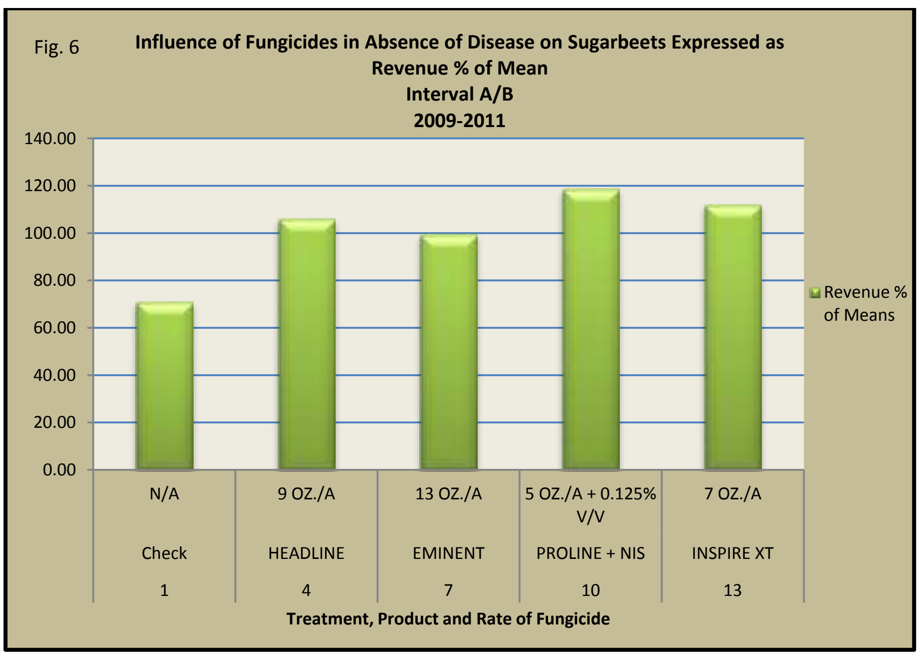
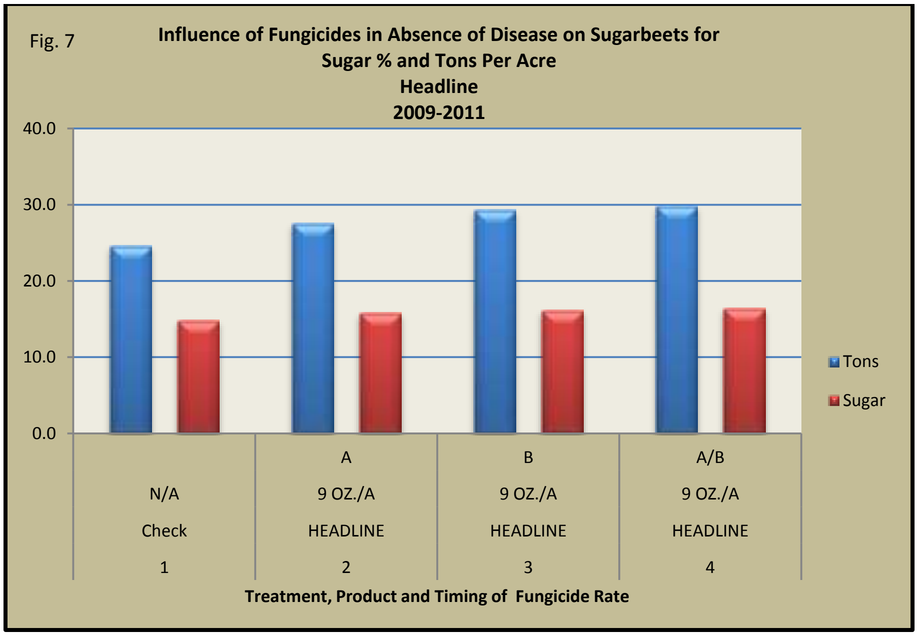


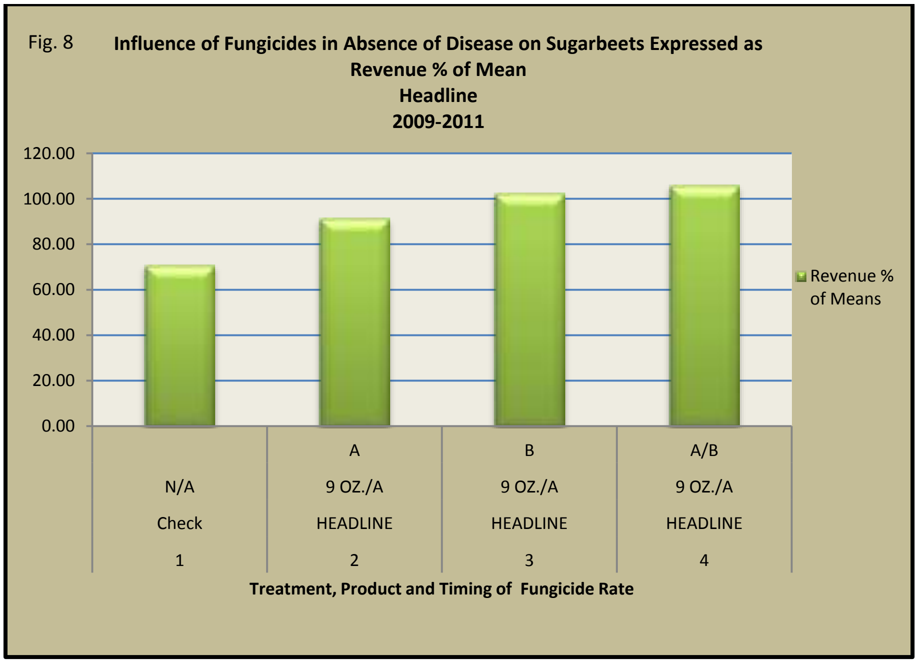
Fig. 6
Influence of Fungicides in Absence of Disease on Sugarbeets Expressed as Revenue % of Mean
Interval A/B
2009-2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
N/A
9 OZ./A
13 OZ./A
5 OZ./A + 0.125% V/V
7 OZ./A
Check
HEADLINE
EMINENT
PROLINE + NIS
INSPIRE XT
1
4
7
10
13
Treatment, Product and Rate of Fungicide

Fig. 7



Influence of Fungicides in Absence of Disease on Sugarbeets for Sugar % and Tons Per Acre
Headline
2009-2011
40.0
30.0
20.0
10.0
0.0
Tons
Sugar
N/A
Check
1
A
9 OZ./A
HEADLINE
2
B
9 OZ./A
HEADLINE
3
A/B
9 OZ./A
HEADLINE
4
Treatment, Product and Timing of Fungicide Rate

Fig. 8



Influence of Fungicides in Absence of Disease on Sugarbeets Expressed as Revenue % of Mean
Headline
2009-2011
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
N/A
Check
1
A
9 OZ./A
HEADLINE
2
B
9 OZ./A
HEADLINE
3
A/B
9 OZ./A
HEADLINE
4
Treatment, Product and Timing of Fungicide Rate

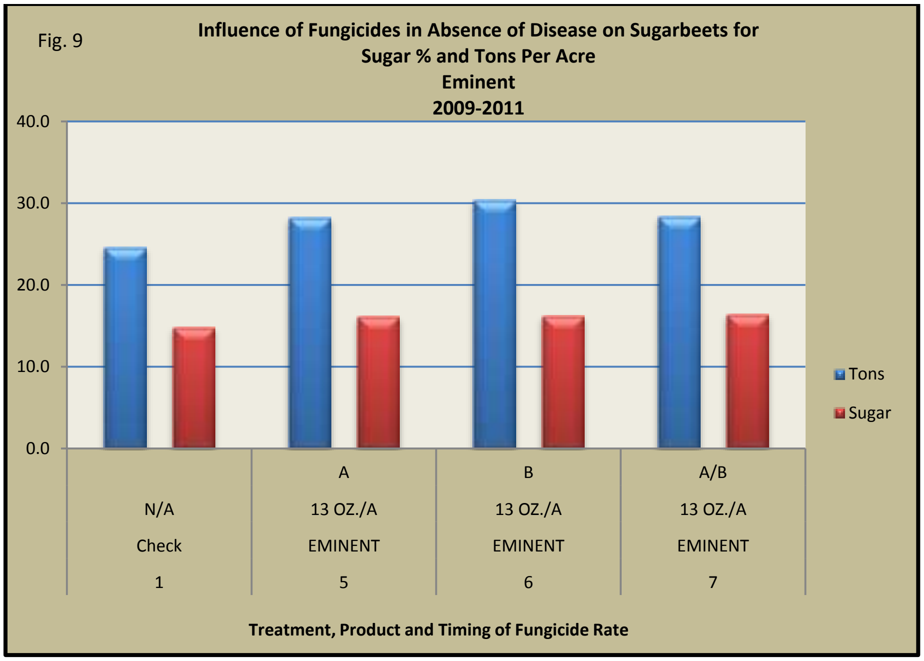


Fig. 9
Influence of Fungicides in Absence of Disease on Sugarbeets for
Sugar % and Tons Per Acre
Eminent
2009-2011
40.0
30.0
20.0
10.0
0.0
Tons
Sugar
A
B
A/B
N/A
13 OZ./A
13 OZ./A
13 OZ./A
Check
EMINENT
EMINENT
EMINENT
1
5
6
7
Treatment, Product and Timing of Fungicide Rate

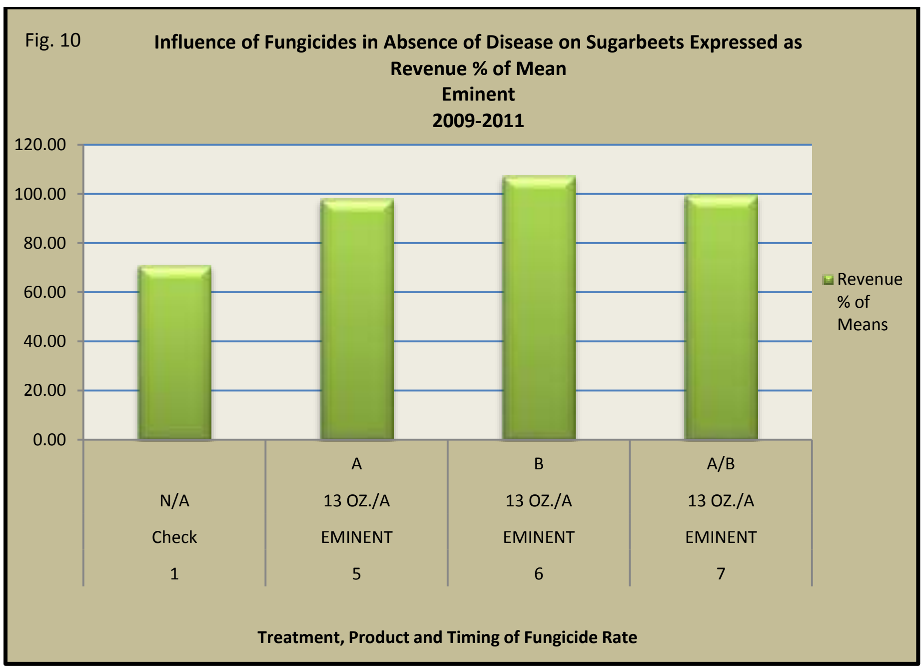


Fig. 10
Influence of Fungicides in Absence of Disease on Sugarbeets Expressed as
Revenue % of Mean
Eminent
2009-2011
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
A
B
A/B
N/A
13 OZ./A
13 OZ./A
13 OZ./A
Check
EMINENT
EMINENT
EMINENT
1
5
6
7
Treatment, Product and Timing of Fungicide Rate

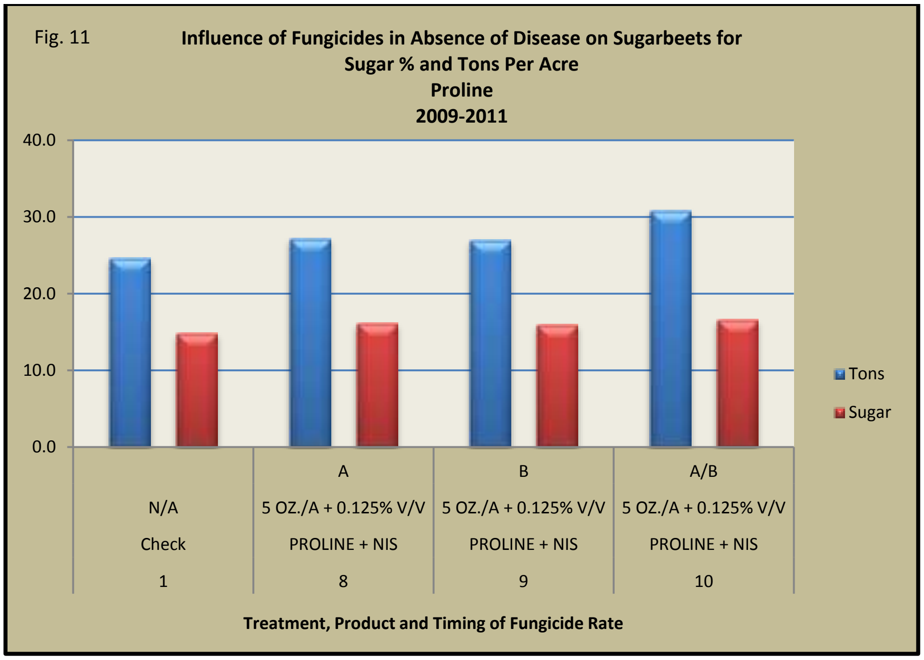


Fig. 11
Influence of Fungicides in Absence of Disease on Sugarbeets for Sugar % and Tons Per Acre
Proline
2009-2011
40.0
30.0
20.0
10.0
0.0
Tons
Sugar
N/A
Check
1
A
5 OZ./A + 0.125% V/V
PROLINE + NIS
8
B
5 OZ./A + 0.125% V/V
PROLINE + NIS
9
A/B
5 OZ./A + 0.125% V/V
PROLINE + NIS
10
Treatment, Product and Timing of Fungicide Rate

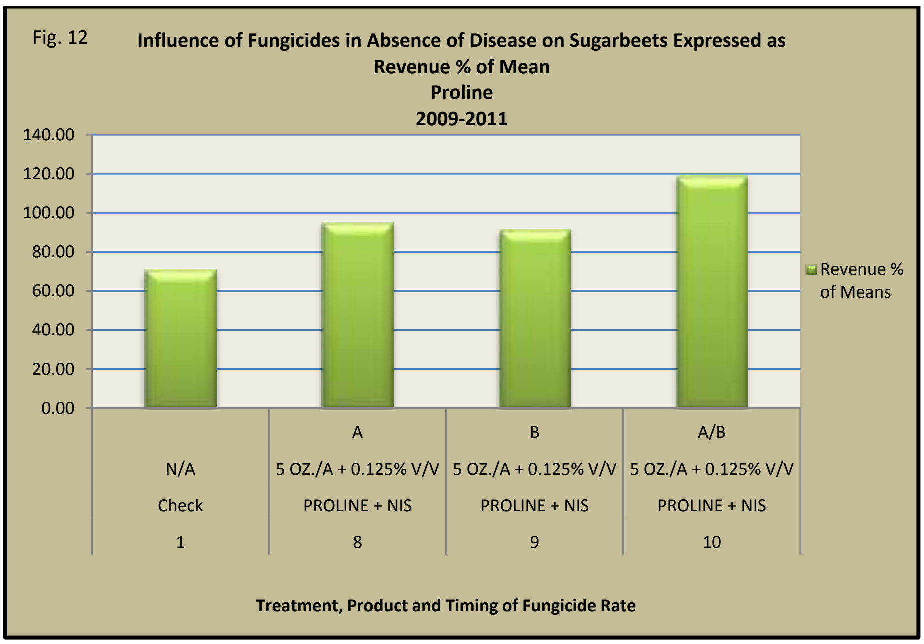


Fig. 12
Influence of Fungicides in Absence of Disease on Sugarbeets Expressed as Revenue % of Mean
Proline
2009-2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
N/A
Check
1
A
5 OZ./A + 0.125% V/V
PROLINE + NIS
8
B
5 OZ./A + 0.125% V/V
PROLINE + NIS
9
A/B
5 OZ./A + 0.125% V/V
PROLINE + NIS
10
Treatment, Product and Timing of Fungicide Rate

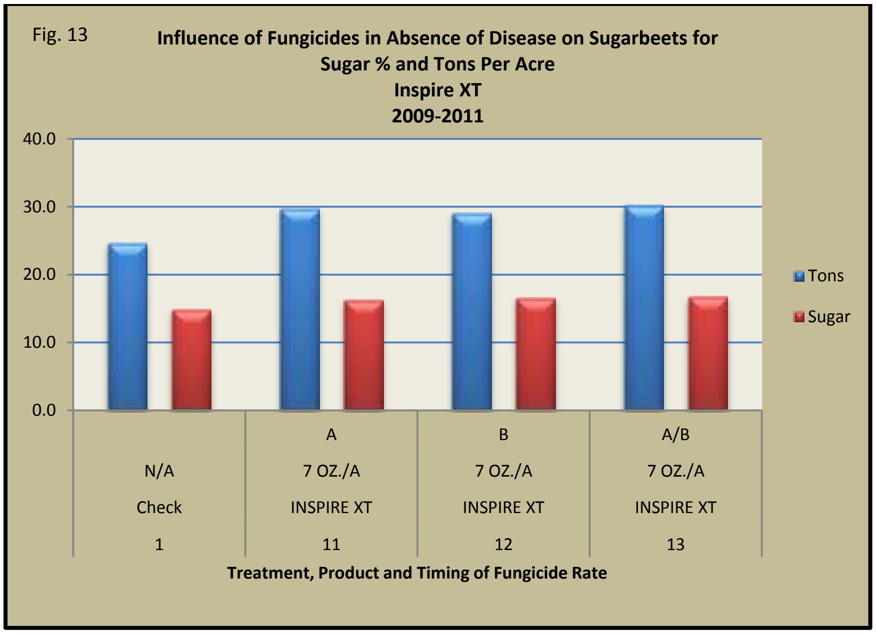


Fig. 13
Influence of Fungicides in Absence of Disease on Sugarbeets for Sugar % and Tons Per Acre
Inspire XT
2009-2011
40.0
30.0
20.0
10.0
0.0
Tons
Sugar
N/A
Check
1
A
7 OZ./A
INSPIRE XT
11
B
7 OZ./A
INSPIRE XT
12
A/B
7 OZ./A
INSPIRE XT
13
Treatment, Product and Timing of Fungicide Rate

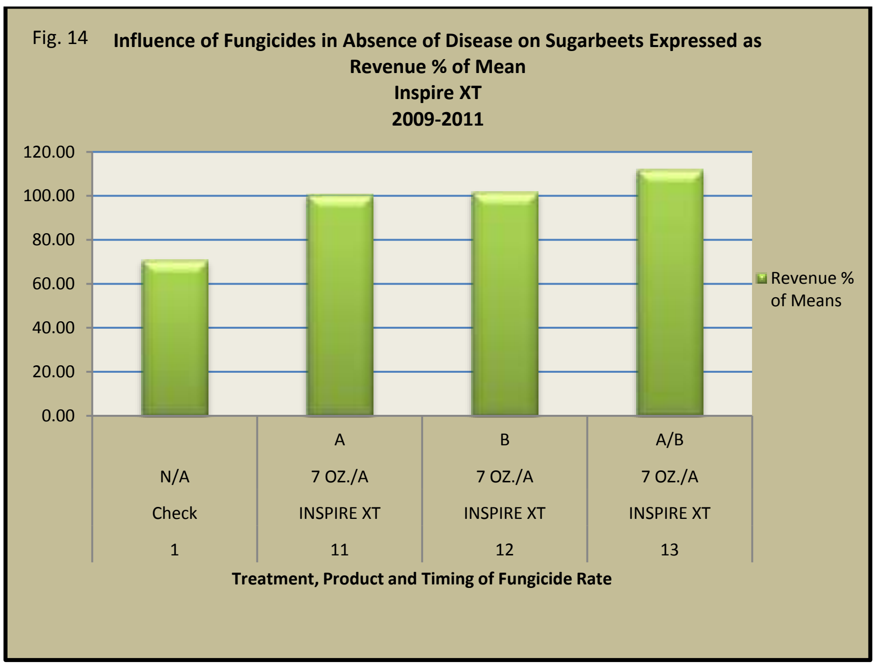


Fig. 14
Influence of Fungicides in Absence of Disease on Sugarbeets Expressed as Revenue % of Mean
Inspire XT
2009-2011
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
N/A
Check
1
A
7 OZ./A
INSPIRE XT
11
B
7 OZ./A
INSPIRE XT
12
A/B
7 OZ./A
INSPIRE XT
13
Treatment, Product and Timing of Fungicide Rate

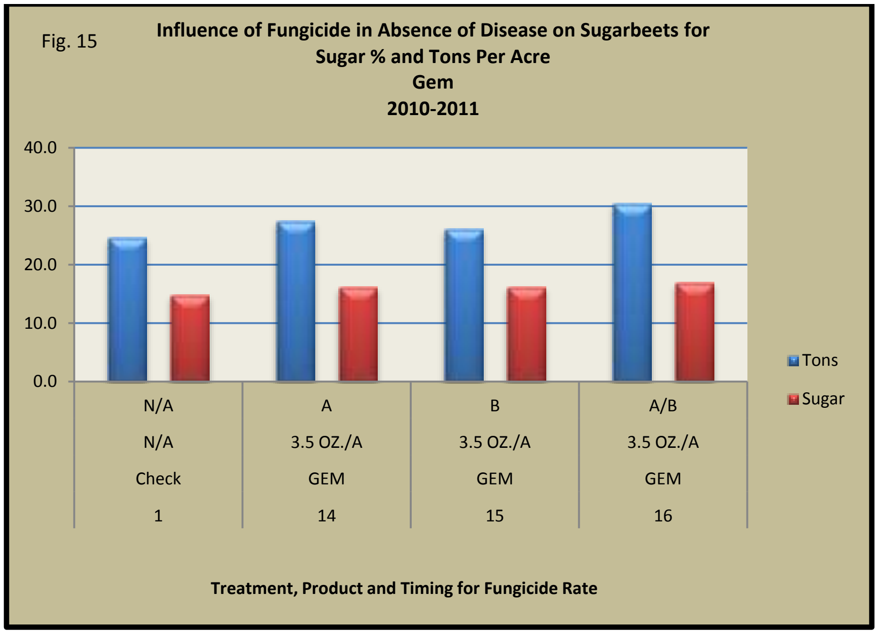


Fig. 15
Influence of Fungicide in Absence of Disease on Sugarbeets for Sugar % and Tons Per Acre
Gem
2010-2011
40.0
30.0
20.0
10.0
0.0
N/A
N/A
Check
1
A
3.5 OZ./A
GEM
14
B
3.5 OZ./A
GEM
15
A/B
3.5 OZ./A
GEM
16
Tons
Sugar
Treatment, Product and Timing for Fungicide Rate

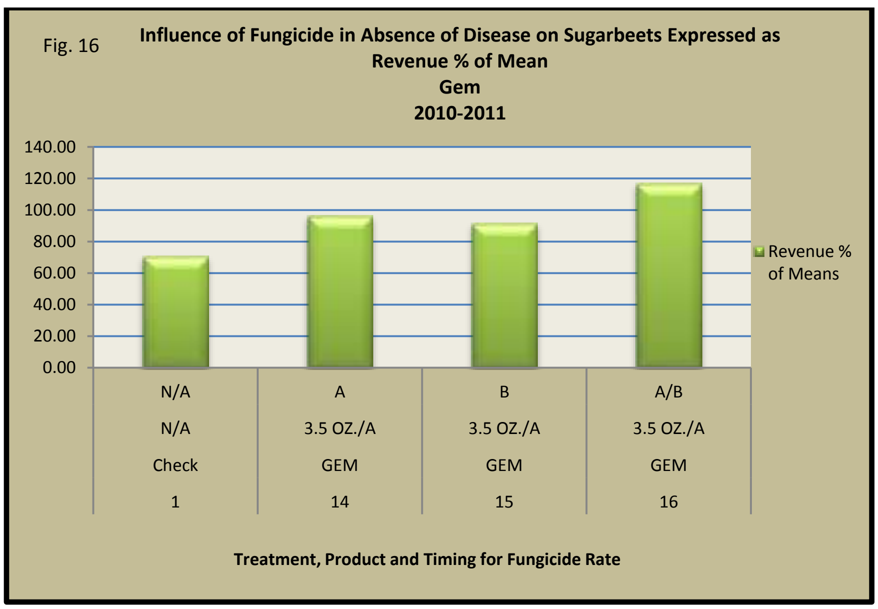


Fig. 16
Influence of Fungicide in Absence of Disease on Sugarbeets Expressed as Revenue % of Mean
Gem
2010-2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
N/A
N/A
Check
1
A
3.5 OZ./A
GEM
14
B
3.5 OZ./A
GEM
15
A/B
3.5 OZ./A
GEM
16
Revenue % of Means
Treatment, Product and Timing for Fungicide Rate

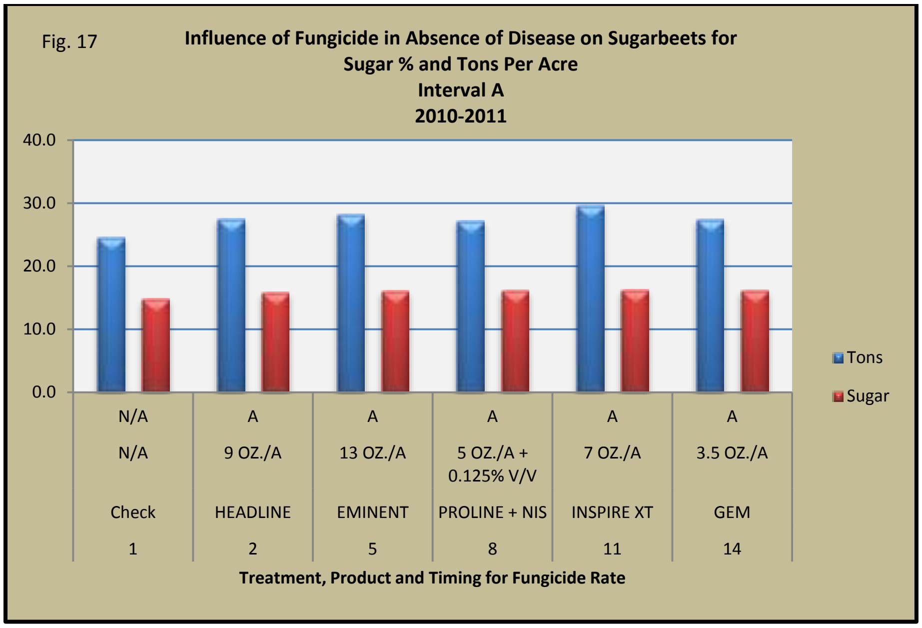


Fig. 17
Influence of Fungicide in Absence of Disease on Sugarbeets for
Sugar % and Tons Per Acre
Interval A
2010-2011
40.0
30.0
20.0
10.0
0.0
Tons
Sugar
N/A
N/A
Check
1
A
9 OZ./A
HEADLINE
2
A
13 OZ./A
EMINENT
5
A
5 OZ./A +
0.125% V/V
PROLINE + NIS
8
A
7 OZ./A
INSPIRE XT
11
A
3.5 OZ./A
GEM
14
Treatment, Product and Timing for Fungicide Rate

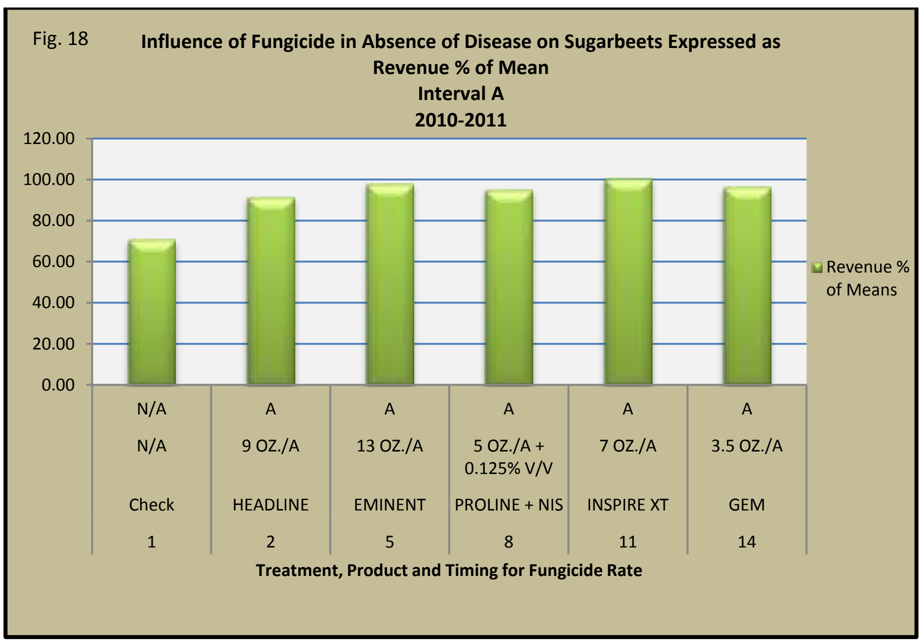


Fig. 18
Influence of Fungicide in Absence of Disease on Sugarbeets Expressed as
Revenue % of Mean
Interval A
2010-2011
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
N/A
N/A
Check
1
A
9 OZ./A
HEADLINE
2
A
13 OZ./A
EMINENT
5
A
5 OZ./A +
0.125% V/V
PROLINE + NIS
8
A
7 OZ./A
INSPIRE XT
11
A
3.5 OZ./A
GEM
14
Treatment, Product and Timing for Fungicide Rate

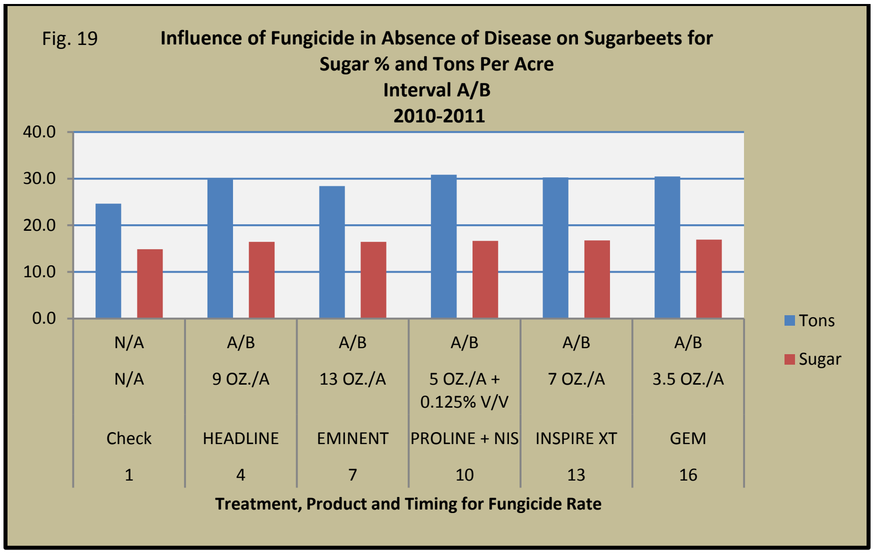


Fig. 19
Influence of Fungicide in Absence of Disease on Sugarbeets for Sugar % and Tons Per Acre
Interval A/B
2010-2011
40.0
30.0
20.0
10.0
0.0
N/A
A/B
A/B
A/B
A/B
A/B
N/A
9 OZ./A
13 OZ./A
5 OZ./A + 0.125% V/V
7 OZ./A
3.5 OZ./A
Check
HEADLINE
EMINENT
PROLINE + NIS
INSPIRE XT
GEM
1
4
7
10
13
16
Treatment, Product and Timing for Fungicide Rate
Tons
Sugar

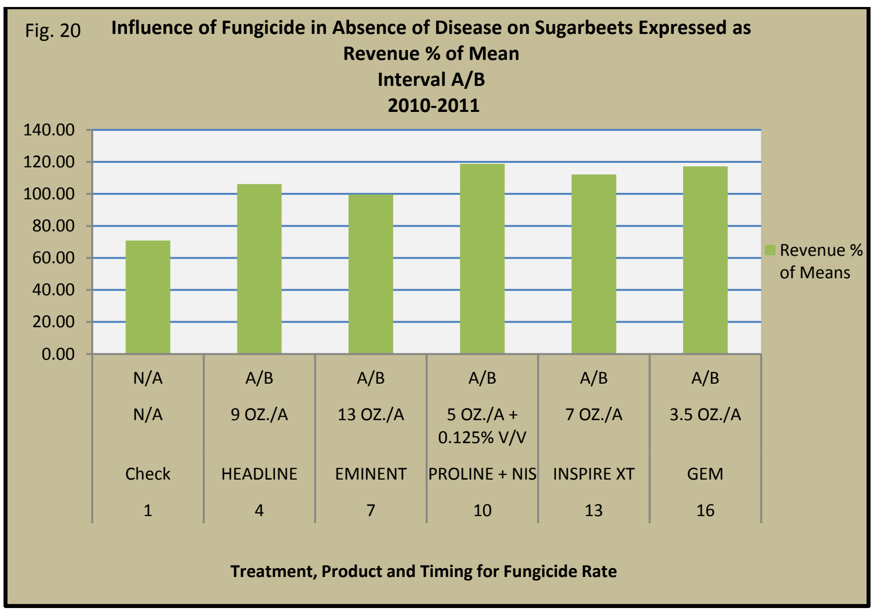


Fig. 20
Influence of Fungicide in Absence of Disease on Sugarbeets Expressed as Revenue % of Mean
Interval A/B
2010-2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
N/A
A/B
A/B
A/B
A/B
A/B
N/A
9 OZ./A
13 OZ./A
5 OZ./A + 0.125% V/V
7 OZ./A
3.5 OZ./A
Check
HEADLINE
EMINENT
PROLINE + NIS
INSPIRE XT
GEM
1
4
7
10
13
16
Treatment, Product and Timing for Fungicide Rate
Revenue % of Means

SMBSC Evaluation of Fungicides for Control of Cercospora Leaf Spot Considering Single Mode of Action
A Combined Report of Data from 2008 and 2011

Objectives

The testing described in this report is an evaluation of single mode of action fungicides for control of Cercospora leaf spot in 2008 through 2011. The test discussed in this report is an evaluation of individual fungicides to determine efficacy of the individual chemistry and the influence on sugarbeet production. This test will be termed as evaluation of single mode chemistry (The test will be discussed in years). The testing of the fungicides in this manner is to determine the efficacy of the individual product (active ingredient) and is not meant as an indicator of how the products should be used. A single fungicide should never be used as a sole control of cercospora leaf spot within a production season.

Methods

Table 1 shows the specifics of activities conducted at the cercospora leaf spot sites in 2008 - 2011. Plots were 11 ft. (6 rows) wide and 35 ft long. The tests were replicated 6 times. Sugarbeets were not thinned since the test did not require thinning. Normal production practices were conducted on the sugarbeets within the testing area. The target interval between fungicide applications was 14 days. In some years humidity, wind and rainfall may have altered the interval. Sugarbeets were harvested on October 10th in 2008, October 20th in 2009, October 8th 2010 and September 9th in 2011 with a 2 row research harvester. Sugar beets were weighed on the harvester for calculation of yield and a subsample was collected and analyzed in the SMBSC quality lab for sugar percent, purity and brie nitrate. The efficacy of the product was evaluated after each fungicide application. The KWS rating scale of 1-9 was used. Tables 2-6 (Table 6 is combined data) shows the data collected from the testing of fungicides with single chemistry. These tests were conducted as basic research to determine the value and efficacy of an individual fungicide. Table 2-6 (with table 6 being combined data) also show the results of the treatments effects on cercospora leaf spot control and sugar beet production in 2008 thru 2011, respectively. The results will be discussed on the data combined over the four years.

Results and Discussion

Fungicide Single Chemistry evaluation for Cercospora leaf spot control and sugar beet production

Discussions are based on the results of the combined years 2008-2011 (Table 6) since an analysis of homogeneity was conducted and determined that the data could be combined.
All treatments significantly increased cercospora leaf spot control, sugar beet production and revenue compared to the treatments where no fungicide was applied (check). All treatments surpassed 100 % of the plot revenue mean with the exception of Super Tin. Sugar beet production and cercospora leaf spot control were statistically similar for Inspire XT, Proline, Gem, Headline and Eminent. Though Super Tin did not perform as well as the other products in the tests it is important to use the product as part of a rotational spray program to aid in the prevention of resistance to fungicides.

Table 1. Site Specific for Fungicide Screening Single Mode of Action, 2008-2011

Location	Planting Timing	Soil Condition
Renville, 2008	5/3/2008	Dry
Renville, 2009	6/5/2009	Damp
Renville, 2010	4/24/2010	Dry
Renville, 2011	5/11/2011	Wet

Table. 2 Fungicides Applied as Single Mode of Action, Influence on Control of Cercospora Leaf Spot and Sugarbeet Yield and Quality Production in Sugarbeets, 2008

Trt	FUNGICIDE	Rate oz./acre	CLS Rating 1	CLS Rating 2	CLS Rating 3	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	4.2	7.1	8.1	23.8	15.03	88.12	5776	61.20
2	EMINENT	13 oz.	2.3	3.1	3.4	31.1	18.44	89.90	9646	125.01
3	GEM 500 SC	3.5 oz.	2.5	2.8	3.3	31.9	17.63	89.50	9361	116.88
4	HEADLINE	9.2 oz.	2.5	2.9	3.5	32.2	18.18	89.69	9799	125.51
5	INSPIRE-XT	7 oz.	1.9	2.3	2.3	32.9	17.92	89.94	9865	124.97
6	PROLINE+NIS	5 oz.+ 0.125%	2.1	2.8	2.5	33.4	18.20	90.04	10237	131.57
7	SUPERTIN	5 oz.	3.3	4.1	4.5	28.7	16.92	88.84	8008	96.18
8	Check	N/A	4.6	7.2	8.0	22.8	15.20	87.62	5562	59.32
		C.V	10.8	11.4	11.6	7.2	4.14	1.00	10	13.29
		LSD(0.05)	NS	NS	NS	3.1	1.04	1.31	1250	20.38

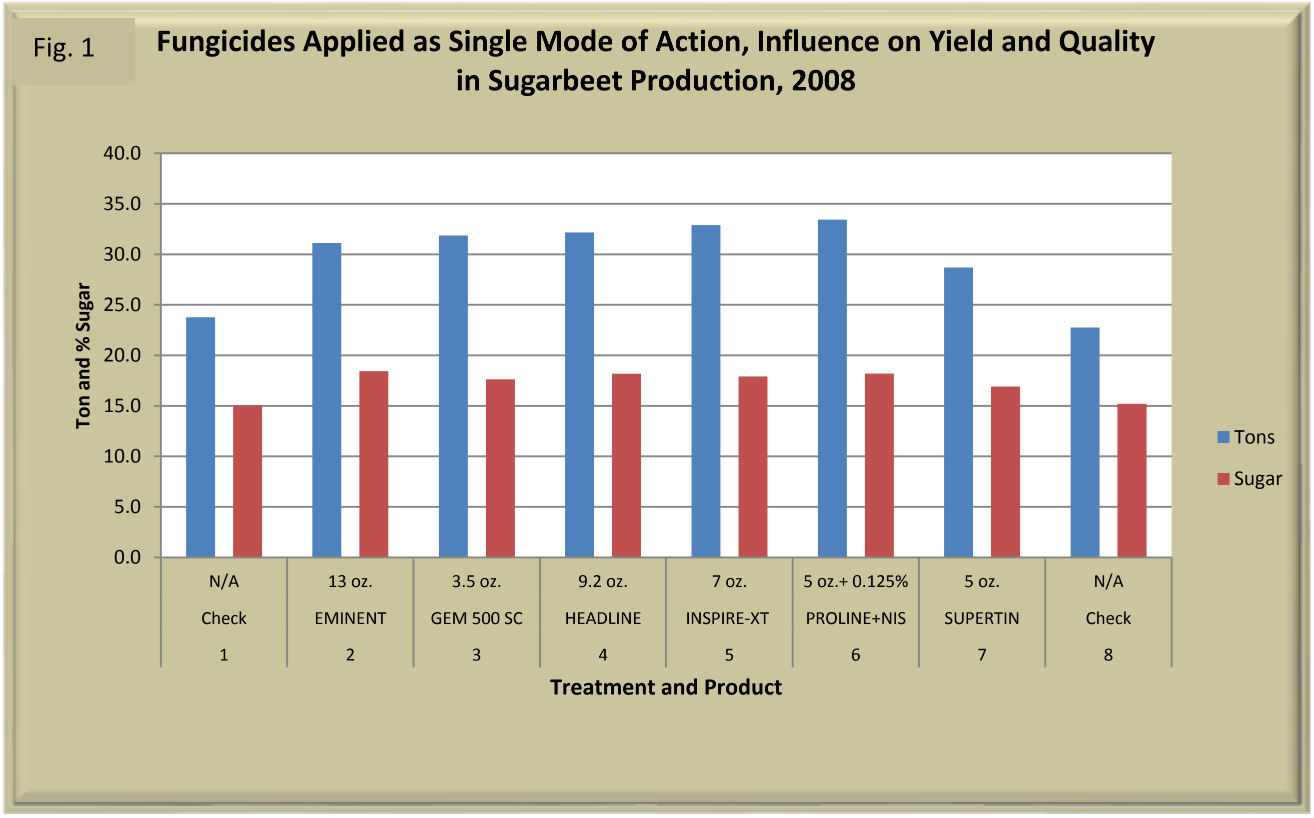


Fig. 1
Fungicides Applied as Single Mode of Action, Influence on Yield and Quality in Sugarbeet Production, 2008
Ton and % Sugar
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
N/A Check 1
13 oz. EMINENT 2
3.5 oz. GEM 500 SC 3
9.2 oz. HEADLINE 4
7 oz. INSPIRE-XT 5
5 oz.+ 0.125% PROLINE+NIS 6
5 oz. SUPERTIN 7
N/A Check 8
Treatment and Product
Tons
Sugar

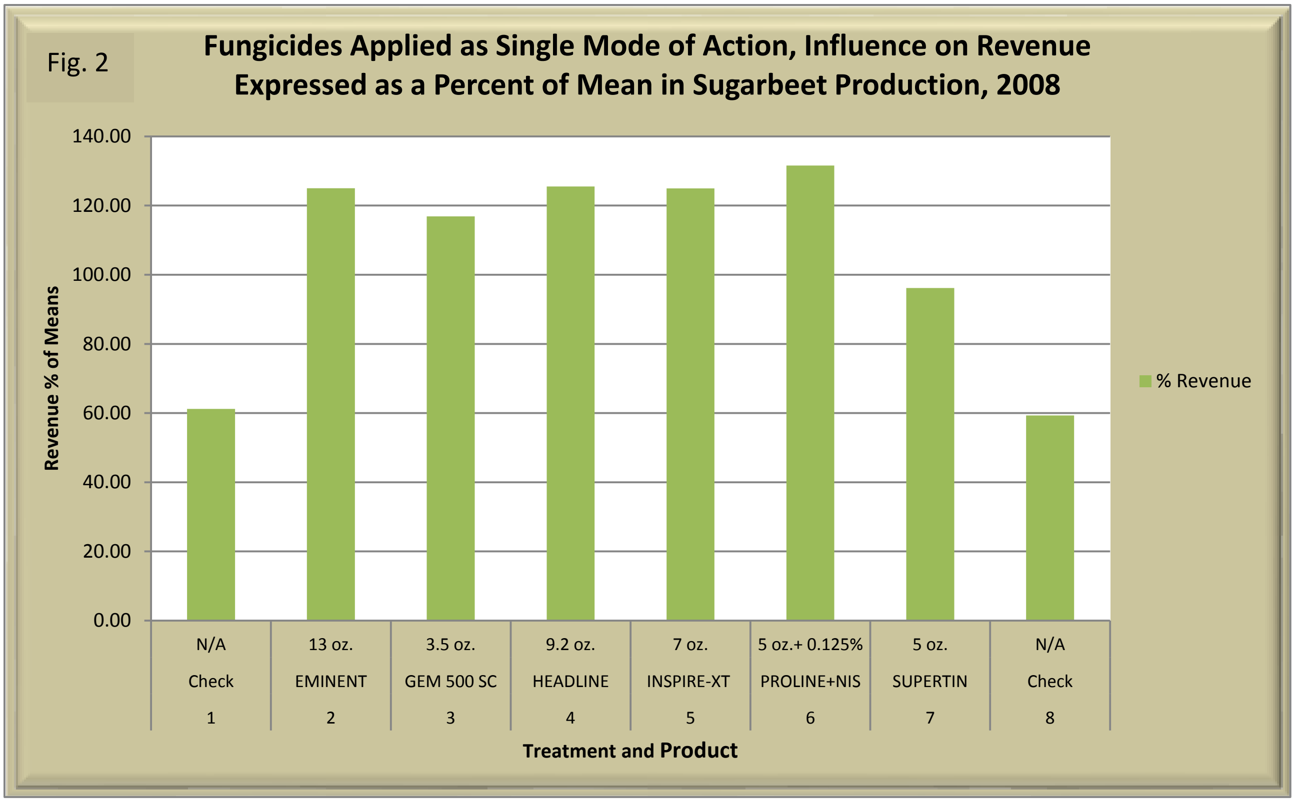


Fig. 2
Fungicides Applied as Single Mode of Action, Influence on Revenue Expressed as a Percent of Mean in Sugarbeet Production, 2008
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
N/A Check 1
13 oz. EMINENT 2
3.5 oz. GEM 500 SC 3
9.2 oz. HEADLINE 4
7 oz. INSPIRE-XT 5
5 oz.+ 0.125% PROLINE+NIS 6
5 oz. SUPERTIN 7
N/A Check 8
Treatment and Product
% Revenue

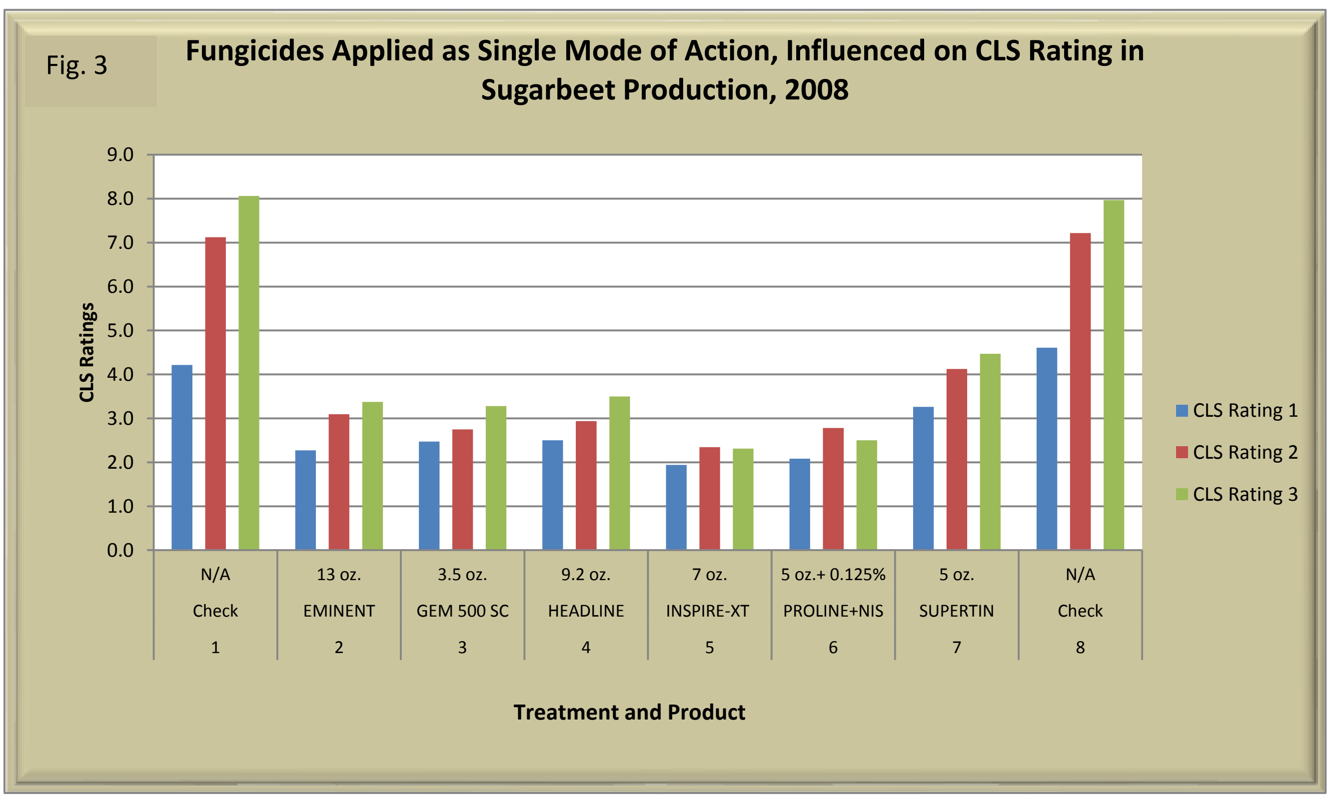
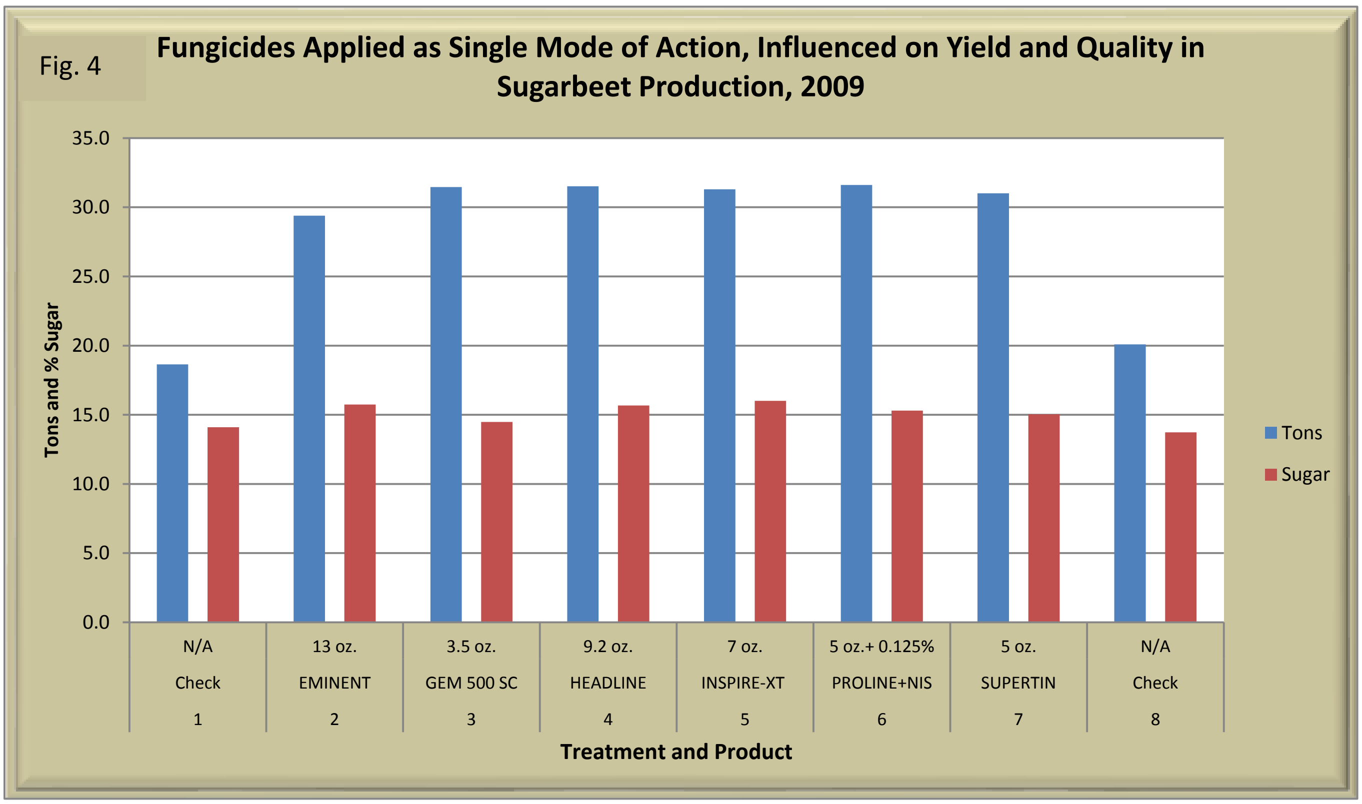


Fig. 3
Fungicides Applied as Single Mode of Action, Influenced on CLS Rating in Sugarbeet Production, 2008
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
CLS Ratings
N/A Check 1
13 oz. EMINENT 2
3.5 oz. GEM 500 SC 3
9.2 oz. HEADLINE 4
7 oz. INSPIRE-XT 5
5 oz.+ 0.125% PROLINE+NIS 6
5 oz. SUPERTIN 7
N/A Check 8
Treatment and Product
CLS Rating 1
CLS Rating 2
CLS Rating 3

Table. 3 Fungicides Applied as Single Mode of Action, Influence on Control of Cercospora Leaf Spot and Sugarbeet Yield and Quality Production in Sugarbeets, 2009

Trt	FUNGICIDE	Rate oz./acre	CLS Rating 1	CLS Rating 2	CLS Rating 3	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	1.6	2.3	5.8	18.6	14.10	91.71	4457	46.45
2	EMINENT	13 oz.	1.5	1.6	1.5	29.4	15.74	92.78	8011	94.39
3	GEM 500 SC	3.5 oz.	1.5	1.7	2.1	31.5	14.48	92.93	7888	86.27
4	HEADLINE	9.2 oz.	1.5	1.9	1.9	31.5	15.67	93.09	8582	101.05
5	INSPIRE-XT	7 oz.	1.3	1.4	1.3	31.3	16.01	93.33	8783	105.95
6	PROLINE+NIS	5 oz.+ 0.125%	1.5	1.5	1.6	31.6	15.31	92.28	8310	94.94
7	SUPERTIN	5 oz.	1.6	1.9	2.7	31.0	15.04	92.57	8026	90.43
8	Check	N/A	1.8	2.0	5.8	20.1	13.73	90.80	4609	45.88
		C.V	13.1	14.6	25.3	7.8	5.64	0.66	11	15.59
		LSD(0.05)	NS	NS	NS	3.2	1.24	0.89	1164	18.93

Fig. 4



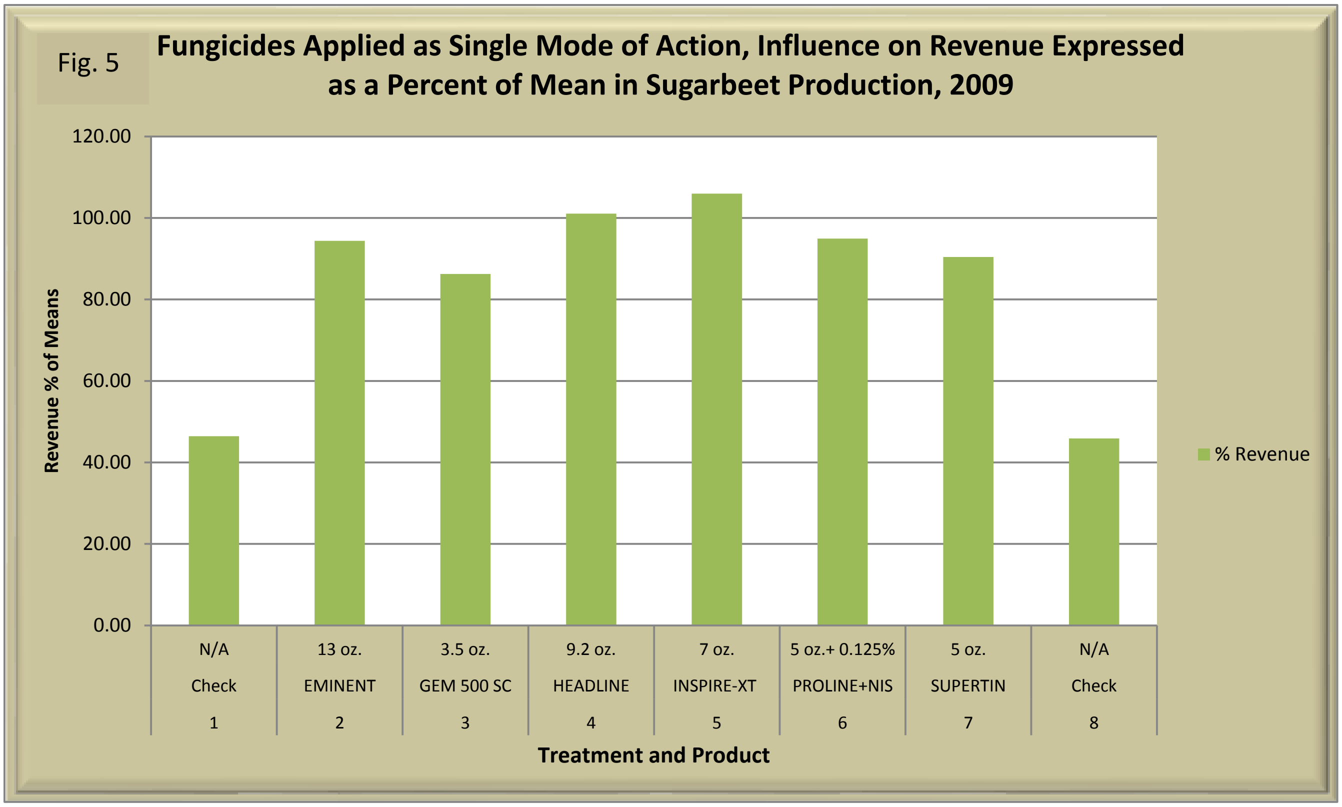


Fig. 5
Fungicides Applied as Single Mode of Action, Influence on Revenue Expressed as a Percent of Mean in Sugarbeet Production, 2009
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
% Revenue
N/A Check 1
13 oz. EMINENT 2
3.5 oz. GEM 500 SC 3
9.2 oz. HEADLINE 4
7 oz. INSPIRE-XT 5
5 oz.+ 0.125% PROLINE+NIS 6
5 oz. SUPERTIN 7
N/A Check 8
Treatment and Product

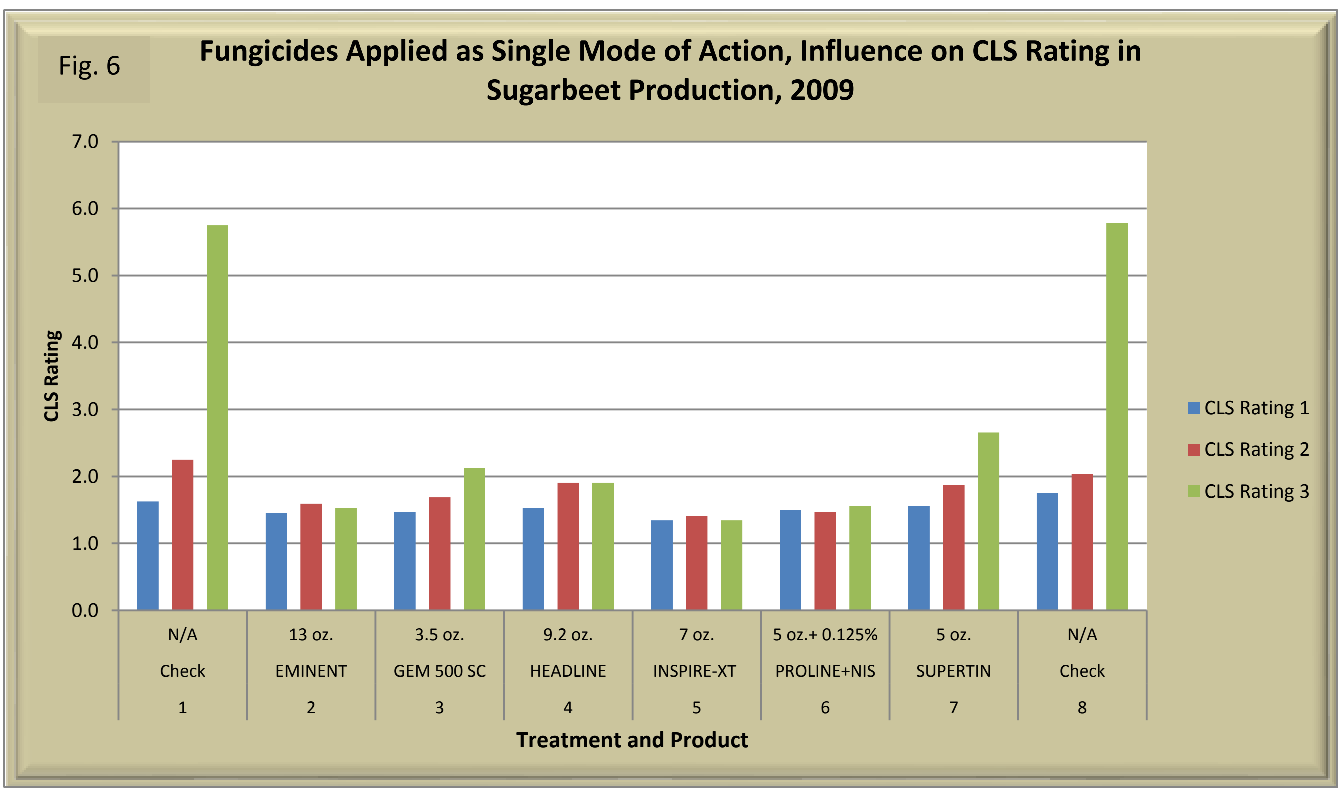
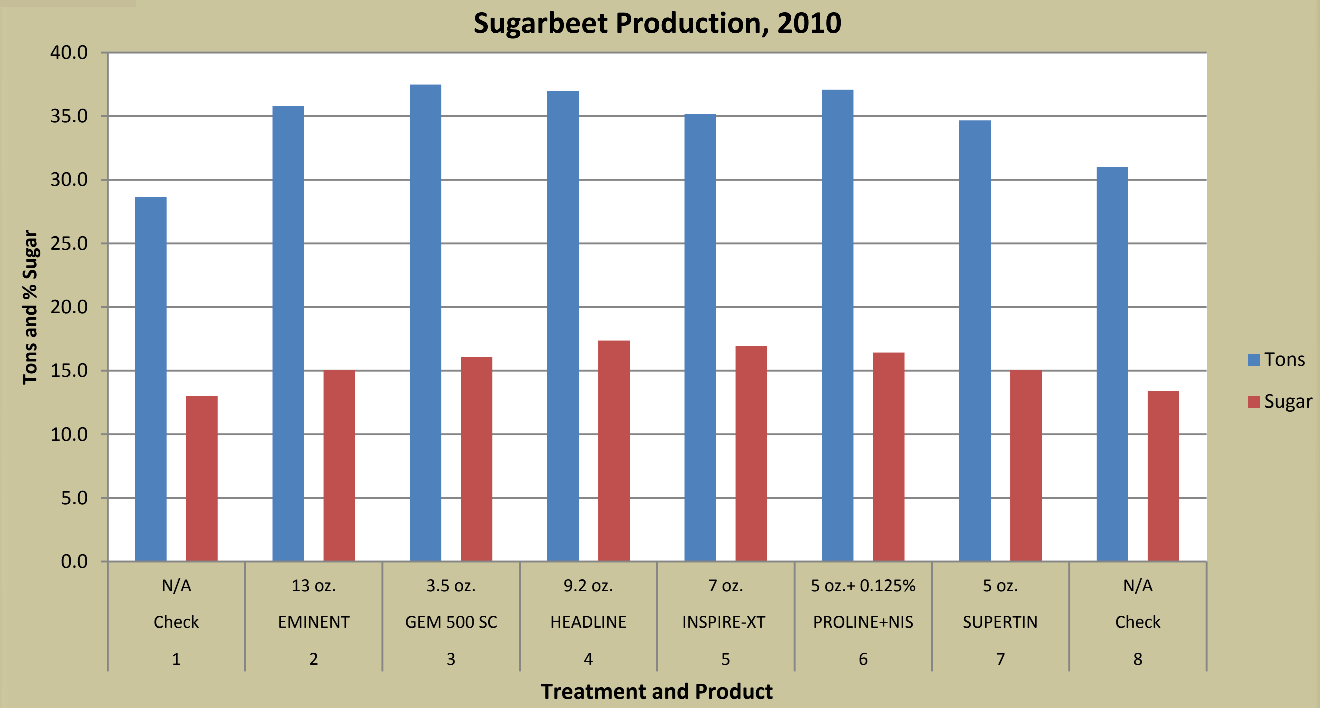


Fig. 6
Fungicides Applied as Single Mode of Action, Influence on CLS Rating in Sugarbeet Production, 2009
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
CLS Rating
CLS Rating 1
CLS Rating 2
CLS Rating 3
N/A Check 1
13 oz. EMINENT 2
3.5 oz. GEM 500 SC 3
9.2 oz. HEADLINE 4
7 oz. INSPIRE-XT 5
5 oz.+ 0.125% PROLINE+NIS 6
5 oz. SUPERTIN 7
N/A Check 8
Treatment and Product

Table. 4 Fungicides Applied as Single Mode of Action, Influence on Control of Cercospora Leaf Spot and Sugarbeet Yield and Quality Production in Sugarbeets, 2010

Trt	FUNGICIDE	Rate oz./acre	CLS Rating 1	CLS Rating 2	CLS Rating 3	Tons /Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	2.8	8.2	9.0	28.6	13.02	87.81	5912	51.25
2	EMINENT	13 oz.	2.0	2.9	4.1	35.8	15.06	90.11	8970	98.06
3	GEM 500 SC	3.5 oz.	1.6	2.5	3.2	37.5	16.08	91.88	10338	123.01
4	HEADLINE	9.2 oz.	1.8	2.1	3.0	37.0	17.37	92.83	11203	142.94
5	INSPIRE-XT	7 oz.	1.8	2.3	2.9	35.2	16.95	91.82	10232	126.88
6	PROLINE+NIS	5 oz.+ 0.125%	1.5	1.8	2.5	37.1	16.43	92.21	10492	127.38
7	SUPERTIN	5 oz.	2.3	3.3	4.7	34.7	15.04	90.64	8745	96.22
8	Check	N/A	2.9	7.6	9.0	31.0	13.42	89.31	6791	63.86
		C.V	13.0	16.7	9.0	4.5	3.24	1.98	6	9.37
		LSD(0.05)	NS	NS	NS	2.3	0.73	2.62	833	14.18

Fig. 7



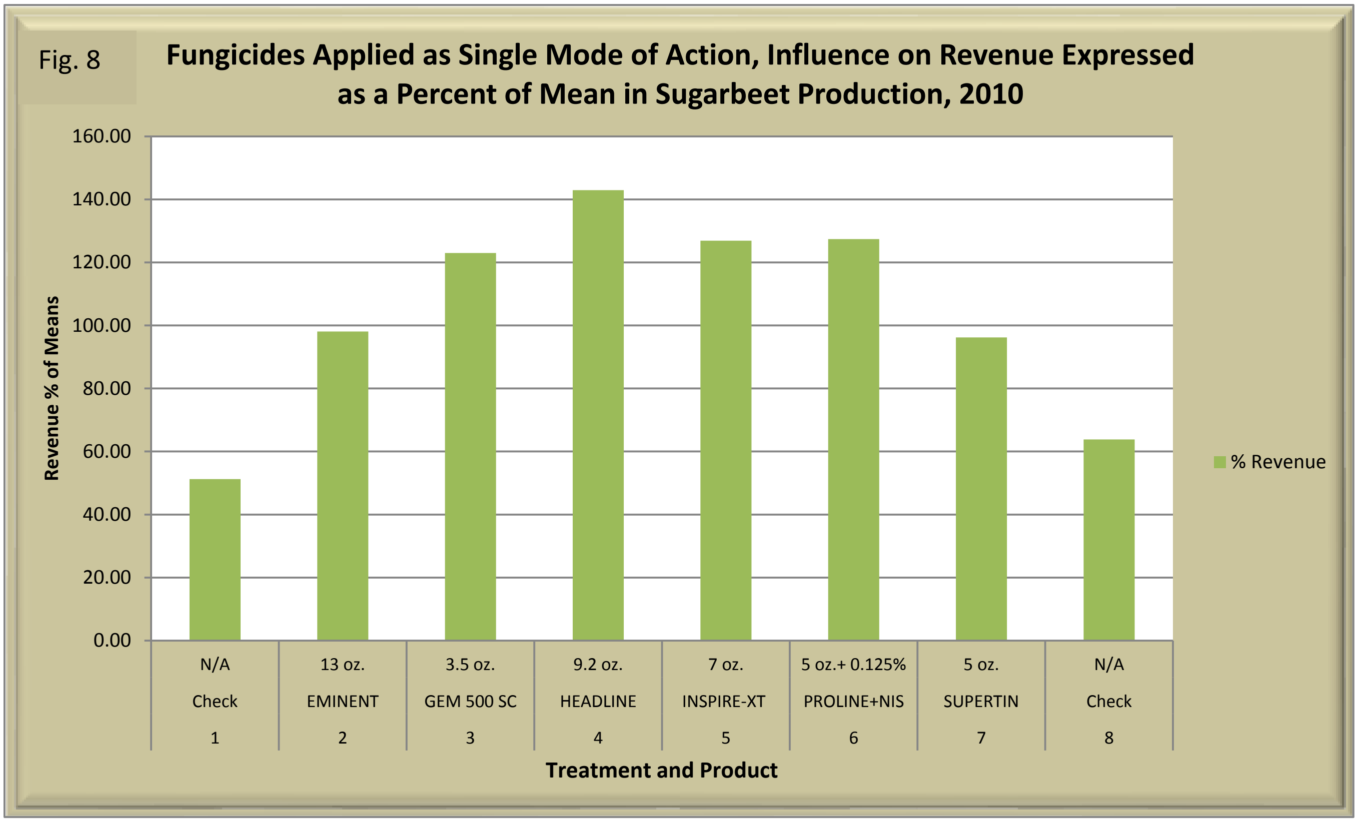


Fig. 8
Fungicides Applied as Single Mode of Action, Influence on Revenue Expressed as a Percent of Mean in Sugarbeet Production, 2010
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
% Revenue
N/A
Check
1
13 oz.
EMINENT
2
3.5 oz.
GEM 500 SC
3
9.2 oz.
HEADLINE
4
7 oz.
INSPIRE-XT
5
5 oz.+ 0.125%
PROLINE+NIS
6
5 oz.
SUPERTIN
7
N/A
Check
8
Treatment and Product

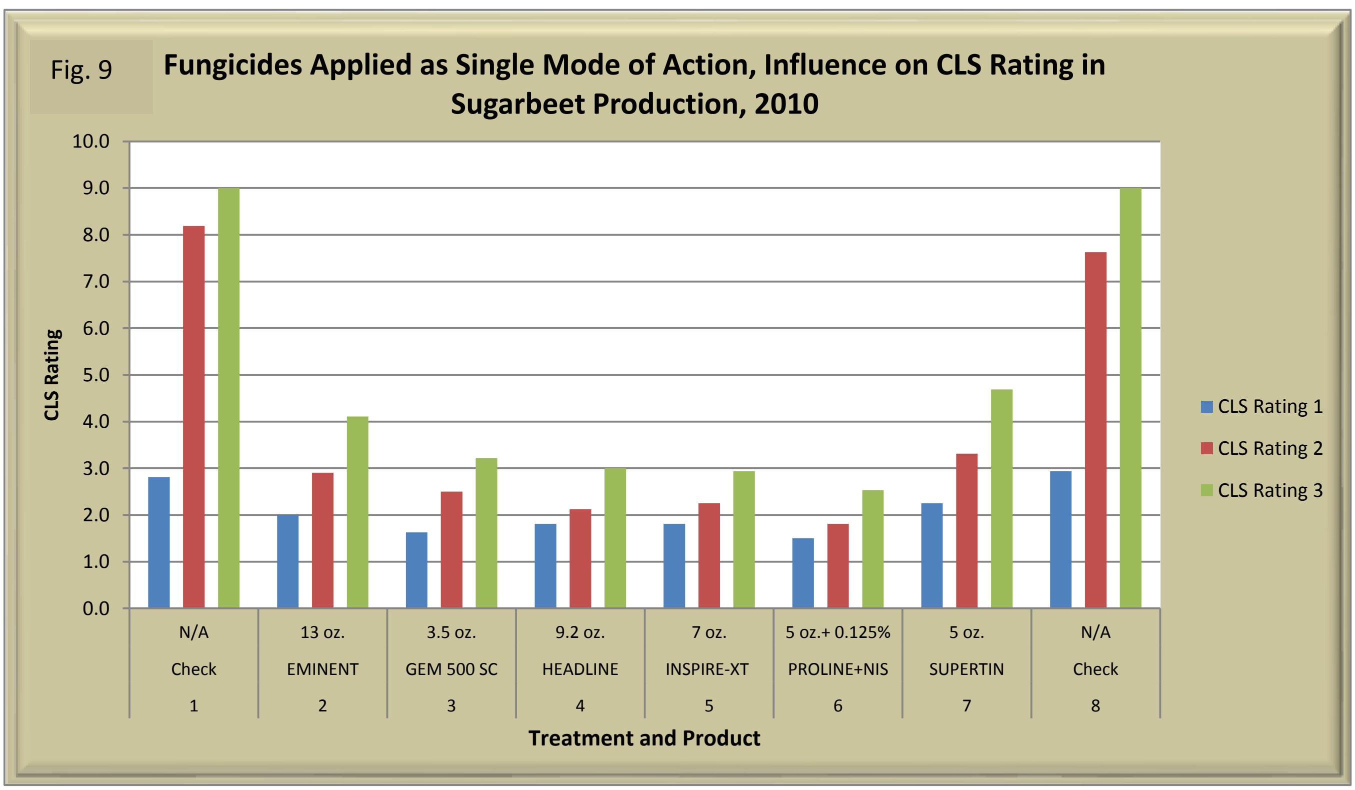
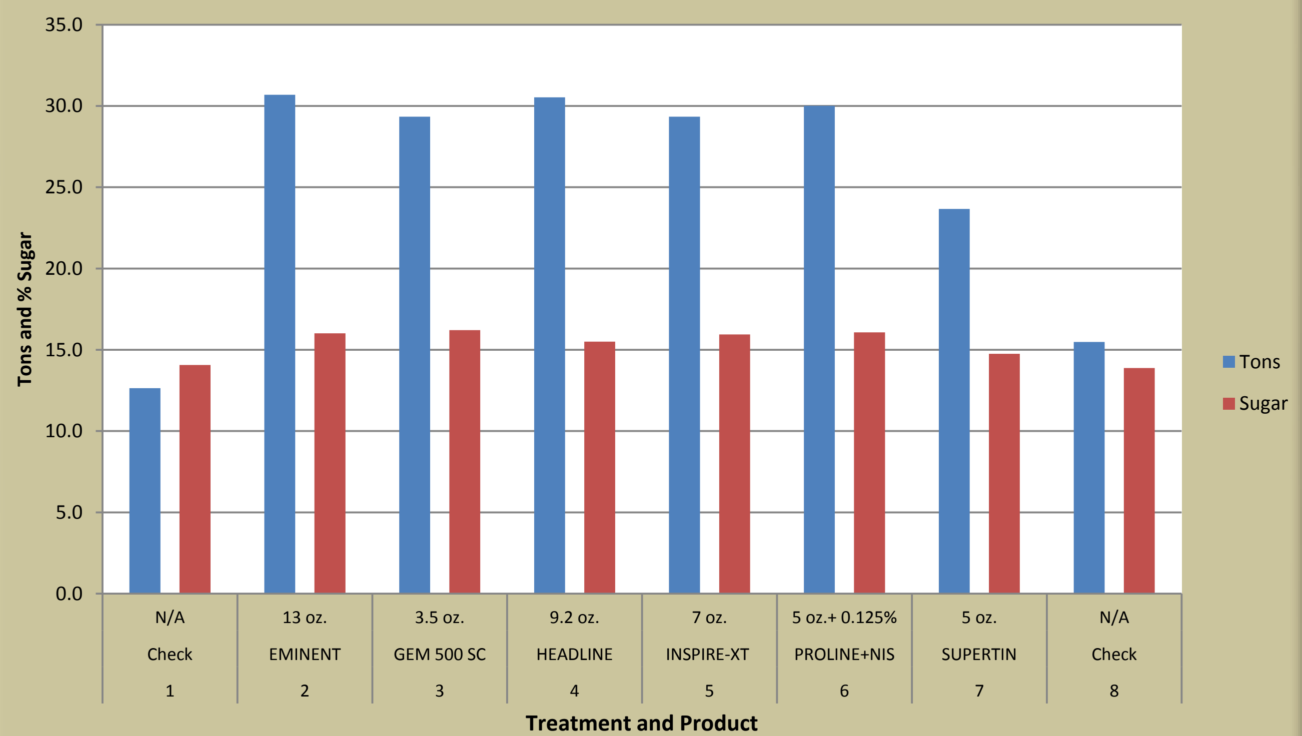


Fig. 9
Fungicides Applied as Single Mode of Action, Influence on CLS Rating in Sugarbeet Production, 2010
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
CLS Rating
CLS Rating 1
CLS Rating 2
CLS Rating 3
N/A
Check
1
13 oz.
EMINENT
2
3.5 oz.
GEM 500 SC
3
9.2 oz.
HEADLINE
4
7 oz.
INSPIRE-XT
5
5 oz.+ 0.125%
PROLINE+NIS
6
5 oz.
SUPERTIN
7
N/A
Check
8
Treatment and Product

Table. 5 Fungicides Applied as Single Mode of Action, Influence on Control of Cercospora Leaf Spot and Sugarbeet Yield and Quality Production in Sugarbeets, 2011

Trt	FUNGICIDE	Rate oz./acre	CLS Rating 1	CLS Rating 2	CLS Rating 3	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	1.8	4.6	8.1	12.6	14.07	85.71	2745	41.56
2	EMINENT	13 oz.	1.3	1.6	1.4	30.7	16.01	87.95	7916	141.68
3	GEM 500 SC	3.5 oz.	1.4	1.5	1.4	29.3	16.21	87.77	7678	139.02
4	HEADLINE	9.2 oz.	1.5	1.6	1.5	30.5	15.51	87.70	7614	132.45
5	INSPIRE-XT	7 oz.	1.3	1.6	1.4	29.3	15.94	87.50	7505	133.41
6	PROLINE+NIS	5 oz.+ 0.125%	1.3	1.6	1.3	30.0	16.08	87.58	7724	137.99
7	SUPERTIN	5 oz.	1.6	2.0	4.1	23.7	14.76	85.50	5392	86.04
8	Check	N/A	1.6	3.4	7.6	15.5	13.88	87.27	3403	52.25
		C.V	17.2	33.7	26.5	12.6	3.81	1.30	11	12.15
		LSD(0.05)	NS	NS	NS	4.6	0.85	1.66	1048	19.16

Fig. 10 **Fungicides Applied as Single Mode of Action, Influenced on Yield and Quality in Sugarbeet Production, 2011**



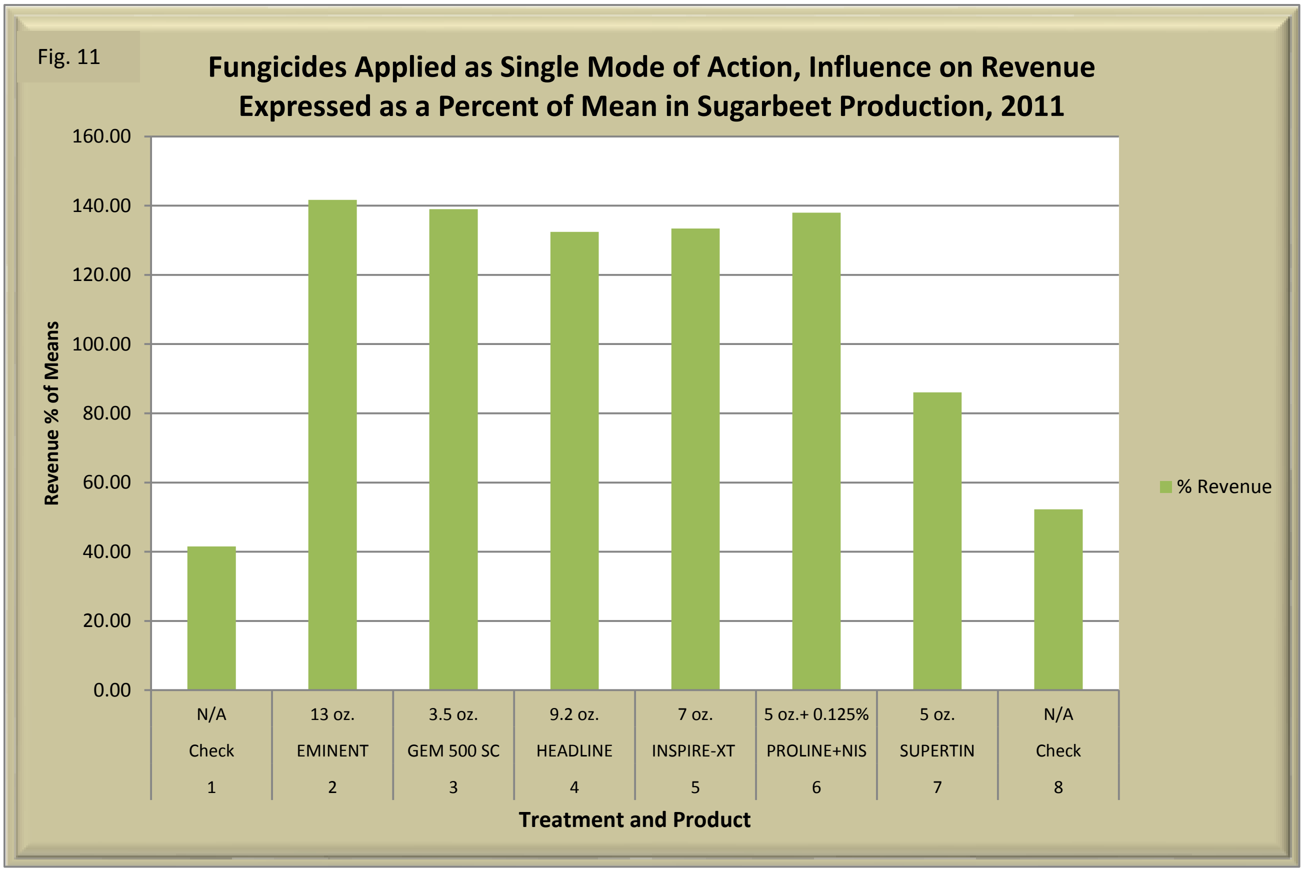


Fig. 11
Fungicides Applied as Single Mode of Action, Influence on Revenue Expressed as a Percent of Mean in Sugarbeet Production, 2011
Revenue % of Means
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
N/A Check 1
13 oz. EMINENT 2
3.5 oz. GEM 500 SC 3
9.2 oz. HEADLINE 4
7 oz. INSPIRE-XT 5
5 oz.+ 0.125% PROLINE+NIS 6
5 oz. SUPERTIN 7
N/A Check 8
Treatment and Product
% Revenue

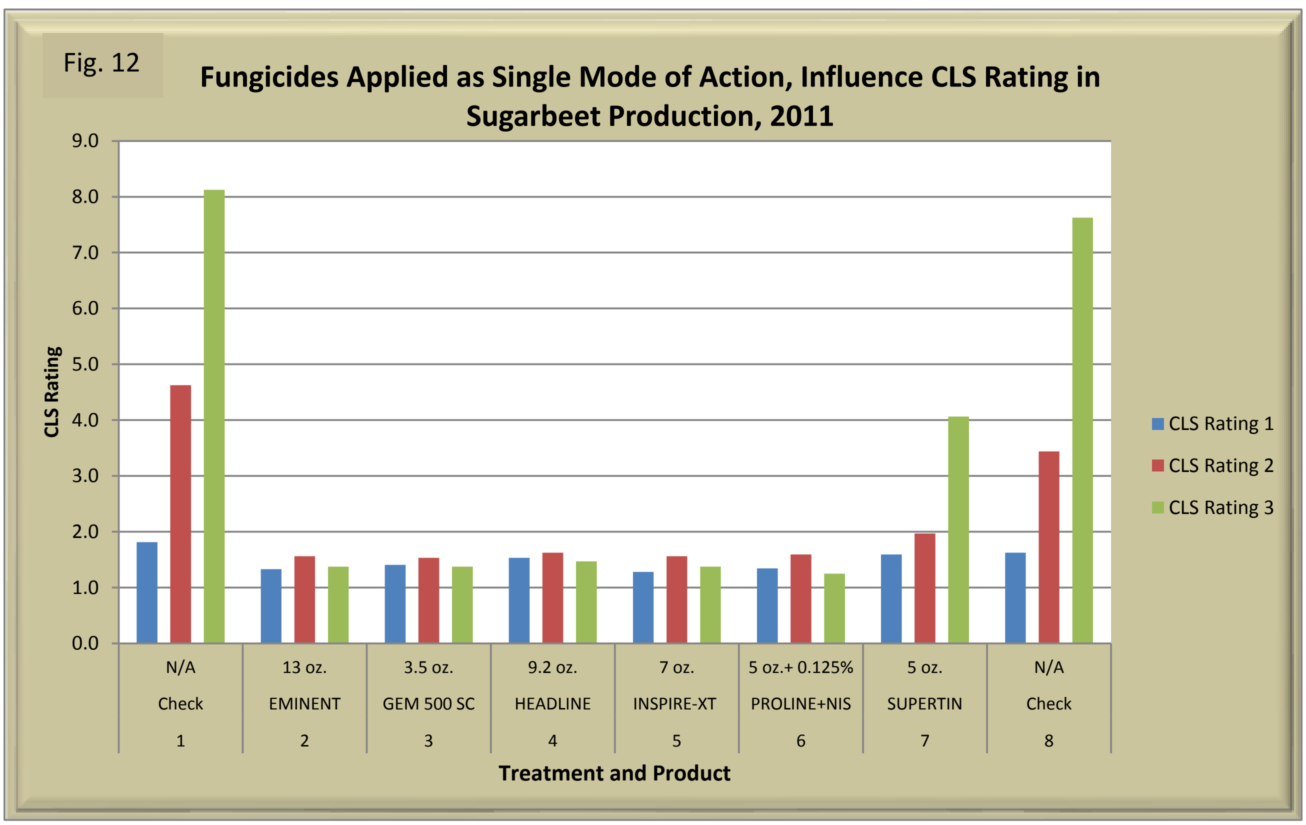
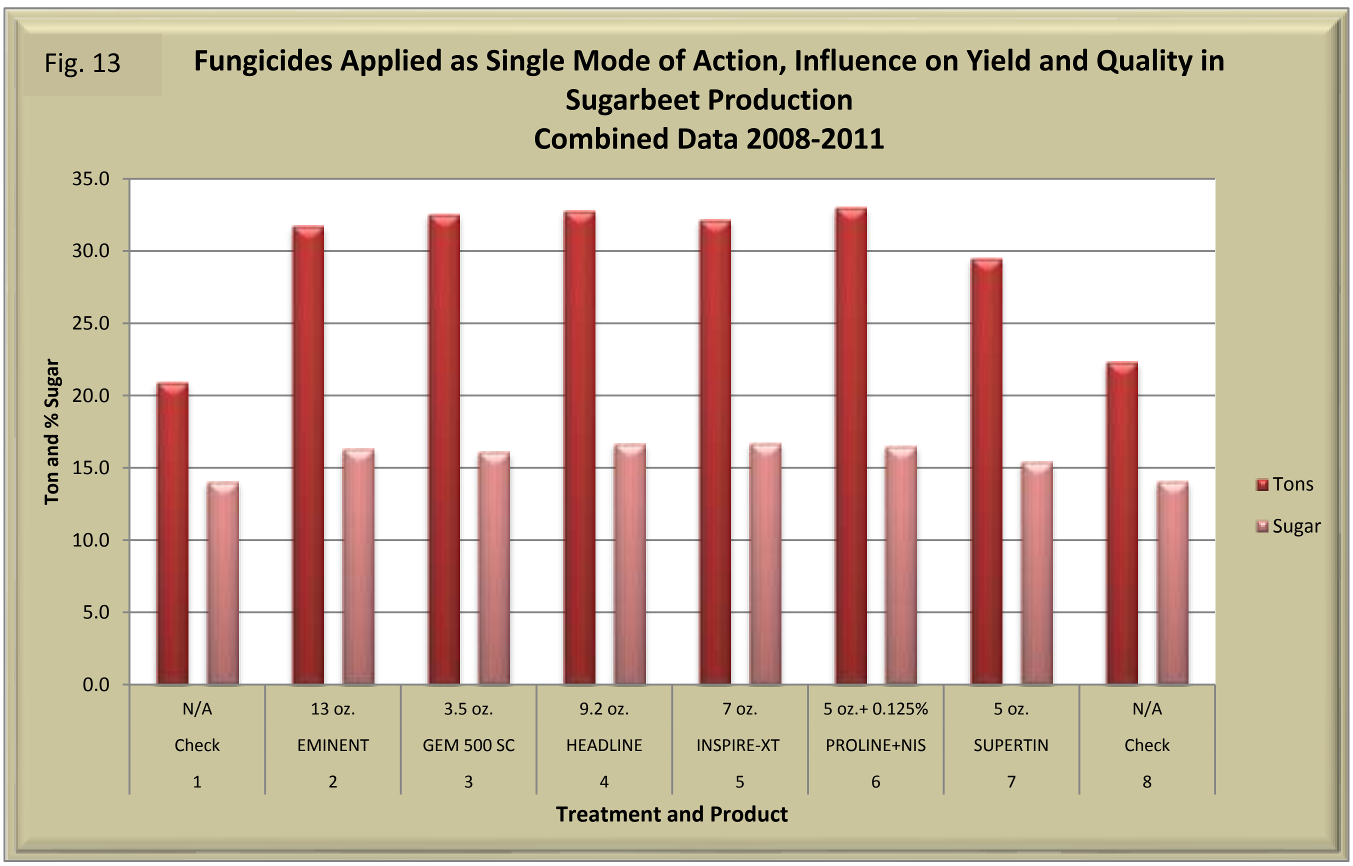


Fig. 12
Fungicides Applied as Single Mode of Action, Influence CLS Rating in Sugarbeet Production, 2011
CLS Rating
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
N/A Check 1
13 oz. EMINENT 2
3.5 oz. GEM 500 SC 3
9.2 oz. HEADLINE 4
7 oz. INSPIRE-XT 5
5 oz.+ 0.125% PROLINE+NIS 6
5 oz. SUPERTIN 7
N/A Check 8
Treatment and Product
CLS Rating 1
CLS Rating 2
CLS Rating 3

Table. 6 Fungicides Applied as Single Mode of Action, Influence on Control of Cercospora Leaf Spot and Sugarbeet Yield and Quality Production in Sugarbeets, Combined Data 2008-2011

Trt	FUNGICIDE	Rate oz./acre	CLS Rating 1	CLS Rating 2	CLS Rating 3	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Check	N/A	2.6	5.5	7.7	20.9	14.05	88.34	4722	50.11
2	EMINENT	13	1.8	2.3	2.6	31.7	16.31	90.19	8636	114.78
3	GEM 500 SC	3.5	1.7	2.1	2.5	32.5	16.10	90.52	8816	116.29
4	HEADLINE	9.2	1.8	2.1	2.5	32.8	16.68	90.83	9300	125.49
5	INSPIRE-XT	7	1.6	1.9	2.0	32.2	16.70	90.65	9096	122.80
6	PROLINE+NIS	5+0.125%	1.6	1.9	2.0	33.0	16.50	90.53	9190	122.97
7	SUPERTIN	5	2.2	2.8	4.0	29.5	15.44	89.39	7543	92.22
8	Check	N/A	2.7	5.1	7.6	22.3	14.06	88.75	5091	55.33
		C.V	13.2	18.9	17.2	7.9	4.28	1.33	10	12.55
		LSD(0.05)	NS	NS	NS	1.6	0.47	0.84	522	8.81



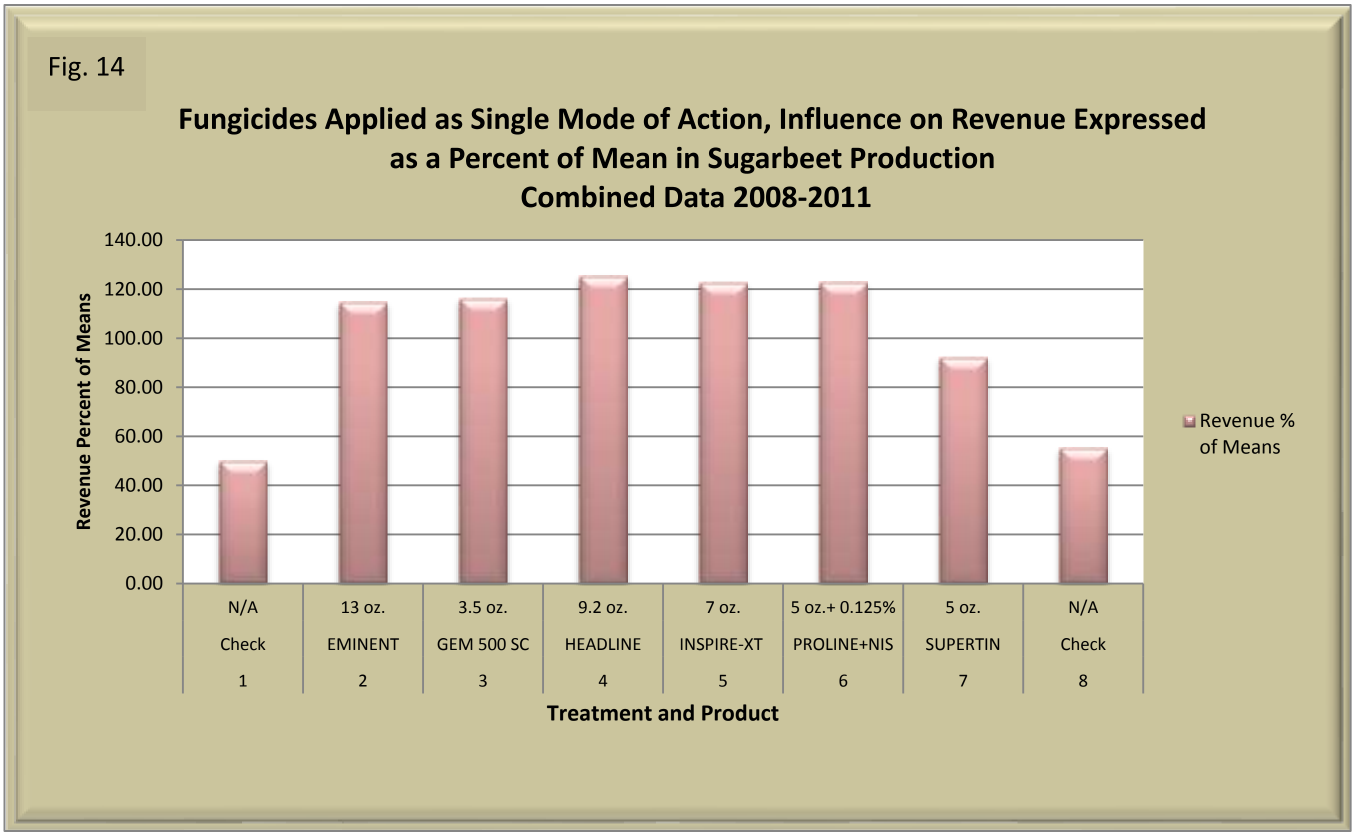


Fig. 14
Fungicides Applied as Single Mode of Action, Influence on Revenue Expressed as a Percent of Mean in Sugarbeet Production
Combined Data 2008-2011
Revenue Percent of Means
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
N/A
Check
1
13 oz.
EMINENT
2
3.5 oz.
GEM 500 SC
3
9.2 oz.
HEADLINE
4
7 oz.
INSPIRE-XT
5
5 oz.+ 0.125%
PROLINE+NIS
6
5 oz.
SUPERTIN
7
N/A
Check
8
Treatment and Product
Revenue % of Means

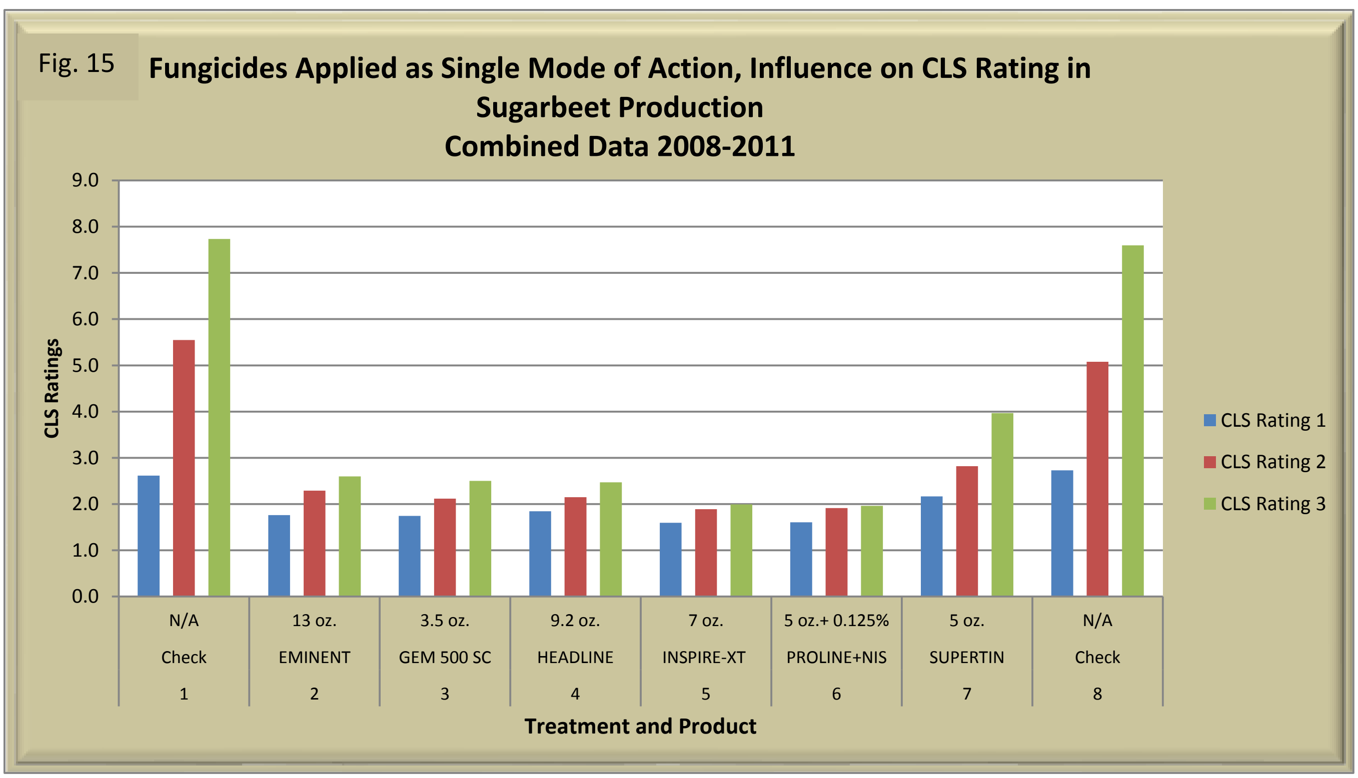


Fig. 15
Fungicides Applied as Single Mode of Action, Influence on CLS Rating in Sugarbeet Production
Combined Data 2008-2011
CLS Ratings
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
N/A
Check
1
13 oz.
EMINENT
2
3.5 oz.
GEM 500 SC
3
9.2 oz.
HEADLINE
4
7 oz.
INSPIRE-XT
5
5 oz.+ 0.125%
PROLINE+NIS
6
5 oz.
SUPERTIN
7
N/A
Check
8
Treatment and Product
CLS Rating 1
CLS Rating 2
CLS Rating 3

SENSITIVITY OF *CERCOSPORA BETICOLA* TO FOLIAR FUNGICIDES IN 2011.

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Leaf spot, caused by the fungus *Cercospora beticola*, is an endemic disease of sugar beet produced in the Northern Great Plains area of North Dakota and Minnesota. It causes a reduction in photosynthetic area thereby reducing both yield and sucrose content of the beets. The disease is controlled by crop rotation, resistant varieties and timely fungicide applications. *Cercospora* leaf spot usually appears in the last half of the growing season, and two to four fungicide applications are made during this time for disease control. Fungicides are used at high label rates and are alternated. The most frequently used fungicides are Tin (triphenyl tin hydroxide), Topsin (thiophanate methyl), Eminent (tetraconazole), Proline (prothioconazole), Inspire (difenoconazole) and Headline (pyraclostrobin). All fungicides are applied alone, except Topsin, which is usually applied as a tank mix with Tin.

Like many other fungi, *C. beticola* has the ability to adapt to repeated fungicide exposure and become less sensitive to the fungicides used to control them, especially if they are applied frequently over a period of time. Loss of disease control can result when fungicides become less sensitive. It is important to monitor the *C. beticola* population for changes in sensitivity to the fungicides used for Cercospora leaf spot management in order to achieve maximum disease control. We began testing *C. beticola* populations for changes in sensitivity to tin in 1996, and expanded sensitivity testing to additional fungicides in subsequent years. From 1997-2000 we evaluated sensitivity of *C. beticola* to tin and thiophanate methyl. We utilized our extensive culture collection of *C. beticola* isolates from 1997-2000 to establish baseline sensitivities to Eminent, Headline and Gem and to evaluate shifts in sensitivity to tin and Topsin. Fungicide sensitivity monitoring of field isolates of *C. beticola* to the commonly used fungicides in our area was conducted in the years 2003 - 2010. In 2011, sensitivity monitoring was conducted for tin, Topsin, Eminent, Inspire, and Headline.

OBJECTIVES

The 2011 objectives were:

1) Monitor sensitivity of *Cercospora beticola* isolates collected from fields representing the sugarbeet production area of the Red River Valley region to Tin (triphenyl tin hydroxide) and Topsin (thiophanate methyl).

2) Monitor sensitivity of *Cercospora beticola* isolates collected from fields representing the sugarbeet production area of the Red River Valley region to Headline (pyraclostrobin) fungicide and compare sensitivity to the previously established baseline.

3) Determine sensitivity of *Cercospora beticola* isolates from fields representing the sugarbeet production areas of ND and MN to two triazole (DMI) fungicides: Eminent (tetraconazole) and Inspire (difenoconazole).

4) Distribute results of sensitivity monitoring in a timely manner to the sugar beet industry in order to make fungicide recommendations for disease management and fungicide resistance management for Cercospora leaf spot disease in our region.

METHODS AND MATERIALS

In 2011, with financial support of the Sugarbeet Research and Extension Board of MN and ND, BASF Corporation, and Syngenta Crop Protection, we conducted extensive testing of *C. beticola* isolates collected from throughout the sugarbeet production regions of ND/MN for sensitivity to Tin, Topsin, Eminent, Inspire, and Headline. For this report we use the commercial name of the fungicides, but all testing was conducted using the technical grade active ingredient of each fungicide, not the formulated commercial fungicide. The term µg/ml is equivalent to ppm.

Sugar beet leaves with Cercospora leaf spot (CLS) were collected from commercial sugar beet fields by agronomists from American Crystal Sugar Company, Minn-Dak Farmers Cooperative and Southern Minnesota Beet Sugar Cooperative representing all production areas in ND and MN. Leaves were delivered to our lab, and processed immediately to insure viability of spores. From each field sample, *C. beticola* spores were collected from a minimum of five spots per leaf from five leaves. The spores were mixed in water, and a composite of 200 µl of the spore suspension was transferred to each of three Petri plates containing water agar amended with Tin at 1 ug/ml, amended with Topsin at 5 µg/ml or non-amended (water agar alone). This year for the first time, leaves with CLS were collected from both the upper canopy and the lower canopy. Isolates were collected from and tested separately from upper and lower leaves in order to determine of time of infection was associated with fungicide sensitivity. Ostensibly, lower leaves were infected earlier in the season than upper leaves.

For Tin and Topsin sensitivity testing, a bulk spore germination procedure was used. Germination of 100 random spores on the Tin and Topsin amended water agar was counted 16 hrs after plating and percent germination calculated. Germination on non-amended media was calculated and this plate was used as a source of single spore sub-cultures for subsequent Eminent, Inspire and Headline testing.

For triazole fungicide sensitivity testing, a standard radial growth procedure for *C. beticola* was used. A single spore subculture from the original non-amended media was grown on water agar medium amended with serial ten-fold dilutions of each technical grade triazole fungicide from 0.01 – 10.0 ppm. This if the first year we have tested for EC_{50} values between 1 and 10 ppm. A separate test was conducted for each triazole fungicide. After 15 days, inhibition of radial growth was measured, and compared to the growth of *C. beticola* on non-amended water agar medium. This data was used to calculate an EC_{50} value for each isolate; EC_{50} is a standardized method of measuring fungicide resistance and is calculated by comparing the concentration of fungicide that reduces radial growth of *C. beticola* by 50% compared to the growth on non-amended media. Higher EC_{50} values mean reduced sensitivity to the fungicide.

For Headline sensitivity testing we use a procedure that measures inhibition of spore germination. A subculture from the original non-amended medium was grown on modified V-8 medium and induced to sporulate abundantly using a procedure developed in our lab. The spores are collected and transferred to water agar amended with serial ten fold dilutions of technical grade pyraclostrobin from 0.001 – 1.0 ppm plus SHAM. Previous studies demonstrated that *C. beticola* spores reach >80% germination in about 16 hours with some variability depending on isolate. Consequently, germination of 100 spores viewed at random was done 16 hrs after plating and percent germination calculated. An EC_{50} was calculated for each isolate; EC_{50} is a standardized method of measuring fungicide resistance and is calculated by comparing the concentration of fungicide that inhibits the germination of *C. beticola* by 50% compared to germination on non-amended media. Higher EC_{50} values mean reduced sensitivity to the fungicide.

RESULTS AND DISCUSSION

In 2011, disease pressure was generally low to moderate and Cercospora disease again developed late in the season. The majority of the CLS samples were delivered to our lab ate the end of the season in l September and October. Approximately 556 field samples representing all production areas and factory districts were tested for sensitivity to five fungicides in 2011. Additional samples (n=450) from fungicide trial plots of Dr. Mohamed Khan, NDSU were also tested for sensitivity to these fungicides. For this report, only results from the field samples are included; the fungicide trial plot results are not included. A few samples that were submitted were not done, because the spores did not germinate. We postulate that the fields from which these samples were collected had recently been treated with a fungicide that interfered with spore germination in the lab, or that the leaves collected had bacterial leaf spot and not Cercospora leaf spot.

Tolerance (resistance) to Tin was first reported in 1994 at concentrations of 1-2 µg/ml. At these levels, disease control in the field was reduced. The incidence of isolates with resistance to Tin at1.0 µg/ml increased between 1997 and 1999, but the incidence of resistant isolates has been declining since the introduction of additional fungicides for resistance management, including Eminent in 1999, Gem in 2002 and Headline in 2003. In 1998, the percentage of isolates resistant to Tin at 1.0 µg/ml was 64.6%, in 1999 was 54.3%, in 2000 was 17.7%, in 2001 was 14.9%, in 2002 was 9.0%, in 2003 was 1.1%, in 2004 was 1.1%, in 2005 was 0.97%, in 2006 was 0.0%, in 2007 was 5.1%, in 2008 was 0%, in 2009 was 2.0%, and in 2010 was 1.4% (**Figure 1**). In 2011, the incidence of isolates resistant to tin at 1.0 ppm increased to 10.3% (**Figure 1**). The increase may be due to the increased use of tin plus Topsin in 2011 because of triazole resistance concerns. This increase is a beginning concern that deserves watching, as tin is an important component of fungicide resistance management program.

Resistance to the benzimidazole fungicide Topsin became widespread in *C. beticola* in the 1980's in many sugar beet production areas of the US, including the Northern Great Plains. In 1998, 70.8% of the samples were resistant to Topsin at >5.0 µg/ml when tested using a bulk spore germination procedure; in 1999, 71.3% of the samples were resistant; in 2001, 56.4% of the samples were resistant; in 2003, 71.3% of the samples were resistant; in 2004, 78.3% of the isolates were resistant, and in 2009, 14% of the samples were resistant (**Figure 2**). In 2011, the incidence of isolates resistant to Topsin at 5.0 ppm increased to 53.2% (**Figure 2**). It appears that incidence of isolates resistant to Topsin has increased dramatically since last tested in 2009. This rapid increase is not surprising, since resistance to benzimidazole fungicides does not revert to sensitive quickly, and resistance returns quickly when benzimidazole fungicides are used again.

Based on average EC_{50} values, overall resistance of *C. beticola* isolates to Eminent has doubled from 1998 to 2010 (**Figure 3**). The average EC_{50} value of field-collected isolates collected in 2002 was 0.21µg/ml, in 2003 was 0.12, in 2004 was 0.24, in 2005 was 0.29, in 2006 was 0.14, in both 2007 and 2008 was 0.20, in 2009 was 0.25, and in 2010 was 0.26. In 2011, the average EC_{50} value increased to 1.40, almost an eight fold increase in resistance over the previous nine year average of 0.18. In 2002, 1.2 % of the isolates tested had an EC_{50} value of >1 compared to 6.0% of the isolates in 2003, 10.8% of the isolates in 2004, 12.4% of the isolates in 2005, 7.3% of the isolates in 2006, 9.5% of the isolates in 2007, 12.4% of the isolates in 2008, and 6.6% of the isolates in 2009, and 19% in 2010. In 2011, 35.5% of the isolates tested had an EC_{50} value >1.0 ppm, some >10.0 ppm.

Based on average EC_{50} values, sensitivity to Inspire also increased The average EC_{50} values for Inspire were 0.15 in 2007, 0.20 in 2008 and 0.10 in 2009 and 0.17 in 2010 (**Figure 4**). In 2011, the average EC_{50} value increased to 0.48, almost a three fold increase in resistance over the previous four year average of 0.15. In 2009, the percent isolates in 2009 isolates with EC_{50} values >1.0 ppm to Inspire was 0.5%, in 2010 was 8.4%, and in 2011 was 9.5%, with a few >10 ppm.

Resistance to triazole fungicides increased in all factory districts (**Figures 5 and 6**). In general, there were no differences in EC50 values between lower leaves (early infection) and upper leaves (recent infection), but some differences were found in the Crookston and Drayton districts (**Figures 7 and 8**). Resistance, defined as EC_{50} >1, in the US correlates with reduced disease control in field and greenhouse trials we have conducted. The resistance to the triazole fungicides we see in US isolates of *C. beticola* is related to overexpression of Cyp51 enzyme, and not due to a specific genetic mutation. In companion studies we have conducted, higher levels of resistance to triazole fungicides are present in *C. beticola* isolates collected from Italy and France than found in the RRV production area. It will be critical to monitor resistance to triazole fungicides in the RRV region due to their widespread use and increased resistance in recent years. It may be prudent to pursue registration of fungicides with new modes of action and/or fungicide mixtures to help manage fungicide resistance

Baseline sensitivity to the strobulurin (QoI) fungicide Headline was calculated using *C. beticola* isolates from our culture collection that were not previously exposed to Headline. Compared to this baseline of 0.003 ppm, sensitivity of C. *beticola* to Headline has remained relatively stable from 2003-2009 with only a seven fold decrease in sensitivity. The average EC_{50} value of RRV isolates during 2003-2009 was 0.022 ppm, but in 2010 it was 0.174 and in 2011 0.082 (**Figure 9**). The percentage of isolates with EC50 values >1 ppm to Headline was 0.5 % in 2009, 2.3% in 2010 and 3.7% in 2011. In 2011, EC_{50} values >1.0 ppm ranged from 1.1 to 3.8 ppm. There has been a 40 fold increase in the EC50 value over the baseline EC50 value of 0.002 ppm prior to 2004, the first year Headline was used. In general, there were higher EC_{50} values to Headline on lower leaves in most factory districts (**Figure 10**), but at the SMBSC district, higher EC_{50} values were found on upper leaves (**Figure 10**). In *C. beticola* isolates collected from Italy in 2010, 27% of the isolates had EC50 values <1 ppm ranging from 1.5-43.6 ppm. A specific genetic mutation was found in these isolates that correlated with Headline resistance. In 2011, there was widespread field resistance to Headline in Michigan. This resistance was correlated with high EC50 values, and resistant isolates had a specific mutation similar to that found in Italy. Isolates from the RRV with high EC50 values are currently being tested for this mutation. It will be critical to continue monitoring for resistance to Headline in the RRV production area, particularly because Headline is often the only fungicide used and is used annually even in the absence of disease.

There are numerous examples in many crops where resistance has developed to this class of fungicides. Because of the widespread application of Headline to sugar beets at the end of the season in our region, the application to many other crops in the sugar beet production area, and the potential for resistance development, it remains critical to monitor sensitivity of *C. beticola* to Headline.

Because *C. beticola* has a history of developing resistance to fungicides, and has a high degree of variability in culture, the potential for resistance development to fungicides is always there. This is especially true since we found both mating types of *C. beticola* naturally occurring in the population in ND and MN. We must continue to monitor *C. beticola* populations in our area for fungicide sensitivity and develop fungicide resistance management strategies with this goal as a high priority to insure effective management of *Cercospora beticola* for the long term.

SUMMARY

1. Resistance to Tin at 1.0 µg/ml has almost disappeared in our region, presumably because of the use of alternate fungicides that has resulted in the reduction in the number of Tin applications from 2.14 in 1998 to less than one each year since 2001. In 2011, there was an increase in isolates resistant to tin, ostensibly due to an increase in tin application. In 2011, 10.3% of the isolates were resistant to tin.

2. Sensitivity to Eminent remains relatively stable: the average EC_{50}values and the number of isolates with an EC_{50} > 1.0 µg/ml doubled from 2003-2009, which may indicate the potential for reduced sensitivity to develop. In the past two years, sensitivity to both triazole fungicides has increased, dramatically so for tertaxonazole.

3. The average EC_{50} value of RRV isolates during 2003-2009 was 0.022 ppm, but in 2010 it was 0.174 and in 2011 0.082. The percentage of isolates with EC50 values >1 ppm to Headline was 0.5 % in 2009, 2.3% in 2010 and 3.7% in 2011. In 2011, EC_{50} values >1.0 ppm ranged from 1.1 to 3.8 ppm. There has been a 40 fold increase in the EC50 value over the baseline EC50 value of 0.002 ppm prior to 2004, the first year Headline was used. It will be critical to continue monitoring for resistance to Headline in the RRV production area, particularly because Headline is often the only fungicide used and is used annually even in the absence of disease.

5. It appears that the fungicide resistance management plan that we are following has been working since there have been no fungicide failures in our area due to fungicide resistance. Our monitoring program has detected several shifts toward decreased sensitivity to all fungicides used for control.

6. Combinations of fungicides with different modes of actions may be necessary to prevent reduced sensitivity of *C. beticola* to currently registered fungicides. New fungicides with new modes of action should be tested for efficacy for registration.

7. Continue to use disease control recommendations currently in place including:

- Fungicide rotation
- Only one triazole per season
- Only one strobilurin (QoI) per season
- A good three spray program is triazole, tin, strobilurin

- Using the high label rate of all fungicides
- Scout at end of the season to decide the necessity of a late application; CLS developed late in recent years
- NDAWN daily infection values, row closure, first appearance of disease and the calendar are all used to determine first fungicide application
- Use fungicide resistance maps for fungicide selection
- Use a variety with resistance to CLS; KWS rating of 5.0 or less
- Spray intervals of 14 days
- Apply fungicides in a manner to insure maximum coverage; the fungicides used for Cercospora leaf spot control are protectants; better coverage results in better control. Fungicides must be in place before *C. beticola* inoculum arrives.

Figure 1. Sensitivity to Tin of *C. beticola* isolates collected in ND and MN from 1998 to 20011 at 1.0 µg/ml as measured by bulk spore germination

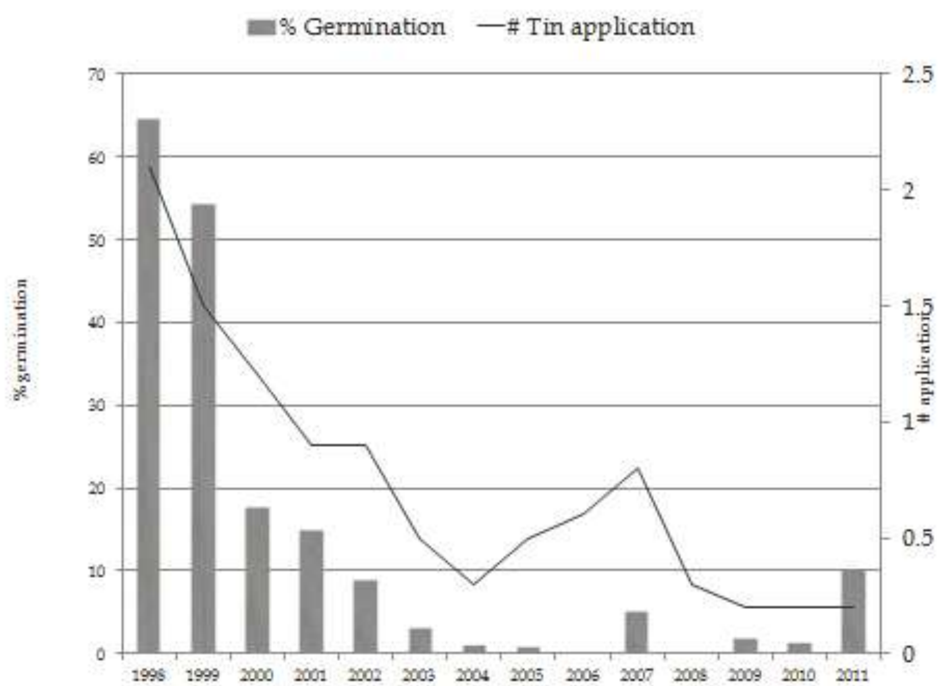


Figure 2. Percent germination of *Cercospora beticola* isolates collected in ND and MN from 2003 to 2011 on medium amended with Topsin at 5 µg/ml

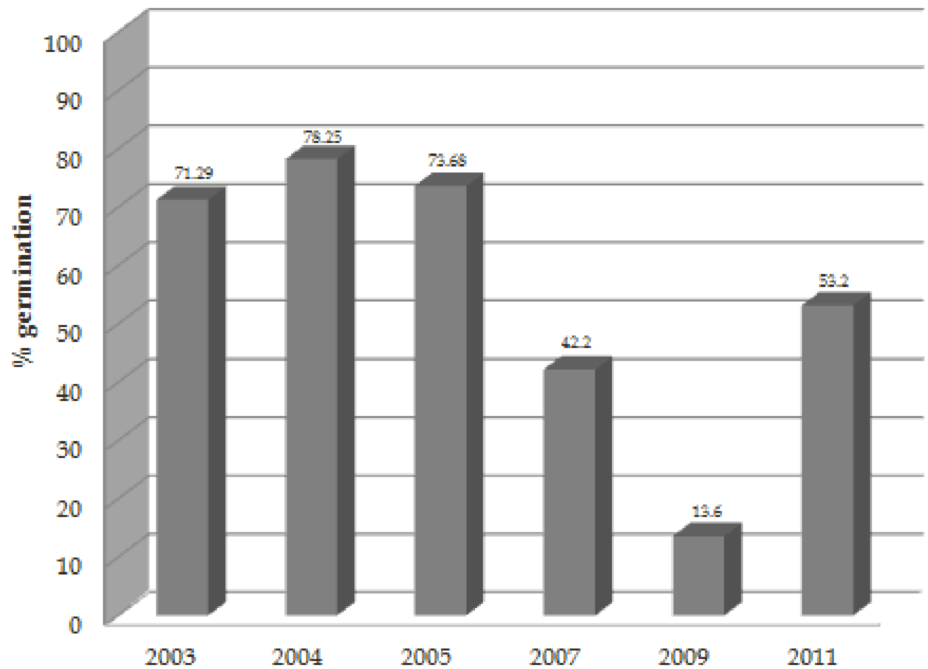


Figure 3. Average EC_{50} values of *C. beticola* isolates collected in ND and MN from 1997-2011 to Eminent

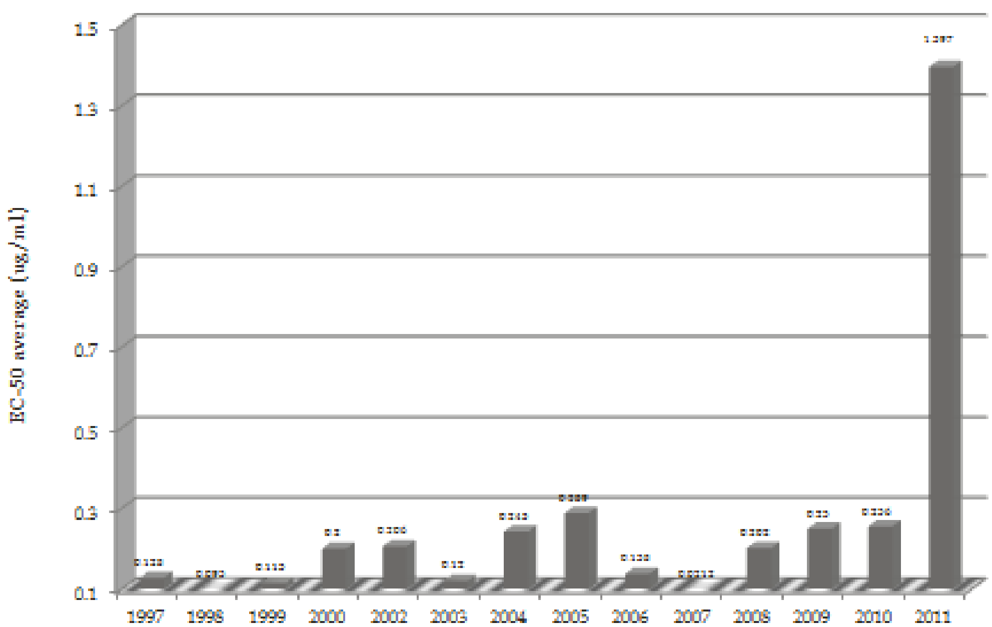


Figure 4. Average EC_{50} values of *C. beticola* isolates collected in ND and MN from 2007-2011 to Inspire

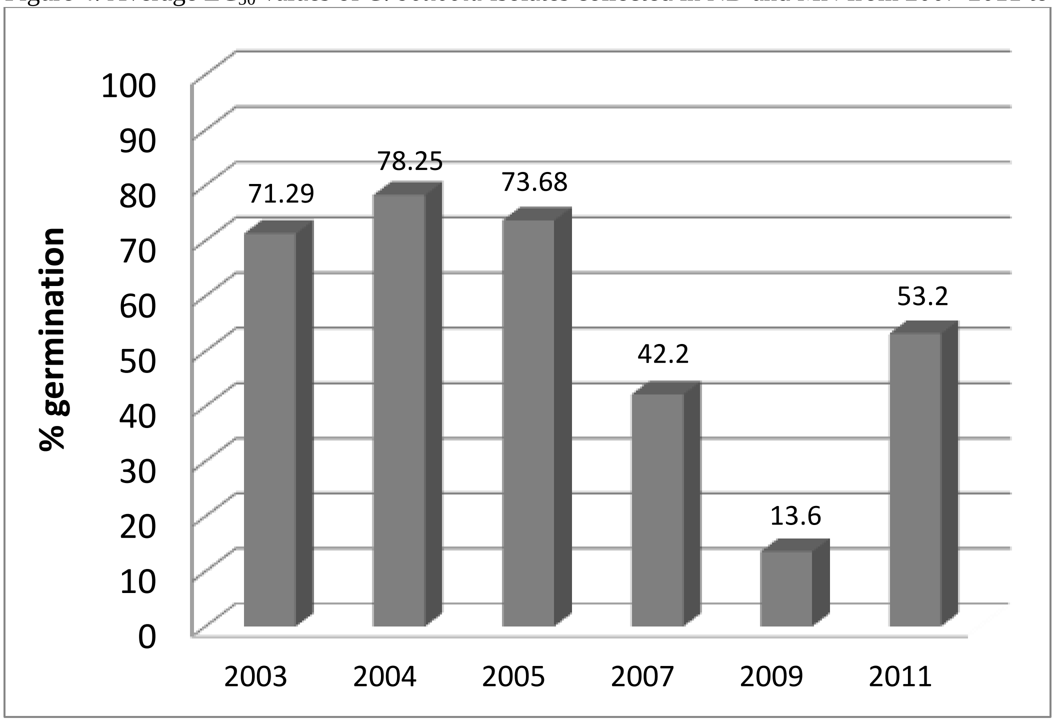


Figure 5. Average EC-50 values of *C. beticola* isolates collected in 2009-2011 to Eminent by factory district

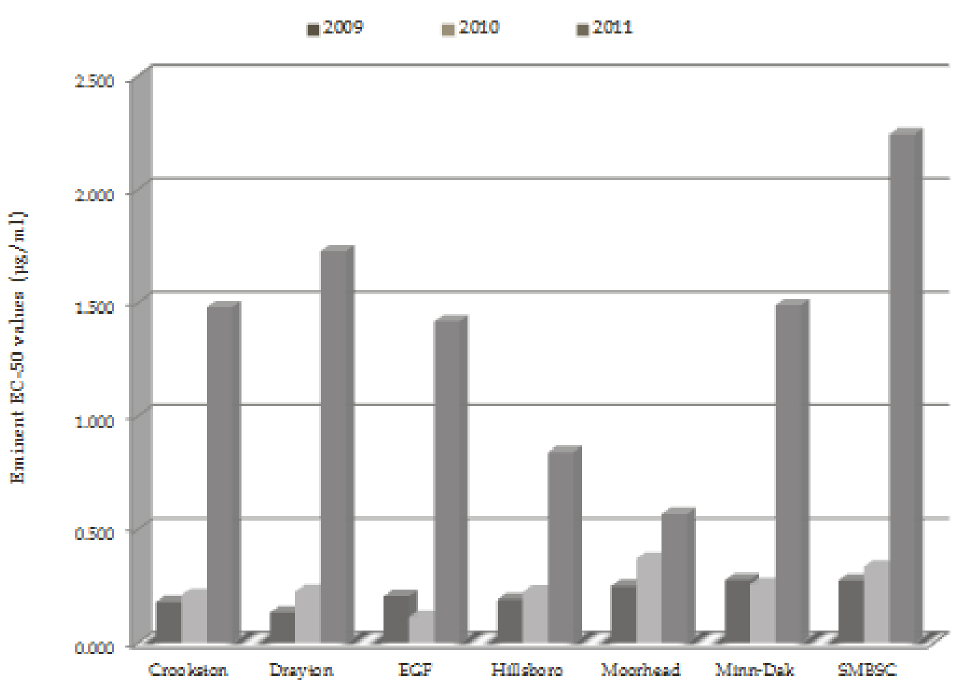


Figure 6. Average EC_{50} values of *C. beticola* isolates collected in 2009-2011 to Inspire by factory district.

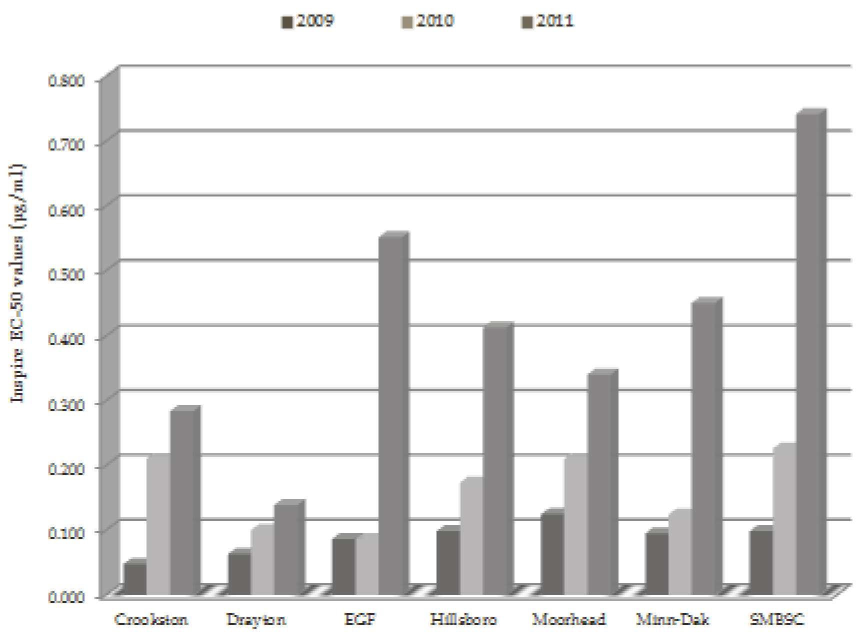


Figure 7. Average EC50 values of *C. beticola* isolates to Eminent from upper and lower canopy collected the same date

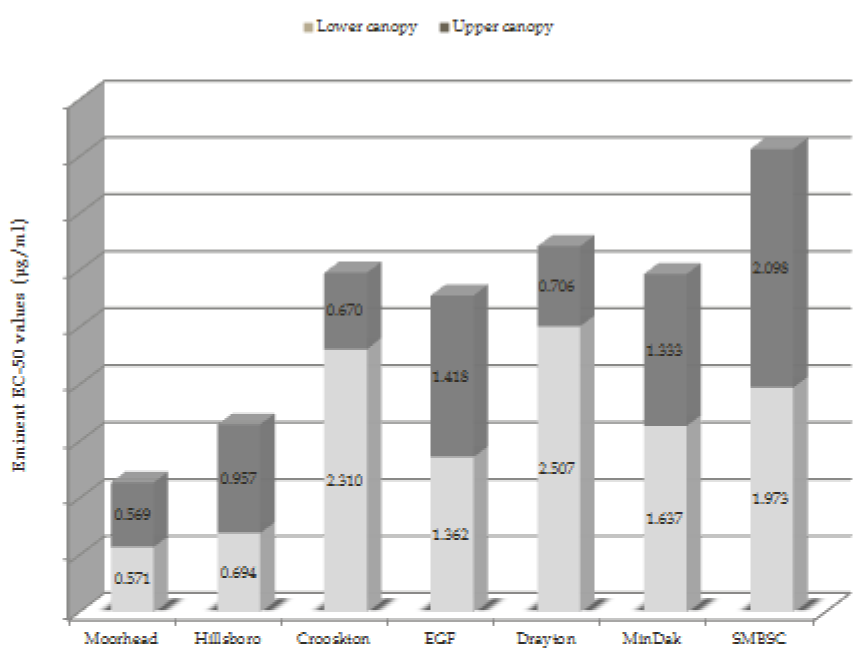


Figure 8. Average EC50 values of *C . beticola* isolates to Inspire from upper and lower canopy collected the same date

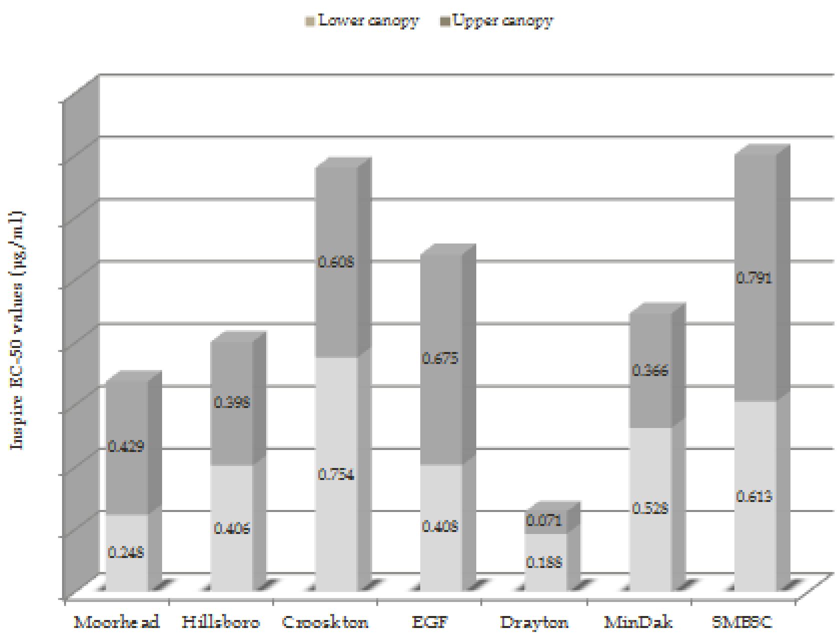


Figure 9. Average EC_{50} values of *C. beticola* isolates collected in ND and NM to Headline from 2003 to 2009

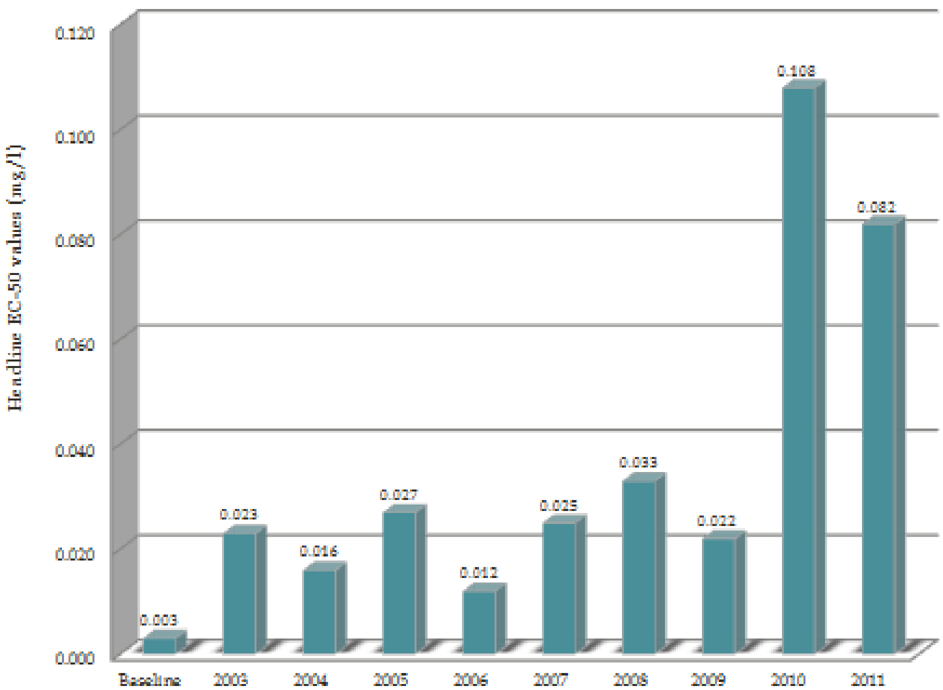
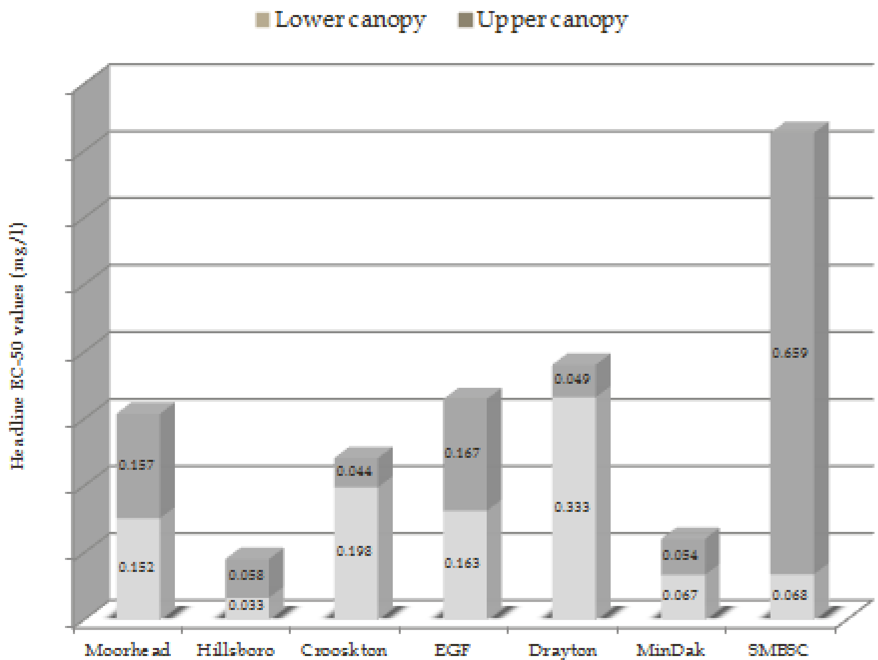


Figure 10. Average EC50 values of *C . beticola* isolates to Headline from upper and lower canopy collected the same date



SMBSC Evaluation of Fungicides for control of Rhizoctonia Solani in Sugarbeet Growth-2011

The following report is a summarization of testing fungicides for controlling Rhizoctonia Solani during the growing seasons of 2011.

Objectives

The objective of these trials was to evaluate fungicides for control of Rhizoctonia Solani (Rhizoctonia root rot) with a susceptible and resistant variety.

Methods

Table 1 shows the specifics of activities conducted at the Rhizoctonia testing. The test is designated by two experiments (Clara City, MN) and (Buffalo Lake, MN). Plots were 11 ft. (6 rows) wide and 20 ft. long. Sugarbeets plots were inoculated with the Rhizoctonia Solani fungus at the 4 leaf stage of the Sugarbeets. The Rhizoctonia strain inoculated was the AG 2-2 IIIB. The inoculum was prepared on barley grain by personnel at the University of Minnesota Northwest Research and Outreach Center. The inoculum was applied via a Gandy band applicator. Sugarbeet stands were counted at 4 leaf sugarbeet stages and at harvest for the whole plot and factored to a 100 ft. relative stand. Sugarbeets were not thinned in order to let the treatment not be influenced by variability in the thinning process. The tests were replicated 4 times. Sugarbeets were harvested with a 2 row research harvester plow. The harvester plow lifted the sugarbeets out of the soil and the sugar beets are then placed in a row for each plot in preparation of visual evaluation. The evaluation scale is a 1-7 scale. This scale is an industry standard used for Rhizoctonia root rot evaluation. Evaluation was conducted of the roots from the middle two rows of the six row plot. Multiple evaluators were used to comprise the evaluations and a test of statistical homogeneity (combinability) was conducted and determined that the evaluators rating could be combined. The sugarbeets were collected and measured for yield and analyzed for quality at the SMBSC Tare Lab.

Results and Discussion

The sugarbeet stand was not significantly changed over time at either location, thus the sugar beet stand presented is the at harvest stand counts. The data from the two test sites are presented separately in table 2 (Buffalo Lake, MN site) and table 3 (Clara City, MN site). Even though the general results were similar it is not unusual for disease trials results to not test out for homogeneity due to magnitude or inherent variability with in the data. Thus, data will be discussed for each site separately and the data will also be discussed in general.

Clara City site

Rhizoctonia rating in the untreated check of the susceptible variety was 3.9, which indicates a moderate level of disease pressure. The tolerant variety gave significantly less Rhizoctonia rating than the susceptible variety. With the susceptible variety all Rhizoctonia ratings were unacceptable where ActinoGrow (biological fungicide) was applied in furrow. The treatments that gave the best control of Rhizoctonia Solani with the susceptible variety were where Quadris was applied at 14.3 oz. in furrow either alone or with ActinoGrow. The application of Quadris gave significantly better Rhizoctonia Solani control than Proline applied without NIS, with the susceptible variety. Rhizoctonia Solani control with the susceptible variety was statistically similar when Proline was applied with NIS or Quadris applied alone.

The same trend followed with the tolerant variety, except for that the Rhizoctonia root rating were significantly less with the tolerant compared to the susceptible variety.

The revenue (expressed as a percent of the mean) was significantly higher for like treatments in the tolerant compared to the susceptible variety. Revenue was higher for all treatments including Quadris, Proline with or without NIS and Proline plus Gem compared to the untreated check with the susceptible and tolerant variety. Performance of sugar beet production was directly related to Rhizoctonia ratings. Both varieties were positively influenced for Rhizoctonia control and sugar beet production by the application of fungicides

Buffalo Lake site

Disease pressure was high, as indicated by the Rhizoctonia rating in the untreated check of the susceptible variety. The rhizoctonia rating was significantly less with the tolerant variety compared to the rhizoctonia rating for the susceptible variety. The only two treatments where the susceptible variety was planted that would be considered acceptable was when Proline at 5.7 plus 1.25% NIS or Quadris at 14.3 were applied in a 5 inch band at the 4 leaf sugarbeet stage.

The tolerant variety performed significantly better than the susceptible variety for all variables measured. The tolerant variety when not treated with a fungicide (untreated) gave 103 and 78.91% greater revenue than the susceptible variety untreated at the Buffalo Lake and Clara City sites, respectively. All variables measured were directly influenced by the degree of the presence of Rhizoctonia Solani.

Even when using a tolerant variety, the use of a fungicide enhanced control of Rhizoctonia Solani and the production of sugar beets. ActinoGrow (biological fungicide) was very inconsistent in the control of Rhizoctonia. The application of Quadris at 14.3 oz. either did or tended to reduce Rhizoctonia ratings and significantly increase sugar beet production. Proline applied alone or with .125% NIS either tended or did reduce Rhizoctonia ratings and significantly increased sugar beet production.

General Comments

1. The tolerant variety performed significantly better in the presence of Rhizoctonia Solani compared to the susceptible variety.
2. Fungicides applications were beneficial to both susceptible and tolerant varieties.
3. Proline plus NIS or Quadris applied on a 7 inch band at the 4^{th} leaf stage of sugar beet both gave very good Rhizoctonia control and sugar beet production regardless of the varieties tolerance to Rhizoctonia Solani.

Table 1. Site Specific for Fungicide by Variety
Clara City, 2011

Location	Planting Timing	Soil Conditions
Clara City, 2011	5/17/2011	Tacky
Buffalo Lake, 2011	5/17/2011	Lumpy/Dry

Note: 4017 was planted in the first 3 rows (1,2,3)
9093 was planted in the last 3 rows (4,5,6)

Table 2. Rhizoctonia Control as Influenced by Fungicide and Variety
Clara City, 2011

Trt	Product *	Rate oz/Acre	Application criteria	Variety type	Stand 6/28/11	Stand 9/14/11	Root Rating	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	ActinoGrow	3	Infurrow	Susceptible	261	105	5.0	10.6	12.14	85.26	1957	58.58
2	ActinoGrow	3	Infurrow	Tolerant	243	212	2.7	19.7	12.49	84.87	3684	112.74
3	ActinoGrow	6	Infurrow	Susceptible	254	112	4.8	11.9	11.19	82.64	1859	38.21
4	ActinoGrow	6	Infurrow	Tolerant	240	225	2.5	19.5	12.52	85.23	3656	111.78
5	ActinoGrow	9	Infurrow	Susceptible	260	112	4.3	11.7	12.22	84.04	2242	71.64
6	ActinoGrow	9	Infurrow	Tolerant	231	197	3.0	15.5	12.30	84.94	2983	95.04
7	ActinoGrow	12	Infurrow	Susceptible	261	138	4.0	16.9	11.62	84.35	2948	79.10
8	ActinoGrow	12	Infurrow	Tolerant	255	240	2.4	20.8	12.40	84.83	3913	120.62
9	ActinoGrow	6	Infurrow	Susceptible	251	213	2.2	19.8	12.26	85.65	3753	116.90
	Quadris	14.3	5" band @ 4 lf SB									
10	ActinoGrow	6	Infurrow	Tolerant	230	198	1.9	18.7	13.08	86.26	3836	133.98
	Quadris	14.3	5" band @ 4 lf SB									
11	Quadris	14.3	5" band @ 4 lf SB	Susceptible	242	223	2.4	20.2	12.68	86.30	4020	135.06
12	Quadris	14.3	5" band @ 4 lf SB	Tolerant	233	230	1.8	21.4	13.14	86.61	4397	153.97
13	Untreated Check			Susceptible	233	87	3.9	10.1	11.77	83.90	1756	47.22
14	Untreated Check			Tolerant	243	203	3.0	18.0	12.62	85.65	3497	113.46
15	PROLINE + NIS	5.7 + ,125%	5" band @ 4 lf SB	Susceptible	253	125	4.0	12.2	12.04	84.61	2180	61.56
16	PROLINE + NIS	5.7 + ,125%	5" band @ 4 lf SB	Tolerant	250	220	2.4	21.0	12.76	85.94	4113	135.26
17	Headline	12	5" band @ 4 lf SB	Susceptible	270	170	3.8	15.1	12.26	84.82	2795	83.52
18	Headline	12	5" band @ 4 lf SB	Tolerant	256	230	2.3	18.8	13.38	87.02	3961	143.18
19	GEM 500 SC	7	5" band @ 4 lf SB	Susceptible	258	127	4.4	13.9	11.49	83.41	2333	58.23
20	GEM 500 SC	7	5" band @ 4 lf SB	Tolerant	233	230	2.4	20.7	12.62	85.49	4015	129.94
				C.V	14	29	30.4	14.52	6.47	2.32	19	31.04
				LSD(0.05)	13	19	0.3	0.89	0.29	0.71	220	11.25

* Proline + (NIS) + Supertin + Gem were applied sequentially in all treatment for cercospora leaf spot control

Table 3. Rhizoctonia Control as Influenced by Fungicide and Variety
Buffalo Lake, 2011

Trt	Product *	Rate oz/Acre	Application criteria	Variety type	Stand 7/13/11	Stand 9/14/11	Root Rating	Tons/Acre	% Sugar	Purity	Ext. Suc.Per Acre (Lbs.)	Revenue % of Mean
1	ActinoGrow	6	Infurrow	Susceptible	122	111	2.4	2.7	16.14	84.61	664	29.76
2	ActinoGrow	6	Infurrow	Tolerant	134	101	2.8	5.9	14.87	85.10	1335	55.69
3	ActinoGrow	9	Infurrow	Susceptible	108	79	2.4	3.2	15.56	88.26	806	37.32
4	ActinoGrow	9	Infurrow	Tolerant	173	109	2.2	5.9	15.13	89.83	1460	66.26
5	ActinoGrow	12	Infurrow	Susceptible	154	75	2.9	4.2	16.20	88.36	1108	53.16
6	ActinoGrow	12	Infurrow	Tolerant	125	82	2.7	6.0	15.34	86.16	1425	62.92
7	ActinoGrow	6	Infurrow	Susceptible	178	112	2.5	10.4	14.99	88.51	2524	112.41
	Quadris	14.3	5" band @ 4 lf SB									
8	ActinoGrow	6	Infurrow	Tolerant	132	99	2.1	12.4	15.89	87.03	3151	146.33
9	Quadris	14.3	5" band @ 4 lf SB	Susceptible	182	138	1.8	11.6	16.60	90.43	3225	161.33
10	Quadris	14.3	5" band @ 4 lf SB	Tolerant	180	129	1.8	13.4	16.40	89.37	3664	180.97
11	Untreated Check			Susceptible	136	74	3.2	2.5	15.24	88.04	626	28.38
12	Untreated Check			Tolerant	122	133	2.3	7.1	15.43	89.20	1804	84.23
13	PROLINE + NIS	5.7 + ,125%	5" band @ 4 lf SB	Susceptible	111	65	2.5	11.5	15.30	89.99	2930	136.82
14	PROLINE + NIS	5.7 + ,125%	5" band @ 4 lf SB	Tolerant	268	230	1.6	12.0	15.35	86.64	2926	131.20
15	Headline	12	Infurrow	Susceptible	127	79	2.8	9.7	15.42	90.35	2532	120.25
16	Headline	12	Infurrow	Tolerant	202	225	1.6	11.6	15.32	86.75	2821	126.00
17	Headline	12	5" band @ 4 lf SB	Susceptible	153	78	2.7	6.7	15.41	83.92	1517	63.56
18	Headline	12	5" band @ 4 lf SB	Tolerant	164	165	1.9	9.6	15.17	89.85	2402	110.81
19	Quadris	14.3	infurrow	Susceptible	192	159	1.9	13.7	16.68	90.07	3841	192.55
20	Quadris	14.3	Infurrow	Tolerant	167	124	2.4	16.7	16.50	92.92	4807	246.33
21	Proline	5.7	infurrow	Susceptible	207	153	3.2	12.0	16.39	89.40	3255	160.07
22	Proline	5.7	Infurrow	Tolerant	150	136	2.3	16.3	15.91	88.81	4268	203.27
				C.V	23	30	17.9	19	5.29	3.86	23	28.80
				LSD(0.05)	1	1	0.1	0.6	0.29	1.18	190	11.34

* Proline + (NIS) + Supertin + Gem were applied sequentially in all treatment for cercospora leaf spot control

SMBSC Evaluation of Fungicides (Seed Treatment) for control of Rhizoctonia Solani in Sugarbeet Growth 2010-2011

The following report is a summarization of testing fungicides for controlling Rhizoctonia Solani during the growing seasons of 2011.

Objectives

The objective of these trials was to evaluate seed treatment Penthiopyriad fungicide for control of Rhizoctonia Solani (Rhizoctonia root rot) with a susceptible and resistant variety.

Methods

Table 1 shows the specifics of activities conducted at the Rhizoctonia testing sites in 2010 and 2011. The test was conducted at four locations. There were two locations in 2010 at Redwood Falls and Gluek, MN and two locations in 2011 at Buffalo Lake and Clara City, Mn. Experiments were conducted in a split plot factorial design. The main plot was fungicide and the subplot was variety and was factored by time. The plots were 11 ft. (6 rows) wide and 20 ft. long. The plots were split by variety. Sugarbeets plots were inoculated with the Rhizoctonia Solani fungus at the 4 leaf sugarbeet stage in 2010 and prior to planting sugarbeets in 2011. The Rhizoctonia strain inoculated was the AG 2-2 IIIB. The inoculum was prepared on barley grain by personnel at the University of Minnesota Northwest Research and Outreach Center. The inoculum was applied via a Gandy band applicator in 2010 and broadcast applied in 2011. Sugarbeet stands were counted at 4 leaf sugarbeet stages and at harvest for the whole plot and factored to a 100 ft. relative stand. Sugarbeets were not thinned in order to let the treatment not be influenced by variability in the thinning process. The tests were replicated 4 times. Sugarbeets were harvested with a 2 row research harvester plow. The harvester plow lifted the sugarbeets out of the soil and the sugar beets are then placed in a row for each plot in preparation of visual evaluation. The evaluation scale is a 1-7 scale. This scale is an industry standard used for Rhizoctonia root rot evaluation. Evaluation was conducted of the roots from the middle two rows of the six row plot. Multiple evaluators were used to comprise the evaluations and a test of statistical homogeneity (combinability) was conducted and determined that the evaluators rating could be combined. The sugarbeets were collected and measured for yield and analyzed for quality at the SMBSC Tare Lab.

The treatment was different for the testing conducted in 2010 and 2011. Tables 2 and 3 show the treatment list. The primary differences between the two site years are depicted in the Penthiopyriad rates. In 2010 the Penthiopyriad rates ranged from 3.5-14 g. a.i./unit and in 2011 the Penthiopyriad rates ranged from 7-28 g. a.i./unit. The rate change was due to the observation in 2010 that the 3.5 g. a.i./unit was not adequate to protect the seed from disease infection and a higher rate than 14 g. a.i./unit was thought to be needed for protecting the seed. In 2010 and 2011 each Penthiopyriad rate did and did not have azoxystrobin (Quadris) applied at the 8 leaf sugarbeet stage to all rates of Penthiopyriad.

Results and Discussion

Redwood Falls site-2010
(Table 5)
The early planting inoculated plots gave the lowest stand count. Rhizoctonia ratings for all treatments were not different. Production was higher with the first (early) planting date and related to treatment to a greater degree than the second (late) planting. Seed treated with Penthiopyriad increased tons per acre and tended to increase sugar percent, purity, extractable sugar per acre and revenue percent of mean. The application of azoxystrobin whether In-furrow or at the 8 leaf sugarbeet stage, to sugarbeets from seed that was treated with Penthiopyriad tended to give higher production than when the seed was not treated with azoxystrobin. Tables 4A through 5F show the source of variance (SOV) showing significance of interactions. The source of variety designated as fung is the seed treatment. The variety, planting date

and planting date*variety interaction was highly significant for all stand counts dates. All SOV interactions were highly significant for tons per acre. Sugar percent was non-significant for all interactions. Planting date was the only interaction significant for extractable sucrose per acre and revenue percent of mean.

Gluek site-2010
(Table 6)
The susceptible variety tended to give the lowest stand count. Rhizoctonia ratings for all treatments were not different. Production tended to be higher with the first (early) planting date than the second (late) planting. Seed treated with Penthiopyriad and/or azoxystrobin increased tons per acre, but did not appear to influence sugar percent or purity. Extractable sugar per acre and revenue percent of mean was directly related to the influence on tons per acre by the treatment. The application of azoxystrobin In-furrow or at the 8 leaf sugarbeet stage tended to give higher sugarbeet production whether the seed was or was not treated with Penthiopyriad. Seed treated with Penthiopyriad gave more consistent production as the rate increased. Tables 6A-7F show the source of variance (SOV) displaying significance of interactions. The SOV designated as fung is the seed treatment. There was no consistent SOV showing significance for stand counts at any of the dates. All SOV interactions were highly significant for tons per acre except for planting date*variety. Sugar percent was non-significant for all interactions except planting date*variety. Variety, Planting date, fung, and planting date*fung were the interactions significant for extractable sucrose per acre and revenue percent of mean.

Buffalo Lake site-2011
(Table 8)
The susceptible variety gave a lower stand count than the resistant variety. Stand count difference between susceptible and resistant decreased or was unnoticeable with the addition of Penthiopyrad seed treatment at 7 and 14 g. ai/unit or quadric applied infurrow. Rhizoctonia rating and tons per acre were consistently influenced by treatment. The Buffalo Lake site in 2011 was a very wet site that was planted very late in the season which was reflective in the stunted froth of sugarbeets at the site. Quality data for the Buffalo site was not able to be collected due to the very low yields did not give enough sugarbeet brie to conduct analysis for sugar percent and purity. Most interaction in source of variance (SOV) tables 8A-8E were non-significant.

Clara City site-2011
(Table 9)

Stand count data at the first date of record shows 0 stand at the second planting date. These results are due to a late planting in 2011 and plants had not emerged for the late planting at the time of collection of the first stand counts. In general the stand counts were higher at the second stand count. The difference in stand count data is probably due to warmer temperature and dryer soil allowing for Rhizoctonia root rot ratings that were low and ranging from 1.7- 2.5. Even though, there were significant differences in the rhizoctonia root rot ratings. The rhizoctonia root rot ratings were significantly higher with azoxystrobin applied In-furrow or at the sugarbeet 8 leaf stage. The early and late planting was influenced similarily by the treatments. However, Penthiopyriad did not seem to reduce the rhizoctonia root rot ratings at the early planting but did at the late planting. There was one anomaly in stand count at the late planting date with 28 g. a.i./unit of Penthiopyriad with azoxystrobin applied at the 8 leaf sugarbeet stage where the sugarbeet stand was abnormally high and did not follow the expected trend in accordance with the rate sequence. This is considered to be variance within the norm of the data and should not be considered typical for this treatment. Early planting gave higher sugarbeet production than the late planting. Treatments did influence sugarbeet production. The difference in sugarbeet production was due to an increase in sugarbeet quality to a greater degree than the increase in tons per acre. Revenue percent of the mean was higher when azoxystrobin was included in the control measures whether applied in-furrow or foliar. Penthiopyriad influenced both the susceptible and tolerant variety, but had a more positive influence on the tolerant variety. Source of variance (SOV) showing significance of interactions are presented in tables 9A-10J. Results show that planting date and fung (treatment) were the two consistent interactions showing significance.

General Comments

1. The tolerant variety performed significantly better in the presence of Rhizoctonia Solani compared to the susceptible variety.

2. Fungicide applications were beneficial to both susceptible and tolerant varieties.

3. Individually the azoxystrobin enhanced sugarbeet production to a greater degree than Penthiopyriad seed treatment.

4. Penthiopyrad and azoxystrobin were needed to optimize sugarbeet production.

5. The combination of Penthiopyrad and azoxystrobin tended to stabilize the performance of the sugarbeet varieties whether the variety was susceptible or tolerant.

Table 1. Site Specifics for all locations, 2010-2011

Location	Planting Date	Soil Conditions
Redwood, 2010	5/10/2010	Moist
Gluek, 2010	5/16/2010	Moist
Buffalo Lake, 2011	6/8/2011	Lumpy/Dry
Clara City, 2011	5/17/2011	Tacky

Table 2. Seed Treatments Tested in the Presence of Rhizoctonia at Redwood Falls and Gluek, 2010

Trt No	Variety Type	Planting timing	R. Solani Inoculation	Penthiopyrad	Azoxystrobin- Furrow	Azoxystrobin 4-8 leaf band
1 A	Resistant	Early	-	No	No	No
1 B	Susceptible	Early	-	No	No	No
2A	Resistant	Early	+	No	No	No
2B	Susceptible	Early	+	No	No	No
3A	Resistant	Early	+	No	No	Yes
3B	Susceptible	Early	+	No	No	Yes
4A	Resistant	Early	+	No	Yes	No
4B	Susceptible	Early	+	No	Yes	No
5A	Resistant	Early	+	No	Yes	Yes
5B	Susceptible	Early	+	No	Yes	Yes
6A	Resistant	Early	+	3.5 g a.i./unit	No	No
6B	Susceptible	Early	+	3.5 g a.i./unit	No	No
7A	Resistant	Early	+	3.5 g a.i./unit	No	Yes
7B	Susceptible	Early	+	3.5 g a.i./unit	No	Yes
8A	Resistant	Early	+	7 g a.i./unit	No	No
8B	Susceptible	Early	+	7 g a.i./unit	No	No
9A	Resistant	Early	+	7 g a.i./unit	No	Yes
9B	Susceptible	Early	+	7 g a.i./unit	No	Yes
10A	Resistant	Early	+	14 g a.i./unit	No	No
10B	Susceptible	Early	+	14 g a.i./unit	No	No
11A	Resistant	Early	+	14 g a.i./unit	No	Yes
11B	Susceptible	Early	+	14 g a.i./unit	No	Yes
12A	Resistant	Late	-	No	No	No
12B	Susceptible	Late	-	No	No	No
13A	Resistant	Late	+	No	No	No
13B	Susceptible	Late	+	No	No	No
14A	Resistant	Late	+	No	No	Yes
14B	Susceptible	Late	+	No	No	Yes
15A	Resistant	Late	+	No	Yes	No
15B	Susceptible	Late	+	No	Yes	No
16A	Resistant	Late	+	No	Yes	Yes
16B	Susceptible	Late	+	No	Yes	Yes
17A	Resistant	Late	+	3.5 g a.i./unit	No	No
17B	Susceptible	Late	+	3.5 g a.i./unit	No	No
18A	Resistant	Late	+	3.5 g a.i./unit	No	Yes
18B	Susceptible	Late	+	3.5 g a.i./unit	No	Yes
19A	Resistant	Late	+	7 g a.i./unit	No	No
19B	Susceptible	Late	+	7 g a.i./unit	No	No
20A	Resistant	Late	+	7 g a.i./unit	No	Yes
20B	Susceptible	Late	+	7 g a.i./unit	No	Yes
21A	Resistant	Late	+	14 g a.i./unit	No	No
21B	Susceptible	Late	+	14 g a.i./unit	No	No
22A	Resistant	Late	+	14 g a.i./unit	No	Yes
22B	Susceptible	Late	+	14 g a.i./unit	No	Yes

All seed was treated with Metalaxyl and Tachigaran 45/unit

Variety 1. (R - Restistant)

Variety 2.(S - Susceptable)

Rhizoctonia Solani innoculation Key

- No Innoculation

+ Innoculation

Azoxystrobin = Quadris

Table 3. Seed Treatments in the Presence of Rhizoctonia at Buffalo Lake and Clara City,2011

Trt. No	Variety Type	Planting Timing	R.Solani Inoculation	Penthiopyrad	Azoxystrobin-infurrow	Azoxystrobin 4-8 leaf band
1 A	Resistant	Early	+	No	No	Yes
1 B	Susceptible	Early	+	No	No	Yes
2A	Resistant	Early	-	No	No	Yes
2B	Susceptible	Early	-	No	No	Yes
3A	Resistant	Early	+	7 g ai/unit	No	Yes
3B	Susceptible	Early	+	7 g ai/unit	No	Yes
4A	Resistant	Early	+	14 ai/unit	No	Yes
4B	Susceptible	Early	+	14 ai/unit	No	Yes
5A	Resistant	Early	+	28 ai/unit	No	Yes
5B	Susceptible	Early	+	28 ai/unit	No	Yes
6A	Resistant	Early	+	No	Yes	Yes
6B	Susceptible	Early	+	No	Yes	Yes
7A	Resistant	Early	+	No	No	No
7B	Susceptible	Early	+	No	No	No
8A	Resistant	Early	+	14 ai/unit	No	No
8B	Susceptible	Early	+	14 ai/unit	No	No
9A	Resistant	Early	+	28 ai/unit	No	No
9B	Susceptible	Early	+	28 ai/unit	No	No
10A	Resistant	Early	+	No	Yes	No
10B	Susceptible	Early	+	No	Yes	No
11A	Resistant	Early	+	7 g ai/unit	No	No
11B	Susceptible	Early	+	7 g ai/unit	No	No
12A	Resistant	Late	+	No	No	Yes
12B	Susceptible	Late	+	No	No	Yes
13A	Resistant	Late	-	No	No	Yes
13B	Susceptible	Late	-	No	No	Yes
14A	Resistant	Late	+	7 g ai/unit	No	Yes
14B	Susceptible	Late	+	7 g ai/unit	No	Yes
15A	Resistant	Late	+	14 ai/unit	No	Yes
15B	Susceptible	Late	+	14 ai/unit	No	Yes
16A	Resistant	Late	+	28 ai/unit	No	Yes
16B	Susceptible	Late	+	28 ai/unit	No	Yes
17A	Resistant	Late	+	No	Yes	Yes
17B	Susceptible	Late	+	No	Yes	Yes
18A	Resistant	Late	+	No	No	No
18B	Susceptible	Late	+	No	No	No
19A	Resistant	Late	+	14 ai/unit	No	No
19B	Susceptible	Late	+	14 ai/unit	No	No
20A	Resistant	Late	+	28 ai/unit	No	No
20B	Susceptible	Late	+	28 ai/unit	No	No
21A	Resistant	Late	+	No	Yes	No
21B	Susceptible	Late	+	No	Yes	No
22A	Resistant	Late	+	7 g ai/unit	No	No
22B	Susceptible	Late	+	7 g ai/unit	No	No

All seed was treated with Metalaxyl and Tachigaran 45/unit

Variety 1. (R - Restistant)

Variety 2.(S - Susceptable)

Rhizoctonia Solani innoculation Key

- No Innoculation

+ Innoculation

Azoxystrobin = Quadris

Table 4. Influence of Seed Treatment Options in the Presence of Rhizoctonia on Disease Control and Sugarbeet Production Redwood Falls, 2010

Trt. No	Variety Type	Stand Count 5/26/10	Stand Count 6/2/10	Stand Count 6/25/10	Stand Count 7/7/10	Rhizoc Ratings 9/13/10
1 A	Resistant	230	230	230	220	2.5
1 B	Susceptible	220	260	230	220	2.0
2A	Resistant	180	180	200	170	2.9
2B	Susceptible	190	200	190	180	2.1
3A	Resistant	220	230	220	200	2.1
3B	Susceptible	220	240	210	190	1.9
4A	Resistant	210	220	220	210	2.7
4B	Susceptible	240	260	240	220	2.0
5A	Resistant	210	220	210	200	2.2
5B	Susceptible	240	260	240	210	2.1
6A	Resistant	230	240	220	230	3.2
6B	Susceptible	260	270	250	230	1.9
7A	Resistant	220	220	220	210	2.3
7B	Susceptible	260	270	240	210	1.9
8A	Resistant	230	240	230	220	3.9
8B	Susceptible	280	280	240	240	2.5
9A	Resistant	220	240	240	220	2.8
9B	Susceptible	280	290	270	240	1.9
10A	Resistant	240	240	230	220	1.9
10B	Susceptible	220	240	220	210	2.7
11A	Resistant	250	260	240	220	1.8
11B	Susceptible	240	260	250	230	2.6
12A	Resistant	240	270	260	240	2.2
12B	Susceptible	240	300	280	270	2.4
13A	Resistant	220	250	230	210	2.1
13B	Susceptible	250	280	260	240	2.7
14A	Resistant	240	260	250	220	2.0
14B	Susceptible	240	290	260	250	2.3
15A	Resistant	250	290	270	230	2.0
15B	Susceptible	250	280	260	250	2.0
16A	Resistant	200	250	230	200	2.0
16B	Susceptible	250	270	260	240	2.2
17A	Resistant	210	280	260	240	2.0
17B	Susceptible	260	300	270	260	2.1
18A	Resistant	240	290	260	230	1.9
18B	Susceptible	270	300	280	270	2.4
19A	Resistant	230	270	260	220	2.0
19B	Susceptible	250	300	280	270	2.7
20A	Resistant	240	280	270	240	2.1
20B	Susceptible	240	290	300	280	2.4
21A	Resistant	240	270	250	230	2.1
21B	Susceptible	250	280	270	250	2.3
22A	Resistant	250	290	290	250	1.9
22B	Susceptible	260	290	300	280	2.2
	CV	**13**	**10**	**11**	**11**	**27.4**
	LSD(.05)	**60**	**70**	**70**	**70**	**NS**

Table 5. Influence of Seed Treatment Options in the Presence of Rhizoctonia for Sugarbeet Quality and Revenue as a % of Means in Sugarbeet Production Redwood Falls, 2010

Trt	Variety Type	Tons/Acre	% Sugar	Purity	Ext. Suc Acre (Lbs.)	Revenue % of Mean
1 A	Resistant	23.0	15.79	88.77	5946	107.43
1 B	Susceptible	24.9	15.40	88.82	6240	109.68
2A	Resistant	25.9	15.09	87.15	6238	105.38
2B	Susceptible	25.2	15.38	88.44	6291	110.17
3A	Resistant	24.0	16.13	88.63	6330	116.46
3B	Susceptible	28.2	16.00	89.79	7511	139.37
4A	Resistant	22.5	15.87	88.58	5828	105.74
4B	Susceptible	24.3	15.45	89.09	6173	109.85
5A	Resistant	25.5	16.00	89.06	6709	123.24
5B	Susceptible	26.4	15.65	89.79	6853	124.46
6A	Resistant	20.7	15.29	87.95	5127	89.15
6B	Susceptible	28.0	15.51	89.09	7138	127.38
7A	Resistant	23.6	16.08	88.88	6208	114.03
7B	Susceptible	26.6	15.86	89.97	7027	129.59
8A	Resistant	20.3	15.66	88.05	5146	91.53
8B	Susceptible	27.0	14.93	88.73	6605	113.29
9A	Resistant	22.7	16.04	89.22	6009	102.45
9B	Susceptible	26.9	15.73	89.42	6976	126.65
10A	Resistant	26.0	15.43	89.28	6615	117.75
10B	Susceptible	25.9	15.34	88.18	6440	112.30
11A	Resistant	27.8	14.98	88.19	6777	115.81
11B	Susceptible	26.2	15.68	88.55	6702	119.93
12A	Resistant	17.9	15.09	87.99	4342	73.94
12B	Susceptible	18.2	15.30	87.50	4467	76.67
13A	Resistant	18.8	14.99	88.14	4564	77.46
13B	Susceptible	17.3	15.12	87.70	4213	71.95
14A	Resistant	17.4	15.62	88.74	4453	79.68
14B	Susceptible	19.7	15.86	88.64	5106	92.74
15A	Resistant	18.0	15.65	89.31	4650	84.11
15B	Susceptible	18.5	15.95	88.52	4824	87.73
16A	Resistant	20.2	15.18	88.07	4946	84.96
16B	Susceptible	21.1	15.49	87.76	5256	91.82
17A	Resistant	19.5	15.24	88.04	4787	82.50
17B	Susceptible	19.3	15.45	87.67	4791	83.29
18A	Resistant	18.9	15.28	88.58	4693	81.91
18B	Susceptible	19.3	15.46	87.92	4808	83.92
19A	Resistant	18.8	15.33	88.47	4675	81.71
19B	Susceptible	19.8	15.64	88.09	5005	88.82
20A	Resistant	18.7	15.35	88.44	4662	81.49
20B	Susceptible	19.8	15.37	87.80	4906	85.38
21A	Resistant	20.2	15.19	88.19	4978	85.81
21B	Susceptible	21.8	15.67	87.67	5477	96.59
22A	Resistant	22.5	15.45	88.08	5633	98.79
22B	Susceptible	23.1	15.27	88.49	5729	99.65
	CV	**8.0**	**7.21**	**6.43**	**43**	**81.35**
	LSD(.05)	**0.4**	**0.31**	**1.38**	**606**	**20.78**

Table 4A: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Redwood Falls, 2010

Stand Count	Source of Variance	Pr > F
5/26/2010	variety	<.0001
	plantdate*variety	0.9303
	plantda*fung*variety	0.0312
	fung*variety	0.3096
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
5/26/2010	plantdate	0.0364
	fung	0.3563
	plantdate*fung	0.0389

Table 4B: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Redwood Falls, 2010

Stand Count	Source of Variance	Pr > F
6/2/2010	variety	<.0001
	plantdate*variety	0.0994
	plantda*fung*variety	0.6666
	fung*variety	0.2448
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
6/2/2010	plantdate	<.0001
	fung	0.7455
	plantdate*fung	0.0184

Table 4C: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Redwood Falls, 2010

Stand Count	Source of Variance	Pr > F
6/16/2010	variety	<.0001
	plantdate*variety	0.1786
	plantda*fung*variety	0.7208
	fung*variety	0.5875
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
6/16/2010	plantdate	<.0001
	fung	0.9901
	plantdate*fung	0.0091

Table 4D: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Redwood Falls, 2010

Stand Count	Source of Variance	Pr > F
6/25/2010	variety	<.0001
	plantdate*variety	<.0001
	plantda*fung*variety	0.9011
	fung*variety	0.9797
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
6/25/2010	plantdate	<.0001
	fung	0.9326
	plantdate*fung	0.0016

Table 5E: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Redwood Falls, 2010

Tons	Source of Variance	Pr > F
	variety	<.0001
	plantdate*variety	<.0001
	plantda*fung*variety	<.0001
	fung*variety	<.0001
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.0096
	plantdate*fung	<.0001

Table 5F: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Redwood Falls, 2010

Sugar	Source of Variance	Pr > F
	variety	0.0833
	plantdate*variety	0.7947
	plantda*fung*variety	0.707
	fung*variety	0.4026
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	0.9795
	fung	0.4299
	plantdate*fung	0.1863

Table 5G: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Redwood Falls, 2010

Ext. Suc Per Acre	Source of Variance	Pr > F
	variety	0.5749
	plantdate*variety	0.9245
	plantda*fung*variety	0.3733
	fung*variety	0.3783
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.247
	plantdate*fung	0.1742

Table 5H: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Redwood Falls, 2010

Revenue % of Means	Source of Variance	Pr > F
	variety	0.9191
	plantdate*variety	0.615
	plantda*fung*variety	0.4089
	fung*variety	0.42
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	0.0004
	fung	0.2853
	plantdate*fung	0.2809

Table 6. Influence of Seed Treatment Options in the Presence of Rhizoctonia on Disease Control and Sugarbeet Production Gluek, 2010

Trt. No	Variety Type	Stand Count 5/25/10	Stand Count 6/2/10	Stand Count 6/16/10	Stand Count 6/29/10	Rhizoc Ratings 9/14/10
1 A	Resistant	160	176	167	163	2.6
1 B	Susceptible	145	170	162	158	2.0
2A	Resistant	139	158	154	145	3.0
2B	Susceptible	172	183	162	157	3.1
3A	Resistant	149	168	174	173	3.2
3B	Susceptible	178	182	197	184	2.3
4A	Resistant	183	204	193	163	2.7
4B	Susceptible	157	193	173	152	2.0
5A	Resistant	164	176	181	172	2.1
5B	Susceptible	149	183	178	169	2.0
6A	Resistant	197	212	211	211	2.4
6B	Susceptible	183	209	203	200	2.1
7A	Resistant	154	198	180	178	2.0
7B	Susceptible	176	181	176	181	2.3
8A	Resistant	182	203	193	208	1.9
8B	Susceptible	173	178	200	184	2.0
9A	Resistant	149	171	153	163	1.9
9B	Susceptible	173	169	160	155	2.2
10A	Resistant	177	214	198	183	2.6
10B	Susceptible	173	225	198	180	2.6
11A	Resistant	172	192	188	174	2.0
11B	Susceptible	188	219	201	195	1.9
12A	Resistant	150	194	170	176	2.4
12B	Susceptible	157	190	170	179	2.3
13A	Resistant	151	214	194	198	2.2
13B	Susceptible	187	235	230	201	2.0
14A	Resistant	153	186	171	181	2.7
14B	Susceptible	154	201	177	174	2.2
15A	Resistant	138	178	172	171	2.5
15B	Susceptible	158	211	204	197	2.1
16A	Resistant	158	163	148	157	2.3
16B	Susceptible	177	171	151	166	2.0
17A	Resistant	171	228	200	220	2.3
17B	Susceptible	164	223	194	216	2.1
18A	Resistant	163	228	202	196	2.3
18B	Susceptible	185	238	233	213	2.1
19A	Resistant	133	185	179	177	2.4
19B	Susceptible	163	235	202	219	2.1
20A	Resistant	168	213	195	193	2.3
20B	Susceptible	163	254	233	231	2.0
21A	Resistant	127	194	176	194	2.0
21B	Susceptible	135	188	172	168	2.3
22A	Resistant	142	221	213	194	2.1
22B	Susceptible	172	264	233	219	1.9
	CV	18	16	15	17	14.6
	LSD(.05)	12	15	15	15	NS

Table 7. Influence of Seed Treatment Options in the Presence of Rhizoctonia for Sugarbeet Quality and Revenue as a % of Means in Sugarbeet Production Gluek, 2010

Trt.	Variety Type	Tons/Acre	% Sugar	Purity	Ext. Suc Acre (Lbs.)	Revenue % of Mean
1 A	Resistant	19.0	13.51	89.49	4187	85.46
1 B	Susceptible	21.9	13.48	89.19	4808	97.85
2A	Resistant	22.1	12.41	88.53	4407	77.75
2B	Susceptible	26.0	13.04	89.14	5504	106.38
3A	Resistant	21.0	13.63	90.44	4769	100.82
3B	Susceptible	27.7	13.20	89.61	5995	119.46
4A	Resistant	22.3	13.00	90.72	4807	95.31
4B	Susceptible	28.5	12.80	90.09	5997	115.10
5A	Resistant	28.0	13.40	89.89	6179	126.51
5B	Susceptible	28.7	13.50	89.49	6341	129.82
6A	Resistant	21.6	13.26	89.44	4713	95.06
6B	Susceptible	26.0	13.61	90.42	5869	123.58
7A	Resistant	23.5	13.17	89.64	5076	101.02
7B	Susceptible	27.5	13.48	89.84	6116	126.15
8A	Resistant	26.1	14.04	90.09	6030	130.53
8B	Susceptible	27.4	14.05	91.00	6469	143.05
9A	Resistant	27.0	12.45	87.94	5358	94.16
9B	Susceptible	28.4	12.51	88.18	5686	101.05
10A	Resistant	23.8	12.77	89.15	4925	92.30
10B	Susceptible	27.9	13.44	89.66	6148	125.21
11A	Resistant	27.1	13.61	90.02	6206	132.90
11B	Susceptible	30.0	13.58	88.39	6883	147.59
12A	Resistant	20.5	13.41	89.91	4525	92.60
12B	Susceptible	24.8	12.80	88.49	5123	95.44
13A	Resistant	20.7	13.56	91.05	4712	100.09
13B	Susceptible	25.3	13.23	89.03	5468	108.78
14A	Resistant	20.5	13.42	89.75	4539	92.93
14B	Susceptible	26.9	13.14	88.23	5670	109.04
15A	Resistant	19.9	12.39	88.26	3937	68.62
15B	Susceptible	22.6	12.32	87.62	4423	75.93
16A	Resistant	19.1	12.90	88.90	3983	75.41
16B	Susceptible	21.7	12.63	88.26	4366	78.30
17A	Resistant	22.4	13.36	88.72	4838	96.28
17B	Susceptible	23.3	13.57	89.24	5160	105.80
18A	Resistant	19.3	12.90	89.32	4087	78.87
18B	Susceptible	25.1	12.30	87.77	4908	84.03
19A	Resistant	20.9	13.83	89.60	4772	101.52
19B	Susceptible	24.5	13.49	89.38	5404	110.56
20A	Resistant	19.4	13.61	89.04	4296	88.20
20B	Susceptible	24.3	13.71	89.27	5449	113.82
21A	Resistant	23.3	13.50	87.97	5019	99.67
21B	Susceptible	25.2	13.14	88.17	5294	101.16
22A	Resistant	24.5	13.29	89.99	5392	109.63
22B	Susceptible	28.3	13.20	88.88	6056	118.97
	CV	**8.11**	**3.96**	**1.48**	**9**	**14.10**
	LSD(.05)	**0.49**	**0.29**	**0.44**	**178**	**7.02**

Table 6A: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Gluek, 2010

Stand Count	Source of Variance	Pr > F
5/25/2010	variety	0.0128
	plantdate*variety	0.1343
	plantda*fung*variety	0.232
	fung*variety	0.426
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
5/25/2010	plantdate	0.0944
	fung	0.5252
	plantdate*fung	0.8539

Table 6B: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Gluek, 2010

Stand Count	Source of Variance	Pr > F
6/2/2010	variety	0.0097
	plantdate*variety	0.0331
	plantda*fung*variety	0.4967
	fung*variety	0.3336
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
6/2/2010	plantdate	0.0094
	fung	0.2923
	plantdate*fung	0.1802

Table 6C: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Gluek, 2010

Stand Count	Source of Variance	Pr > F
6/16/2010	variety	0.0113
	plantdate*variety	0.038
	plantda*fung*variety	0.6208
	fung*variety	0.6889
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
6/16/2010	plantdate	0.1897
	fung	0.1255
	plantdate*fung	0.2822

Table 6D: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Gluek, 2010

Stand Count	Source of Variance	Pr > F
6/29/2010	variety	0.1811
	plantdate*variety	0.0847
	plantda*fung*variety	0.7152
	fung*variety	0.2977
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
6/29/2010	plantdate	0.0185
	fung	0.763
	plantdate*fung	0.2388

Table 7E: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Gluek, 2010

Tons	Source of Variance	Pr > F
	variety	<.0001
	plantdate*variety	0.6075
	plantda*fung*variety	0.0045
	fung*variety	0.0275
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	<.0001
	plantdate*fung	<.0001

Table 7F: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Gluek, 2010

Sugar	Source of Variance	Pr > F
	variety	0.4097
	plantdate*variety	0.0045
	plantda*fung*variety	0.545
	fung*variety	0.38
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	0.4963
	fung	0.1707
	plantdate*fung	0.1033

Table 7G: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Gluek, 2010

Ext. Suc Per Acre	Source of Variance	Pr > F
	variety	<.0001
	plantdate*variety	0.1267
	plantda*fung*variety	0.1351
	fung*variety	0.0577
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	<.0001
	plantdate*fung	<.0001

Table 7H: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Gluek, 2010

Revenue % of Means	Source of Variance	Pr > F
	variety	<.0001
	plantdate*variety	0.0091
	plantda*fung*variety	0.7291
	fung*variety	0.2726
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.0048
	plantdate*fung	0.0002

Table 8. Influence of Seed Treatment Options in the Presence of Rhizoctonia on Disease Control and Sugarbeet Production Buffalo Lake, 2011

Treatment	Seed Type	Planting Date	Stand Count 7/20/2011	Stand Count 8/2/2011	Stand Count 8/22/2011	Stand Count 9/14/2011	Rhizoctonia Rating Avg	Tons/Acre
1 A	Resistant	Early	217	177	180	158	2.3	6.1
1 B	Susceptible	Early	162	140	142	127	2.1	0.6
2A	Resistant	Early	215	220	190	193	2.1	5.6
2B	Susceptible	Early	170	168	143	160	2.0	3.8
3A	Resistant	Early	240	230	180	187	2.6	7.3
3B	Susceptible	Early	208	202	188	192	2.2	4.9
4A	Resistant	Early	252	245	240	177	2.8	5.5
4B	Susceptible	Early	252	265	245	232	2.0	5.0
5A	Resistant	Early	193	173	163	160	2.1	4.1
5B	Susceptible	Early	197	213	185	202	1.8	4.9
6A	Resistant	Early	205	220	220	207	1.7	5.1
6B	Susceptible	Early	183	185	175	177	1.8	3.5
7A	Resistant	Early	207	213	198	152	2.5	4.4
7B	Susceptible	Early	178	158	173	155	2.0	2.7
8A	Resistant	Early	257	247	210	183	2.7	6.0
8B	Susceptible	Early	245	258	213	222	1.9	3.4
9A	Resistant	Early	280	227	203	165	2.8	4.6
9B	Susceptible	Early	253	238	222	223	2.1	6.2
10A	Resistant	Early	260	248	248	230	2.2	6.1
10B	Susceptible	Early	250	192	238	172	2.1	3.0
11A	Resistant	Early	222	215	177	172	2.8	5.5
11B	Susceptible	Early	198	203	183	178	2.1	3.8
12A	Resistant	Late	267	258	253	250	1.5	4.5
12B	Susceptible	Late	210	195	205	190	1.8	1.1
13A	Resistant	Late	245	263	227	235	1.8	5.3
13B	Susceptible	Late	193	228	182	185	1.9	3.0
14A	Resistant	Late	265	242	220	243	1.6	5.7
14B	Susceptible	Late	242	198	230	198	1.9	2.0
15A	Resistant	Late	322	305	298	287	1.5	6.1
15B	Susceptible	Late	293	247	265	272	1.7	4.1
16A	Resistant	Late	325	325	300	300	1.7	6.5
16B	Susceptible	Late	305	262	270	257	1.7	4.2
17A	Resistant	Late	227	228	212	232	1.7	3.4
17B	Susceptible	Late	168	195	168	195	1.8	1.3
18A	Resistant	Late	262	237	192	213	2.1	4.4
18B	Susceptible	Late	230	242	207	213	1.7	1.4
19A	Resistant	Late	273	253	237	240	1.7	4.0
19B	Susceptible	Late	243	222	228	220	1.8	0.2
20A	Resistant	Late	285	282	268	278	1.6	5.2
20B	Susceptible	Late	252	220	238	237	1.7	3.1
21A	Resistant	Late	275	257	210	295	1.7	4.5
21B	Susceptible	Late	242	230	222	225	1.9	1.5
22A	Resistant	Late	285	260	237	280	1.6	5.1
22B	Susceptible	Late	253	273	212	263	1.8	3.3
		C.V	22	22	21	24	23.0	48.7
		LSD (0.05)	2	2	2	2	0.15	0.86

Table 8A: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Buffalo Lake, 2011

Stand Count	Source of Variance	Pr > F
7/20/2011	variety	<.0001
	plantdate*variety	NS
	plantda*fung*variety	0.9993
	fung*variety	NS
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
7/20/2011	plantdate	NS
	fung	0.0913
	plantdate*fung	NS

Table 8B: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Buffalo Lake, 2011

Stand Count	Source of Variance	Pr > F
8/2/2011	variety	<.0001
	plantdate*variety	NS
	plantda*fung*variety	0.4041
	fung*variety	NS
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
8/2/2011	plantdate	NS
	fung	0.2731
	plantdate*fung	NS

Table 8C: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Buffalo Lake, 2011

Stand Count	Source of Variance	Pr > F
8/22/2011	variety	0.0074
	plantdate*variety	NS
	plantda*fung*variety	0.0349
	fung*variety	NS
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
8/22/2011	plantdate	NS
	fung	0.6158
	plantdate*fung	NS

Table 8D: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Buffalo Lake, 2011

Stand Count	Source of Variance	Pr > F
9/14/2011	variety	0.0165
	plantdate*variety	NS
	plantda*fung*variety	0.3155
	fung*variety	NS
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
9/14/2011	plantdate	NS
	fung	0.243
	plantdate*fung	NS

Table 8E: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Buffalo Lake, 2011

Tons	Source of Variance	Pr > F
	variety	<.0001
	plantdate*variety	NS
	plantda*fung*variety	0.0876
	fung*variety	NS
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	NS
	fung	0.6537
	plantdate*fung	NS

Table 9. Influence of Seed Treatment Options in the Presence of Rhizoctonia on Disease Control and Sugarbeet Production Clara City, 2011

Treatment	Seed Type	Planting Date	Stand Count 6/8/2011	Stand Count 6/28/201	Stand Count 7/18/201	Stand Count 8/1/2011	Stand Count 8/22/201	Stand Count 9/6/2011	Rhizoctonia Rating
1 A	Resistant	Early	238	228	255	222	0	200	1.9
1 B	Susceptible	Early	223	233	267	230	0	218	1.9
2A	Resistant	Early	308	275	290	263	0	252	1.9
2B	Susceptible	Early	277	253	253	260	0	253	1.9
3A	Resistant	Early	248	253	247	238	7	197	1.8
3B	Susceptible	Early	208	238	237	227	22	227	1.8
4A	Resistant	Early	283	298	287	272	0	267	1.9
4B	Susceptible	Early	300	283	310	278	0	287	1.9
5A	Resistant	Early	300	293	310	297	0	272	1.7
5B	Susceptible	Early	278	273	308	275	0	268	1.7
6A	Resistant	Early	228	260	288	250	42	257	1.7
6B	Susceptible	Early	162	218	263	215	43	213	1.7
7A	Resistant	Early	277	270	268	275	0	237	2.1
7B	Susceptible	Early	238	250	248	230	0	225	2.1
8A	Resistant	Early	228	212	223	208	0	183	2.4
8B	Susceptible	Early	218	197	225	190	2	188	2.5
9A	Resistant	Early	238	235	250	215	12	177	2.5
9B	Susceptible	Early	238	242	248	220	3	228	2.5
10A	Resistant	Early	272	278	285	247	0	245	2.2
10B	Susceptible	Early	212	232	250	233	0	227	2.2
11A	Resistant	Early	280	275	285	240	0	222	2.5
11B	Susceptible	Early	250	238	270	218	0	232	2.5
12A	Resistant	Late	0	322	280	277	297	285	2.1
12B	Susceptible	Late	0	400	333	318	325	303	2.1
13A	Resistant	Late	0	365	320	282	308	293	2.2
13B	Susceptible	Late	0	328	305	268	317	278	2.0
14A	Resistant	Late	0	410	392	357	390	375	1.8
14B	Susceptible	Late	0	430	380	348	368	357	1.8
15A	Resistant	Late	0	433	378	327	370	375	1.8
15B	Susceptible	Late	0	402	373	338	385	357	1.8
16A	Resistant	Late	0	382	343	287	310	317	2.2
16B	Susceptible	Late	0	435	387	335	363	367	2.5
17A	Resistant	Late	0	310	290	285	305	298	1.9
17B	Susceptible	Late	0	385	330	310	312	315	1.9
18A	Resistant	Late	43	282	272	245	173	233	2.2
18B	Susceptible	Late	43	347	318	268	245	290	2.2
19A	Resistant	Late	0	428	395	343	353	353	1.9
19B	Susceptible	Late	0	407	365	347	323	363	1.9
20A	Resistant	Late	0	482	418	362	420	412	1.9
20B	Susceptible	Late	0	458	398	337	417	392	1.9
21A	Resistant	Late	0	382	328	318	328	332	1.7
21B	Susceptible	Late	0	260	267	268	238	267	1.7
22A	Resistant	Late	0	427	390	337	383	343	2.1
22B	Susceptible	Late	0	395	363	320	328	340	2.1
		C.V	15	14	15	31	17	15	5.9
		LSD (0.05)	2	2	2	2	2	2	0.1

Table 10. Influence of Seed Treatment Options in the Presence of Rhizoctonia for Sugarbeet Quality and Revenue as a % of Means in Sugarbeet Production, Clara City, 2011

Treatment	Seed Type	Planting Date	Tons/Acre	% Sugar	Purity	Ext. Suc.Per Acre	Revenue % of Mean
1 A	Resistant	Early	22.1	11.87	86.82	4057	106.59
1 B	Susceptible	Early	20.4	12.72	87.42	4085	122.66
2A	Resistant	Early	21.1	12.44	87.69	4092	117.67
2B	Susceptible	Early	23.6	13.09	87.96	4957	158.38
3A	Resistant	Early	17.0	12.34	87.01	3387	101.27
3B	Susceptible	Early	19.9	13.14	88.32	4210	135.73
4A	Resistant	Early	20.2	12.26	87.53	3913	112.29
4B	Susceptible	Early	22.5	13.09	87.61	4683	147.66
5A	Resistant	Early	22.5	12.62	87.88	4462	132.40
5B	Susceptible	Early	22.7	13.06	87.33	4676	145.58
6A	Resistant	Early	23.1	12.17	87.16	4412	123.36
6B	Susceptible	Early	21.2	12.70	87.15	4241	127.16
7A	Resistant	Early	22.0	12.53	87.64	4354	128.53
7B	Susceptible	Early	24.5	12.77	86.61	4894	146.51
8A	Resistant	Early	18.0	12.39	87.41	3520	102.16
8B	Susceptible	Early	19.7	12.79	86.86	4007	122.83
9A	Resistant	Early	15.8	11.89	86.58	3016	84.75
9B	Susceptible	Early	20.5	12.82	86.69	4221	131.21
10A	Resistant	Early	21.9	12.54	86.82	4274	123.90
10B	Susceptible	Early	23.8	12.82	87.33	4774	143.65
11A	Resistant	Early	20.0	11.64	85.81	3589	90.77
11B	Susceptible	Early	22.4	12.60	86.91	4438	131.26
12A	Resistant	Late	14.7	11.46	84.72	2526	58.61
12B	Susceptible	Late	13.4	11.94	85.80	2435	62.62
13A	Resistant	Late	15.6	11.72	85.75	2651	80.57
13B	Susceptible	Late	13.3	12.36	86.54	2521	73.52
14A	Resistant	Late	14.8	11.78	86.74	2699	69.99
14B	Susceptible	Late	15.9	12.51	86.98	3092	88.62
15A	Resistant	Late	15.7	11.77	85.84	2813	70.61
15B	Susceptible	Late	16.8	12.53	86.35	3241	92.30
16A	Resistant	Late	15.9	11.95	86.92	2959	79.17
16B	Susceptible	Late	16.0	12.32	86.11	3054	85.15
17A	Resistant	Late	15.0	11.74	85.92	2703	68.90
17B	Susceptible	Late	15.4	12.20	85.99	2913	80.19
18A	Resistant	Late	13.9	11.79	85.36	2516	64.68
18B	Susceptible	Late	13.3	12.53	85.86	2572	73.19
19A	Resistant	Late	15.0	11.99	86.12	2767	73.34
19B	Susceptible	Late	15.7	12.41	86.51	3003	84.33
20A	Resistant	Late	14.5	12.14	85.85	2658	69.82
20B	Susceptible	Late	16.6	12.68	86.83	3282	96.43
21A	Resistant	Late	15.1	11.79	86.18	2727	69.45
21B	Susceptible	Late	14.0	12.07	85.90	2633	71.65
22A	Resistant	Late	15.6	11.86	85.99	2838	72.94
22B	Susceptible	Late	13.6	12.35	86.46	2593	72.59
		C.V	16.9	4.00	1.25	18	22.37
		LSD (0.05)	0.9	0.19	0.39	202	8.23

Table 9A: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Stand Count	Source of Variance	Pr > F
6/8/2011	variety	0.0002
	plantdate*variety	0.0002
	plantda*fung*variety	0.3119
	fung*variety	0.3119
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
6/8/2011	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.4758
	plantdate*fung	0.4111

Table 9B: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Stand Count	Source of Variance	Pr > F
6/28/2011	variety	0.1243
	plantdate*variety	0.0328
	plantda*fung*variety	0.0006
	fung*variety	0.0055
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.0311
	plantdate*fung	0.0809

Table 9C: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Stand Count	Source of Variance	Pr > F
7/18/2011	variety	0.3536
	plantdate*variety	0.1672
	plantda*fung*variety	0.0096
	fung*variety	0.0623
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.079
	plantdate*fung	0.2082

Table 9D: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Stand Count	Source of Variance	Pr > F
8/22/2011	variety	0.942
	plantdate*variety	0.9068
	plantda*fung*variety	0.0169
	fung*variety	0.0116
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
8/22/2011	plantdate	<.0001
	fung	0.0157
	plantdate*fung	0.011

Table 9E: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Stand Count	Source of Variance	Pr > F
8/1/2011	variety	0.2533
	plantdate*variety	0.0417
	plantda*fung*variety	0.0838
	fung*variety	0.3413
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.0672
	plantdate*fung	0.6573

Table 9F: Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Stand Count	Source of Variance	Pr > F
9/6/2011	variety	0.471
	plantdate*variety	0.7533
	plantda*fung*variety	0.2343
	fung*variety	0.0306
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
9/6/2011	plantdate	<.0001
	fung	0.0099
	plantdate*fung	0.0847

Table 10G : Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Sugar	Source of Variance	Pr > F
	variety	<.0001
	plantdate*variety	0.4676
	plantda*fung*variety	0.7045
	fung*variety	0.9231
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.7336
	plantdate*fung	0.5494

Table 10H : Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Tons	Source of Variance	Pr > F
	variety	0.043
	plantdate*variety	0.0156
	plantda*fung*variety	0.2837
	fung*variety	0.6378
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.0368
	plantdate*fung	0.3298

Table 10 I : Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Ext. Suc per Acre	Source of Variance	Pr > F
	variety	0.0013
	plantdate*variety	0.0011
	plantda*fung*variety	<.0001
	fung*variety	0.0049
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.0778
	plantdate*fung	0.4346

Table 10 J : Source of Significant Variance of Interaction Considered at the 95% Level of Confidence. Clara City, 2011

Revenue of Means	Source of Variance	Pr > F
	variety	<.0001
	plantdate*variety	0.0021
	plantda*fung*variety	0.4492
	fung*variety	0.7268
Tests of Hypotheses Using the Type III MS for REP*plantdate*fung as an Error Term		
	Source of Variance	Pr > F
	plantdate	<.0001
	fung	0.5233
	plantdate*fung	0.4648

SMBSC Evaluation of Fungicides (New Products) for control of Rhizoctonia Solani in Sugarbeet Growth-2011

The following report is a summarization of testing fungicides applied as a seed treatment for controlling Rhizoctonia Solani during the growing seasons of 2011.

Objectives

The objective of these trials was to evaluate fungicides applied as a seed treatment for control of Rhizoctonia Solani (Rhizoctonia root rot) with a susceptible and resistant variety and supplemented with Quadris at a later plant stage.

Methods

Table 1 shows the specifics of activities conducted at the Rhizoctonia testing. The test is designated by two experiments (Clara City, MN), (Buffalo Lake, MN). Plots were 11 ft. (6 rows) wide and 20 ft. long. Sugarbeets plots were inoculated with the Rhizoctonia Solani fungus applied to the soil prior to planting. The Rhizoctonia strain inoculated was the AG 2-2 IIIB. The inoculum was prepared on barley grain by personnel at the North West Research and Outreach Center. Sugarbeet stands were counted at 4 leaf sugarbeet stages and at harvest for the whole plot and factored to a 100 ft. relative stand. Sugarbeets were not thinned in order to let the treatment not be influenced by variability in the thinning process. The tests were replicated 4 times. Sugarbeets were harvested with a 2 row research harvester plow. The harvester plow lifted the sugarbeets. The sugar beets are then placed in a row in each plot for evaluation. The evaluation scale is a 1-7 scale. This scale is an industry standard used for Rhizoctonia root rot evaluation. Evaluation was conducted of the roots from the middle two rows of the six row plot. Multiple evaluators were used to comprise the evaluations and a test of statistical homogeneity (combinability) was conducted and determined that the evaluators rating could not be combined. The sugarbeets were collected and measured for yield and analyzed for quality at the SMBSC Tare Lab.

Results and Discussion

The sugarbeet stand tended to not change over time at either location, thus the sugarbeet stand presented is the “harvest stand counts”. The data from the two test sites are presented separately in tables 2 (Clara City, MN site) and table 3 (Buffalo Lake, MN site). Even though the general results were similar it is not unusual for disease trials results to not test out for homogeneity due to magnitude or inherent variability with in the data. Thus, data will be discussed for each site separately and the data will also be discussed in general.

Clara City site

Rhizoctonia root rating indicated a low level of disease pressure. The data showed a statistically significant difference among treatments for Rhizoctonia root ratings. However the ratings range from 1.4 to 2.1 on a scale 1-7, which indicates low disease pressure regardless of treatment. Tons per acre, sugar percent and extractable sugar per acre were significantly influenced by treatments. Resistant varieties tended to enhance sugarbeet production more than susceptible varieties. Dynasty and Penthiopyriad enhanced sugarbeet production similarly. Metlock seed treatment influenced sugarbeet production to a greater degree than Dynasty or Penthiopyriad. The revenue (expressed as a percent of the mean) from the tolerant variety tended to be higher for like treatments compared to the susceptible variety. Revenue percent tended to be higher with Metlock treated seed. The treatments with the highest revenue percent were where a tolerant variety was applied with Metlock on the seed and Quadris applied in furrow.

Buffalo Lake site

Disease pressure was moderate as indicated by the Rhizoctonia ratings. The susceptible variety was influenced more by Rhizoctonia than the tolerant variety. Stand count when Dynasty was applied to the susceptible and tolerant variety either tended or was significantly lower than the susceptible and tolerant variety treated with Penthiopyriad or Metlock. Metlock treated seed tended to or did perform better than seed treated with Penthiopyrad for production variables presented. Metlock treated seed gave statistically significantly higher revenue percent of mean than all other treatments. Rhizoctonia tolerant variety seed treated with Metlock and foliar treated with Quadris gave 211.30% of the revenue mean.

General Comments

1. The tolerant variety performed better in the presence of Rhizoctonia Solani compared to the susceptible variety.

2. Fungicide applications were beneficial to both susceptible and tolerant varieties.

3. Seed treatments applied with Quadris as a foliar treatment were beneficial for Rhizoctonia control and sugarbeet performance.

4. Seed treated with Metlock either did or tended to give better Rhizoctonia control and sugarbeet production than seed treated with Dynasty or Penthiopyrad.

Table 1. Site Specific for Fungicide by Variety Clara City, 2011

Location	Planting Date	Soil Conditions
Clara City, 2011	5/17/2011	Tacky
Buffalo Lake, 2011	6/6/2011	Lumpy/Dry

Table 2. New Product Seed Treatment Testing
Clara City, 2011

TRT	PRODUCT	Resistant Variety	Susceptible Variety	Quadris	No Quadris	Stand Count 6/8/2011	Stand Count 6/28/2011	Stand Count 9/6/2011	Rhizoctonia Rating	Tons/Acre	% Sugar	Purity	Ext. Suc.Per Acre (Lbs.)	Revenue % of Mean
1	Standard	x			x	315	267	258	1.7	23.3	13.78	87.76	5127	101.91
2	Standard		x		x	283	258	230	1.9	22.3	13.21	88.10	4721	89.51
3	Standard	x		x		275	251	253	1.8	24.4	13.07	86.97	5017	91.68
4	Standard		x	x		228	223	215	2.1	19.6	12.81	87.52	3964	71.20
5	Metlock	x			x	325	324	320	1.5	29.8	13.72	87.88	6539	129.51
6	Metlock		x		x	323	328	305	1.5	30.1	12.60	87.27	5973	104.16
7	Metlock	x		x		342	331	368	1.4	30.5	13.82	88.05	6755	135.30
8	Metlock		x	x		341	335	320	1.4	31.0	12.91	87.73	6361	116.09
9	Dynasty	x			x	308	293	287	1.6	24.8	13.61	87.88	5386	105.63
10	Dynasty		x		x	278	298	262	1.7	23.1	13.22	87.86	4866	91.99
11	Dynasty	x		x		340	308	303	1.5	26.8	13.47	87.24	5702	109.01
12	Dynasty		x	x		303	283	295	1.6	28.8	12.76	87.29	5782	102.71
13	Penth	x			x	262	232	252	1.9	22.5	13.43	87.68	4802	92.30
14	Penth		x		x	234	235	185	2.2	16.7	13.12	87.60	3483	64.79
15	Penth	x		x		325	269	288	1.6	25.9	13.56	87.66	5592	108.67
16	Penth		x	x		281	282	268	1.7	25.5	13.05	87.82	5291	98.14
					C.V	17	14	17	21.0	15.3	3.34	1.08	16	18.26
					LSD (0.05	NS	47	55	0.4	4.5	0.51	NS	982	NS

Table 3. New Product Seed Treatment Testing
Buffalo Lake, 2011

TRT	PRODUCT	Resistant Variety	Susceptible Variety	Quadris	No Quadris	Stand Count 7/13/2011	Stand Count 9/14/2011	Rhizoctonia Rating	Tons/Acre	% Sugar	Purity	Ext. Suc.Per Acre (Lbs.)	Revenue % of Mean
1	Standard	x			x	76	69	3.2	3.7	13.60	85.85	759	50.04
2	Standard		x		x	82	73	3.6	2.8	14.43	86.00	630	46.75
3	Standard	x		x		110	119	4.6	4.8	16.00	89.94	1224	102.18
4	Standard		x	x		56	46	4.8	3.7	14.91	85.56	845	51.19
5	Metlock	x			x	104	89	2.7	8.1	15.48	84.84	1906	146.72
6	Metlock		x		x	116	87	2.7	7.3	15.25	88.33	1664	124.06
7	Metlock	x		x		146	125	3.2	11.8	15.15	85.73	2757	211.30
8	Metlock		x	x		112	118	4.1	9.3	15.29	84.14	2120	158.99
9	Dynasty	x			x	75	59	3.5	3.0	14.73	85.47	688	52.00
10	Dynasty		x		x	104	66	4.2	2.1	14.97	81.53	462	32.39
11	Dynasty	x		x		93	86	2.7	5.7	14.49	83.75	1210	84.26
12	Dynasty		x	x		65	90	3.2	3.7	15.51	85.82	929	75.25
13	Penth	x			x	70	58	3.6	7.0	14.95	87.43	1564	113.80
14	Penth		x		x	68	68	3.8	5.7	15.02	86.78	1175	78.24
15	Penth	x		x		55	43	4.2	7.8	14.17	86.49	1637	131.60
16	Penth		x	x		63	48	3.8	6.8	13.98	82.75	1348	85.73
					C.V	38	36	21.9	19.4	6.91	3.73	17	24.39
					LSD (0.05)	38	33	0.9	1.3	1.18	3.68	260	27.08

Fig. 1

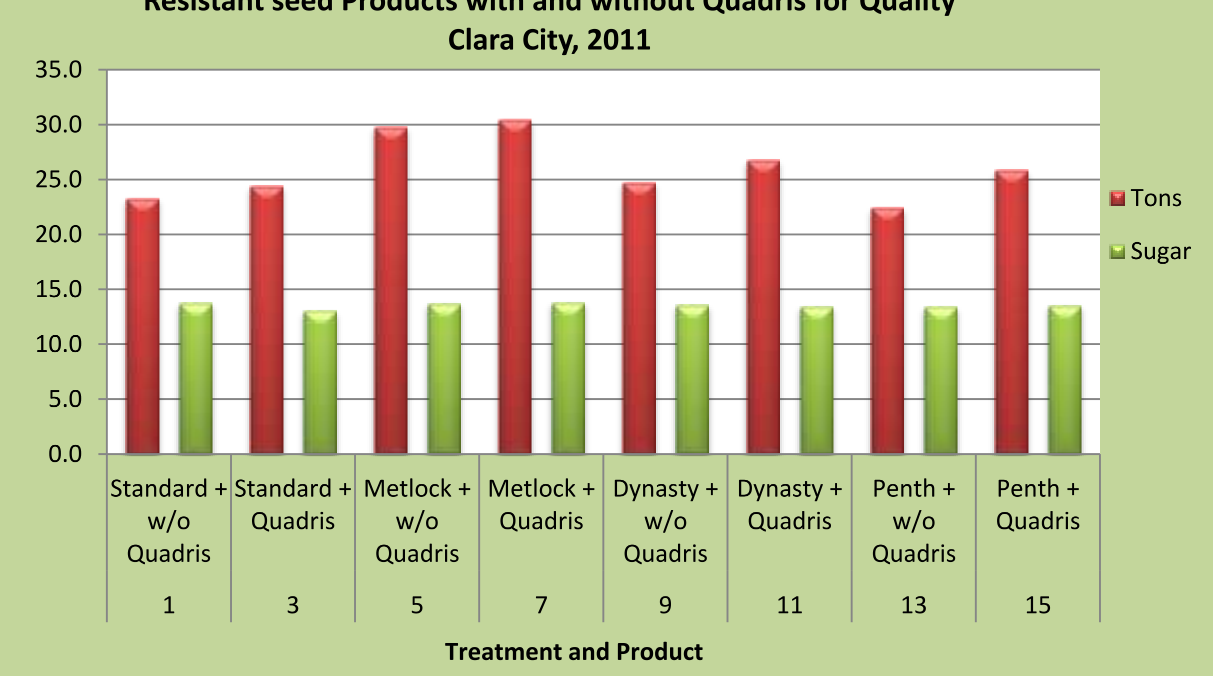
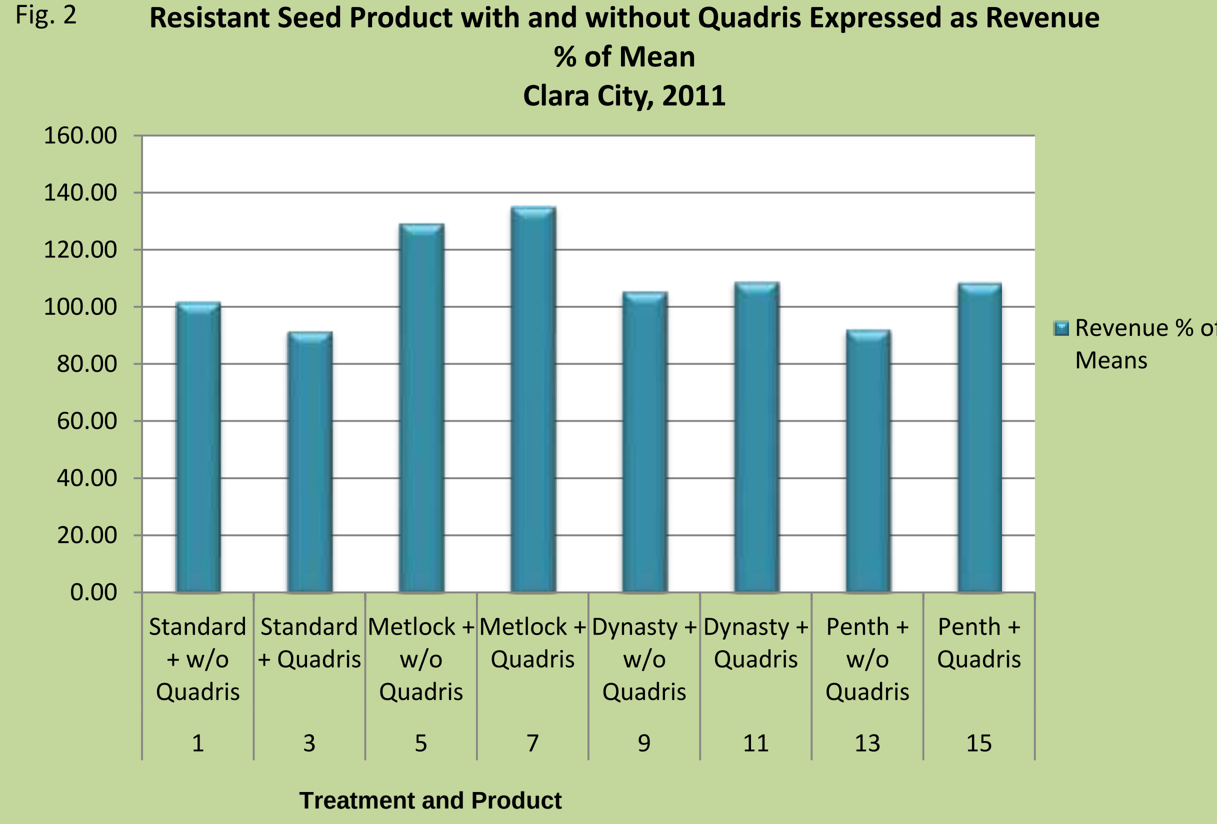

Resistant seed Products with and without Quadris for Quality
Clara City, 2011
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Tons
Sugar
Standard + w/o Quadris
1
Standard + Quadris
3
Metlock + w/o Quadris
5
Metlock + Quadris
7
Dynasty + w/o Quadris
9
Dynasty + Quadris
11
Penth + w/o Quadris
13
Penth + Quadris
15
Treatment and Product

Fig. 2


Resistant Seed Product with and without Quadris Expressed as Revenue % of Mean
Clara City, 2011
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
Standard + w/o Quadris
1
Standard + Quadris
3
Metlock + w/o Quadris
5
Metlock + Quadris
7
Dynasty + w/o Quadris
9
Dynasty + Quadris
11
Penth + w/o Quadris
13
Penth + Quadris
15
Treatment and Product

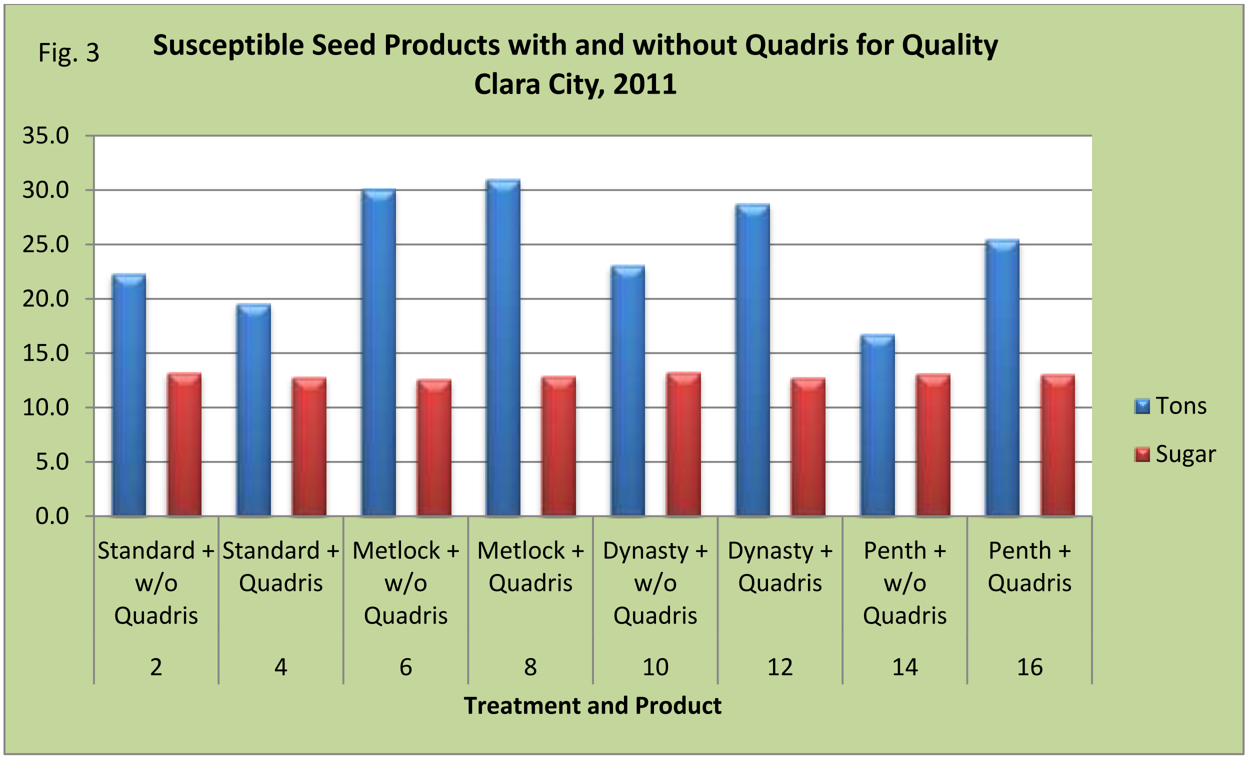


Fig. 3
Susceptible Seed Products with and without Quadris for Quality
Clara City, 2011
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Standard + w/o Quadris
Standard + Quadris
Metlock + w/o Quadris
Metlock + Quadris
Dynasty + w/o Quadris
Dynasty + Quadris
Penth + w/o Quadris
Penth + Quadris
2
4
6
8
10
12
14
16
Treatment and Product
Tons
Sugar

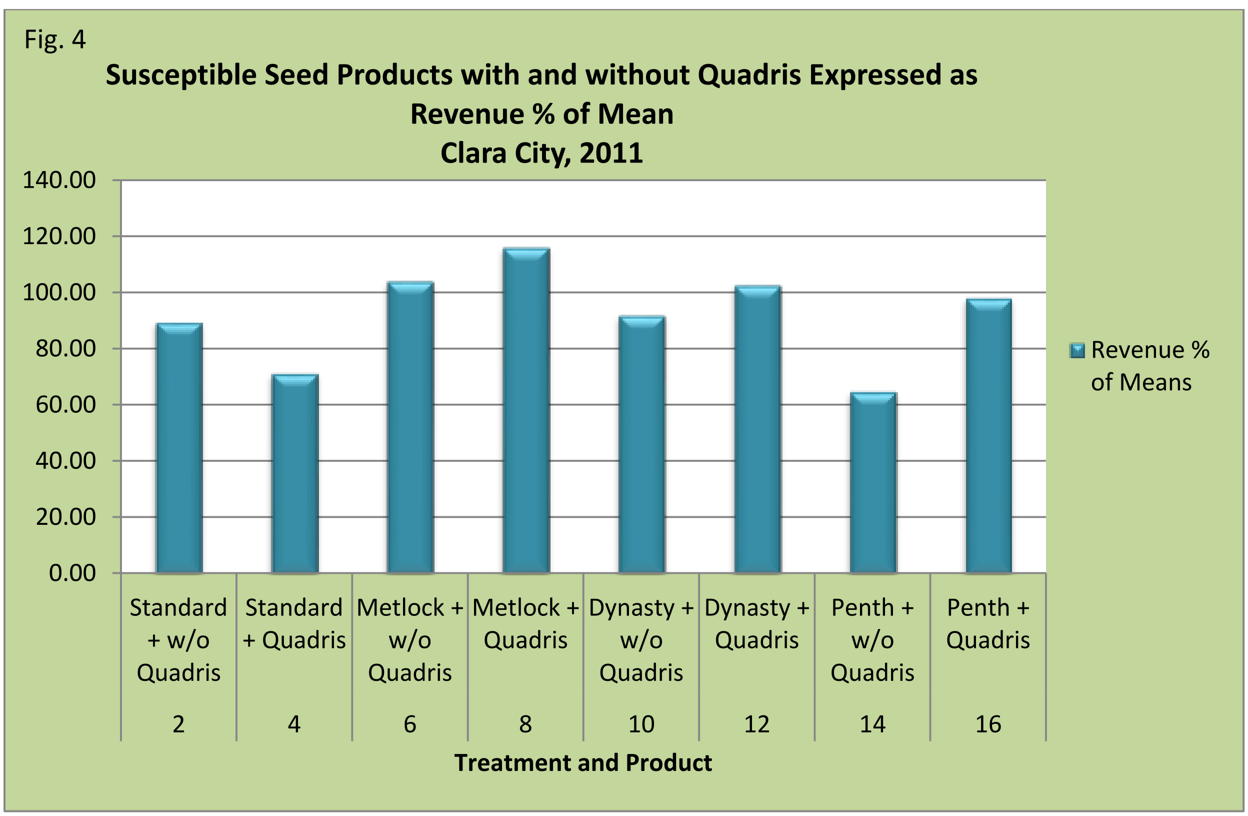


Fig. 4
Susceptible Seed Products with and without Quadris Expressed as Revenue % of Mean
Clara City, 2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Standard + w/o Quadris
Standard + Quadris
Metlock + w/o Quadris
Metlock + Quadris
Dynasty + w/o Quadris
Dynasty + Quadris
Penth + w/o Quadris
Penth + Quadris
2
4
6
8
10
12
14
16
Treatment and Product
Revenue % of Means

Fig. 5

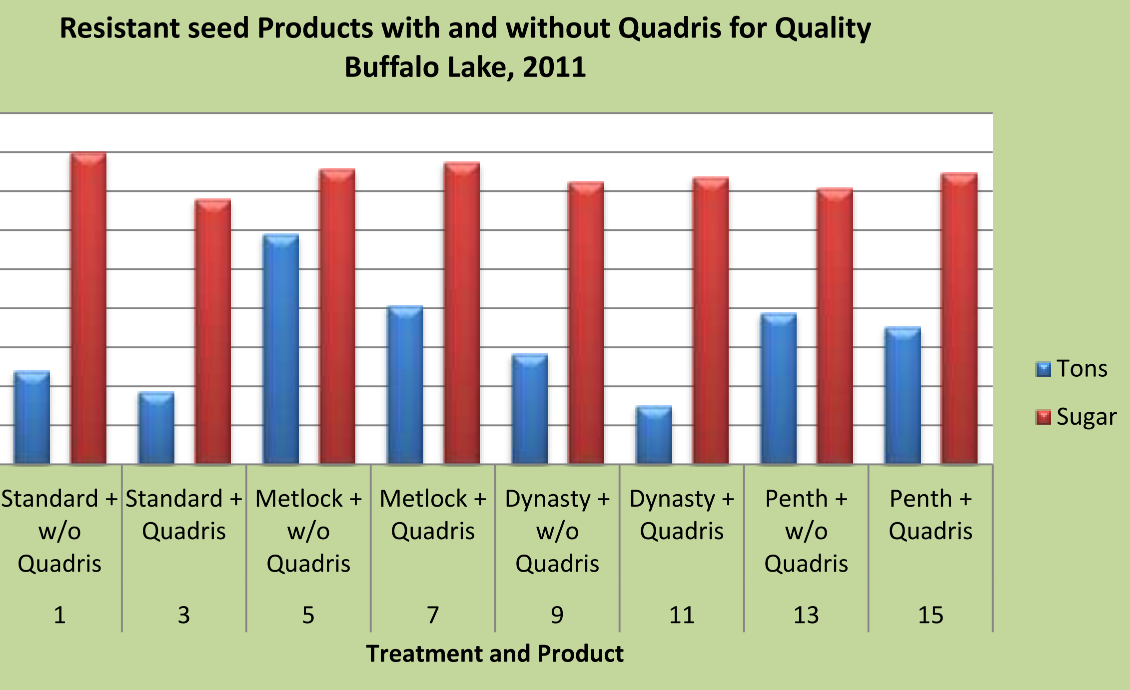
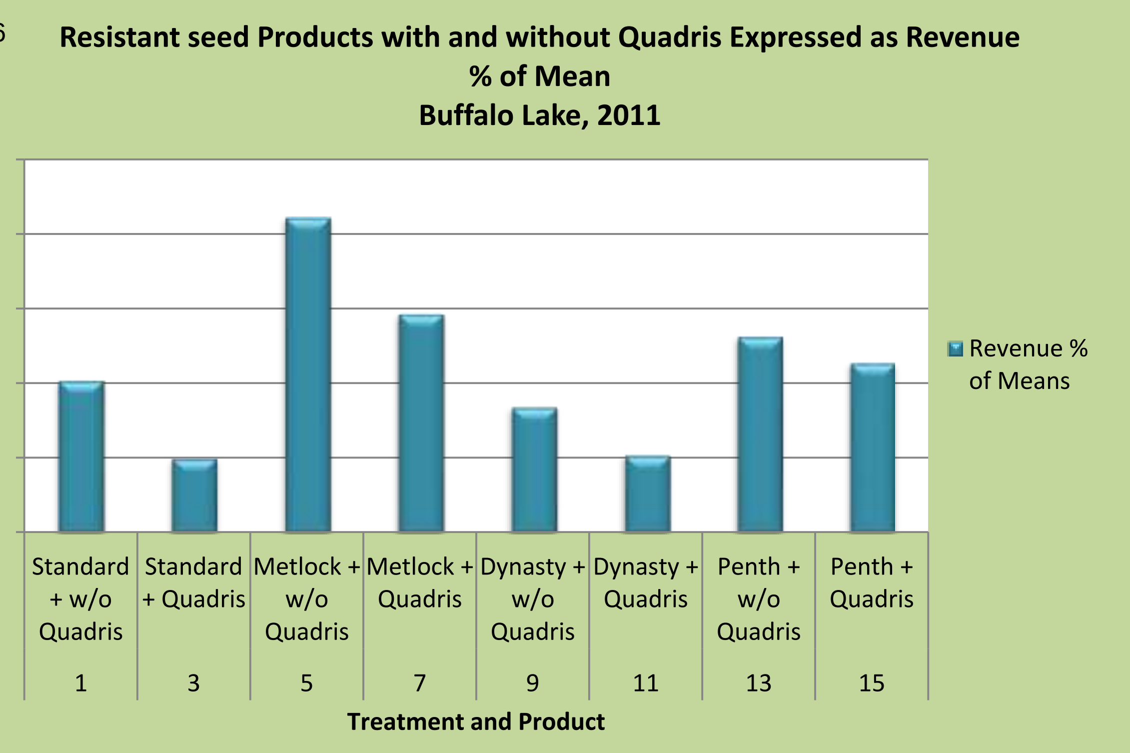

Resistant seed Products with and without Quadris for Quality
Buffalo Lake, 2011
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Standard + w/o Quadris
1
Standard + Quadris
3
Metlock + w/o Quadris
5
Metlock + Quadris
7
Dynasty + w/o Quadris
9
Dynasty + Quadris
11
Penth + w/o Quadris
13
Penth + Quadris
15
Treatment and Product
Tons
Sugar

Fig. 6


Resistant seed Products with and without Quadris Expressed as Revenue % of Mean
Buffalo Lake, 2011
250.00
200.00
150.00
100.00
50.00
0.00
Standard + w/o Quadris
1
Standard + Quadris
3
Metlock + w/o Quadris
5
Metlock + Quadris
7
Dynasty + w/o Quadris
9
Dynasty + Quadris
11
Penth + w/o Quadris
13
Penth + Quadris
15
Treatment and Product
Revenue % of Means

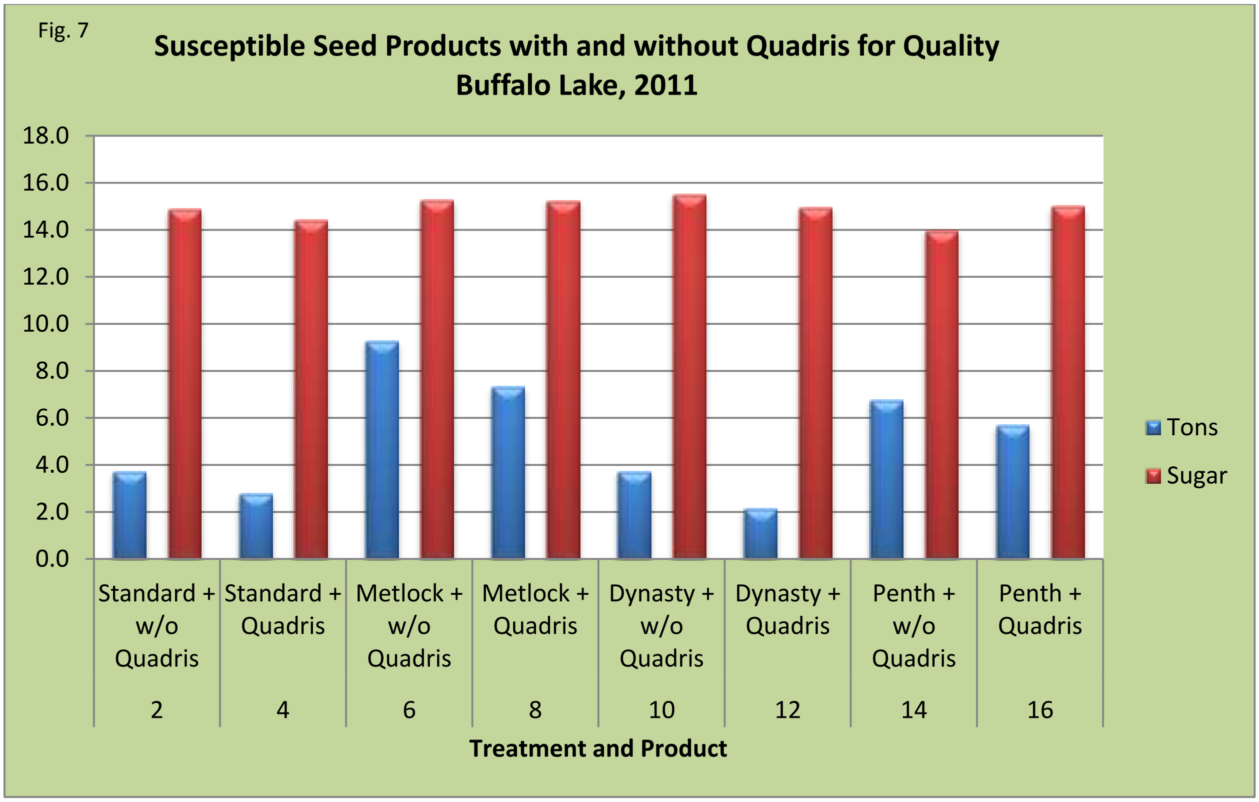


Fig. 7
Susceptible Seed Products with and without Quadris for Quality
Buffalo Lake, 2011
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Standard + w/o Quadris
Standard + Quadris
Metlock + w/o Quadris
Metlock + Quadris
Dynasty + w/o Quadris
Dynasty + Quadris
Penth + w/o Quadris
Penth + Quadris
2
4
6
8
10
12
14
16
Treatment and Product
Tons
Sugar

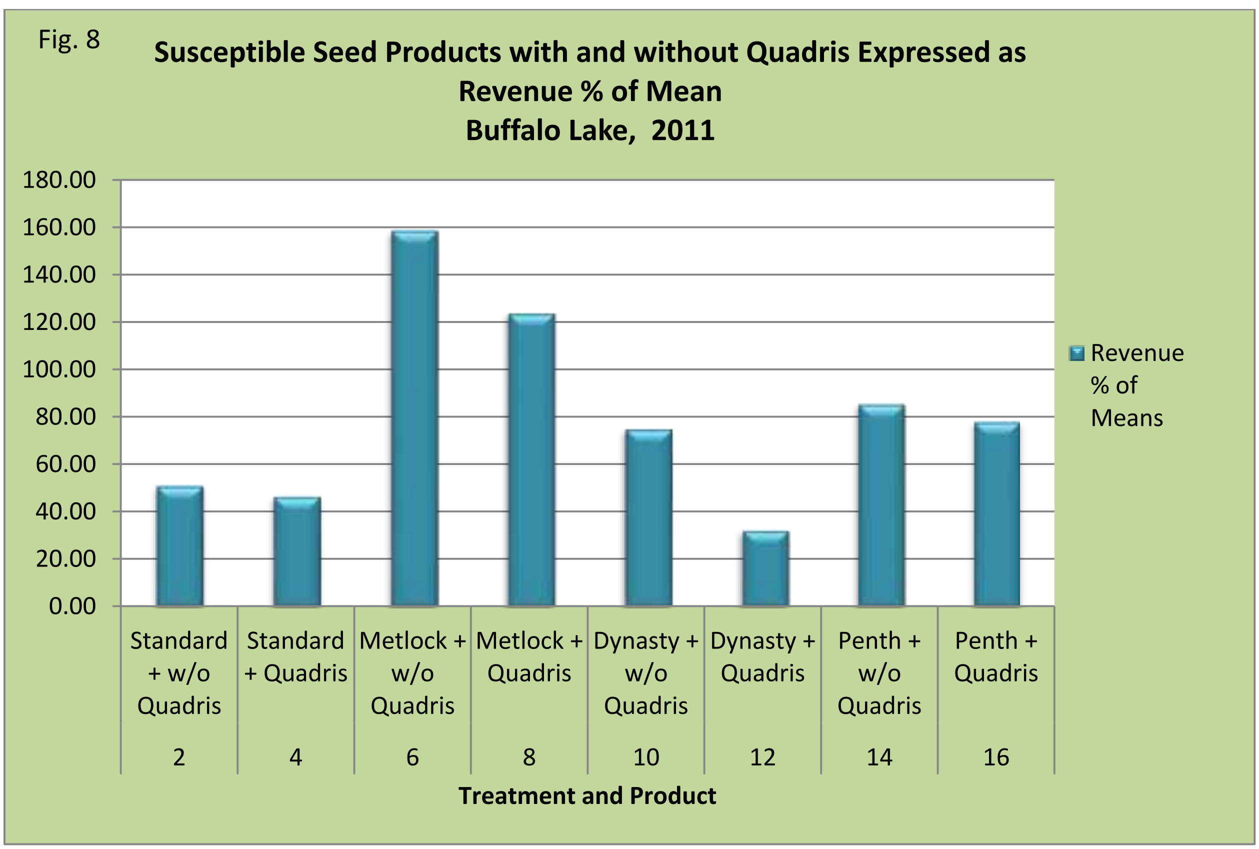


Fig. 8
Susceptible Seed Products with and without Quadris Expressed as
Revenue % of Mean
Buffalo Lake, 2011
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Standard + w/o Quadris
Standard + Quadris
Metlock + w/o Quadris
Metlock + Quadris
Dynasty + w/o Quadris
Dynasty + Quadris
Penth + w/o Quadris
Penth + Quadris
2
4
6
8
10
12
14
16
Treatment and Product
Revenue % of Means

EFFECT OF BAND AND BROADCAST APPLICATIONS OF FUNGICIDE AT CONTROLLING RHIZOCTONIA ROOT ROT IN SUGARBEET

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Rhizoctonia root and crown rot, caused by *Rhizoctonia solani* Kühn, is currently the most devastating soilborne disease of sugarbeet (*Beta vulgaris* L.) in the North Dakota and Minnesota. In the bi-state area, *R. solani* anastomosis group(AG) 1, AG-2-2, AG-4, and AG-5 cause damping off and AG-2-2 causes root and crown rot of sugarbeet (Windels and Nabben 1989). *R. solani* survives as thickened hyphae and sclerotia in organic material and is endemic in soils where sugarbeet is grown. *R. solani* has a wide host range including broad leaf crops and weeds (Anderson 1982; Nelson et al. 1996). Severe disease occurs if sugarbeet follows beans or potato (Baba and Abe 1966; Johnson et al. 2002). Crop rotations of 3 or more years with small grains planted before sugarbeet is recommended to reduce disease incidence (Windels and Lamey 1998). In fields with a history of high disease severity, growers may plant varieties that are more resistant but with significantly lower yield potential compared to more susceptible varieties (Panella and Ruppel 1996). Research showed that timely application of azoxystrobin provided effective disease control but not when applied after infection, or after symptoms were observed (Brantner and Windels, 2002; Jacobsen et al. 2002).

The objective of this research was to evaluate broadcast vs. one-nozzle vs. two-nozzle band applications of fungicide for controlling Rhizoctonia root rot in sugarbeet.

MATERIALS AND METHODS

A field trial was conducted in Glyndon, MN in 2011. The site was inoculated on 18 May with *R. solani* AG 2-2 IIIB grown on barley. Inoculum was broadcast using a three-point mounted rotary/spinner type spreader calibrated to deliver 15 lbs/A of inoculum. The inoculum was incorporated with a Konskilde field cultivator to about the two-inch depth just before planting. The experimental design was a randomized complete block with four replicates. Field plots comprised of six 25-foot long rows spaced 22 inches apart. Plots were planted to stand on 18 May with a commercially available, glyphosate tolerant variety (Proprietary material, Crystal Beet Seeds) which was resistant to Rhizomania and very susceptible to *Rhizoctonia solani*. Seeds were treated with Tachigaren at 45 g/kg seed to provide early season protection against *Aphanomyces cochlioides,* and Poncho-Beta to provide protection against insect pests. Counter 15G was also applied at 11.9 lb/A at planting to control insect pests. Weeds were controlled with glyphosate on 20 June, 6 July, and 11 August.

Specific treatments are listed in Table 1. Fungicides used were Quadris at 4.6, 9.2, or 15.4 fl oz/A, Proline at 4.3 or 5.7 fl oz/A + NIS at 0.25% v/v, and Headline at 12 fl oz/A. Treatments were applied on 9 June and 20 June. Band applications were made using either one TeeJet 4002 E flat fan nozzle or two TeeJet 4001 E flat fan nozzles per row. When one nozzle per row was used for band applications, then nozzle was centered over the row and operated at 9.5 inches above ground surface for 7 inch bands and 5.5 inches above ground for a 4 inch band. When two nozzles were used for a band application, the nozzles were attached to drop tubes on both sides of a row and orientated in towards the sugarbeet row. Broadcast applications were made using TeeJet 8002 XR flat fan nozzles spaced 20” on center. All treatments were made using a bicycle type sprayer operated at 3 mph and 40 psi.

Stand counts were taken during the season and at harvest. The middle two-rows of plots were harvested on 28 September and weights were recorded. Samples (12-15 roots) from each plot, not including roots on the ends of plots, were analyzed for quality at American Crystal Sugar Company tare laboratory at East Grand Forks, MN. The data analysis was performed with the ANOVA procedure of the Agriculture Research Manager, version 8 software package (Gylling Data Management Inc., Brookings, South Dakota, 2010). The least significant difference (LSD) test was used to compare treatments when the F-test for treatments was significant.

RESULTS AND DISCUSSIONS

Warm and wet soils resulted in favorable conditions for infection by *R. solani* early in the season. Applications scheduled for 4-leaf and 8-leaf sugarbeet had to be applied earlier (cotyledon to 2 leaf – 9 June, and 4 to 6 leaf – 20 June) because soil temperature at the four inch soil depth climbed to over 70°F in early June. There was some seedling damping-off in early June. Wilting, yellowing of leaves of older plants and plant death started in mid-June and continued throughout the season.

One application of Proline + NIS or Headline made on 9 June resulted in sugarbeet stand and extractable sucrose similar to the inoculated check, regardless of rate or application method.

One band application of Quadris on 9 June gave greater sugarbeet stand compared to the inoculated check at harvest regardless of rate or band width. One broadcast application of Quadris at 15.4 fl oz/A on 9 June gave greater sugarbeet stand compared to the inoculated check at harvest but Quadris at 9.2 fl oz/A did not. One application of Quadris, regardless of rate or application method, did not significantly improve extractable sucrose per acre compared to the inoculated check.

Band and broadcast applications of Quadris at 9.2 fl oz/A made on both 9 June and 20 June resulted in greater sugarbeet stand at harvest and extractable sucrose per acre compared to the inoculated check. Two band applications of Quadris, both with one and two nozzles, tended to give greater extractable sucrose compared to two broadcast applications of Quadris. Two single-nozzle band applications of Quadris at 9.2 fl oz/A always gave greater extractable sucrose compared to one application of Quadris, regardless of application method or rate.

Band applications tended to give better control of Rhizoctonia than broadcast applications but no significant differences occurred. Using two nozzles for band application gave similar Rhizoctonia control to using one nozzle.

It may become necessary to use two applications of Quadris for effective Rhizoctonia root rot control. Further research should include rotation of different chemistries of fungicides for controlling Rhizoctonia root rot, as well as root sampling and testing for pathogen sensitivity to a fungicide when that same fungicide is used multiple times in a growing season.

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Table 1. Effect of band and broadcast applications of fungicide on Rhizoctonia root rot at Glyndon, MN in 2011.

Product and Rate in fl oz/A	Application Date(s)	Band Width	14 June Stand Count	10 Aug Stand Count	28 September Stand Count	28 September Yield	28 September Sucrose	28 September Recoverable sucrose
			beets/100’	beets/100’	beets/100’	Ton/A	%	lb/A
One Nozzle Band								
Quadris 9.2	9 & 20 June	7” band	192	178	159	26.2	15.9	7451
Quadris 15.4	9 June	7” band	175	141	117	19.9	15.0	5169
Quadris 9.2	9 June	7” band	165	117	91	19.0	15.0	4852
Quadris 4.6	9 June	4” band	172	114	91	17.9	14.5	4555
Proline 4.3 + NIS 0.25% v/v	9 June	4” band	167	80	73	16.1	13.7	3712
Proline 5.7 + NIS 0.25% v/v	9 June	7” band	162	90	70	14.0	14.0	3352
Headline 12	9 June	7” band	149	69	66	10.5	14.5	3255
Two Nozzle Band								
Quadris 9.2	9 & 20 June	7” band	173	166	147	24.3	15.9	6869
Quadris 15.4	9 June	7” band	169	131	113	20.5	14.9	5445
Quadris 9.2	9 June	7” band	177	142	113	18.1	15.1	4803
Quadris 4.6	9 June	7” band	182	122	94	18.5	15.3	4884
Broadcast								
Quadris 9.2	9 & 20 June	-	174	158	132	23.0	15.3	6165
Quadris 15.4	9 June	-	167	128	105	18.8	13.5	4340
Quadris 9.2	9 June	-	179	121	83	16.4	14.7	4795
Headline 12	9 June	-	173	71	53	13.2	14.6	3306
Proline 5.7 + NIS 0.25% v/v	9 June	-	164	64	50	9.6	13.7	2611
Inoculated Check			168	68	42	9.4	15.6	3881
LSD (P=0.05)			**NS**	**38**	**45**	**6.1**	**1.4**	**1512**

EFFICACY OF FUNGICIDES FOR CONTROLLING CERCOSPORA LEAF SPOT ON SUGARBEET

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Cercospora leaf spot (CLS), caused by the fungus *Cercospora beticola* Sacc., is the most economically damaging foliar disease of sugarbeet in Minnesota and North Dakota. The disease reduces root yield and sucrose concentration, and increases impurity concentrations resulting in reduced extractable sucrose and higher processing losses (Smith and Ruppel, 1973; Shane and Teng, 1992; Lamey et al., 1996; Khan and Smith, 2005). Roots of diseased plants do not store well in storage piles that are processed in a 7 to 9 month period in North Dakota and Minnesota (Smith and Ruppel, 1973). Cercospora leaf spot is managed by integrating the use of tolerant varieties, reducing inoculum by crop rotation and tillage, and fungicide applications (Miller et al., 1994; Khan et al; 2007). It is difficult to combine high levels of Cercospora leaf spot resistance with high recoverable sucrose in sugarbeet (Smith and Campbell, 1996). Consequently, commercial varieties generally have only moderate levels of resistance and require fungicide applications to obtain acceptable levels of protection against Cercospora leaf spot (Miller et al., 1994) under moderate and high disease severity.

The objective of this research was to evaluate the efficacy of fungicides used in rotation to control Cercospora leaf spot on sugarbeet.

MATERIALS AND METHODS

A field trial was conducted at Foxhome, MN in 2011. The experimental design was a randomized complete block with four replicates. Field plots comprised of six 30-feet long rows spaced 22 inches apart. Plots were planted on 10 May with BTS 86RR66 resistant to Rhizomania and with a Cercospora leaf spot KWS rating of 5.04. Seeds were treated with Tachigaren (45 g/kg seed) and Poncho beta, and Counter 15G was applied in-furrow (6 lb/A) at planting. Seed spacing within the row was 4.7 inches. Weeds were controlled with two applications (14 and 28 June) of glyphosate. Quadris was applied 14 June to help control Rhizoctonia. Plots were inoculated on 8 July with *C. beticola* inoculum not previously exposed to fungicides (Betaseed, Shakopee, MN).

Fungicide spray treatments were applied with a CO_2 pressurized 4-nozzle boom sprayer with 11002 TT TwinJet nozzles calibrated to deliver 17 gpa of solution at 60 p.s.i pressure to the middle four rows of plots. One treatment received a fungicide application on 1 July for Rhizoctonia root rot control and as a protectant for *C. beticola*; all other fungicide treatments were initiated on July 28. All treatments received three fungicide applications on 28 July, 9 and 22 August. One treatment received an additional fungicide application on July 1, prior to CLS inoculation (see Table 1). Treatments were applied at rates indicated in Table 1.

Cercospora leaf spot severity was rated on the leaf spot assessment scale of 1 to 10 (Jones and Windels, 1991). A rating of 1 indicated the presence of 1- 5 spots/leaf or 0.1% disease severity and a rating of 10 indicated 50% or higher disease severity. Cercospora leaf spot severity was assessed three times during the season. The rating performed on 1 September is reported.

Plots were defoliated mechanically and harvested using a mechanical harvester on 22 September. The middle two rows of each plot were harvested and weighed for root yield. Twelve to 15 representative roots from each plot, not including roots on the ends of the plot, were analyzed for quality at the American Crystal Sugar Company Quality Tare Laboratory, Moorhead, MN. The data analysis was performed with the ANOVA procedure of the Agriculture Research Manager, version 8 software package (Gylling Data Management Inc., Brookings, South Dakota, 2010). The least significant difference (LSD) test was used to compare treatments when the F-test for treatments was significant.

RESULTS AND DISCUSSIONS

Environmental conditions were favorable for development of *C. beticola* and first symptoms were visible during the week of 18 July. Fungicide treatments were delayed by 10 days after first symptoms were observed because of wet field conditions. Cercospora leaf spot progressed very rapidly in the non-treated check and reached economic injury level by early-August. By mid-August, the non-treated check had severe disease and a Cercospora leaf spot rating of 10 which was significantly greater than the fungicide treatments (Table 1). The 10-day delay of the first fungicide application made it difficult to effectively control the disease later in the season, particularly when only one fungicide chemistry was used in an application. Over the past decade, three single-chemistry applications were as effective as four single-chemistry applications. However, in 2011, three single-chemistry applications could not provide season long control even though fungicide chemistries were rotated from one application timing to the next. Tank mixing two fungicides with different modes of action (triphenyltin hydroxide + thiophanate methyl) for the first application provided good early season control. The use of thiophanate methyl alone was significantly better than triphenyltin hydroxide alone in a separate experiment at the same site. Treatments with tank-mixtures in the first application followed by tank-mixtures in the second application typically had better disease control and higher recoverable sucrose compared to the use of single-chemistry applications in rotation. Dry conditions from early August through harvest resulted in low root yields. As such, most treatments that did not effectively control *C. beticola* gave low sucrose concentrations which adversely affected recoverable sucrose.

This research suggests that fungicides should be applied promptly at first symptoms of CLS; and the use of tank-mixtures of two fungicide chemistries in a rotation program provides effective disease control in high inoculum conditions.

General comments for Cercospora leaf spot control in growers' fields in North Dakota and Minnesota <u>where inoculum levels are very low and CLS tolerant</u> (KWS ratings of 5.2 and less) varieties are grown:

1. The first fungicide application should be made when disease symptoms are first observed (which entails scouting after row closure). If the first application is late, control will be difficult all season.
2. Subsequent applications should be made when symptoms are present and environmental conditions (2 day DIV obtained at http://ndawn.ndsu.nodak.edu) are favorable (DIV $\geq$7) for disease development.
3. Use fungicides that are effective at controlling Cercospora leaf spot in an alternation program.
4. Use the recommended rates of fungicides to control Cercospora leaf spot.
5. Only one application of a benzimidazole fungicide (such as Topsin M 4.5F) in combination with a protectant fungicide (such as SuperTin) should be used. The mixture of SuperTin (6 fl oz) and Topsin (7.6 fl oz) provided the best early season leaf spot control.
6. Never use the same fungicide or fungicides from the same class of chemistry or same mode of action 'back-to-back'.
7. Limiting the use of triazoles and strobilurins to one application for *C. beticola* control will prolong the effectiveness of these fungicides.
8. Use high volumes of water (20 gpa for ground-rigs and 5 to 7 gpa for aerial application) with fungicides for effective disease control.
9. Alternate, alternate, alternate! Always alternate different chemistries of fungicides.

The following fungicides in several classes of chemistry are registered for use in sugarbeet:

Strobilurins	**Sterol Inhibitors**	**Ethylenebisdithiocarbamate (EBDC)**
Headline	Eminent	Penncozeb
Gem	Inspire XT	Manzate
Quadris	Proline	
	Enable	
	Tilt	

Benzimidazole	**TriphenylTin Hydroxide (TPTH)**
Topsin	SuperTin
	AgriTin

Table 1. Effect of fungicides on Cercospora leaf spot control and sugarbeet yield and quality at Foxhome, MN in 2011.

Treatment and rate/A	App. Interval	CLS*	Root yield	Sucrose concentration	Recoverable sucrose		Gross Income**
	days	1-10	Ton/A	%	lb/Ton	lb/A	$/A
***Proline 5.7 fl oz + Premier 90 NIS 0.125%v/v / Super Tin 4SC 6 fl oz +Topsin M 4.5F 7.6 oz / Headline 2.09 EC 9 fl oz / Super Tin 4SC 8fl oz	14	6.9	21.9	15.1	276	6059	851
Super Tin 4SC 6 fl oz +Topsin M 4.5F 7.6 oz / Topsin 7.6 oz + Inspire XT 2.08 EC 5.25 fl oz/ Headline 2.09 EC 9 fl oz	14	7.3	21.5	15.1	274	5890	819
Super Tin 4SC 6 fl oz +Topsin M 4.5F 7.6 oz / Inspire XT 2.08 EC 7 fl oz/ Headline 2.09 EC 9 fl oz	14	7.3	20.2	15.1	271	5494	752
Super Tin 4SC 6 fl oz +Topsin M 4.5F 7.6 oz / Topsin 7.6 oz +P-line 3.75 fl oz +NIS 0.125%v/v/ Headline 2.09 EC 9 fl oz	14	7.0	19.7	15.3	278	5453	767
Super Tin 4SC 6 fl oz +Topsin M 4.5F 7.6 oz / S-Tin 6 fl oz+P-line 3.75 fl oz +NIS 0.125%v/v/ Headline 2.09 EC 9 fl oz	14	7.3	19.9	15.0	270	5370	730
Super Tin 4SC 6 fl oz +Topsin M 4.5F 7.6 oz / Eminent 125 SL 13 fl oz / Headline 2.09 EC 9 fl oz	14	7.4	19.5	14.8	267	5230	700
Headline 2.09 EC 9 fl oz / Super Tin 4SC 8 fl oz / Inspire XT 2.08 EC 7 fl oz	14	8.5	18.2	15.5	283	5171	751
Agritin 6 fl oz + Topsin M 4.5F 7.6 oz / Inspire XT 2.08 EC 7 fl oz/ Headline 2.09 EC 9 fl oz	14	7.3	18.3	15.1	275	5042	706
Eminent 125 SL 13 fl oz + Topsin M 4.5F 7.6 oz / Super Tin 4SC 8fl oz / Headline 2.09 EC 9 fl oz	14	8.5	18.2	14.7	267	4886	658
Super Tin 4SC 6 fl oz +Topsin M 4.5F 7.6 oz / SuperTin 6 fl oz + Inspire XT 2.08 EC 5.25 fl oz/ Headline 2.09 EC 9 fl oz	14	7.5	18.2	14.8	268	4862	652
Agritin 6 fl oz + Topsin M 4.5F 7.6 oz / Proline 5 fl oz + Premier 90 NIS 0.125%v/v/ Headline 2.09 EC 9 fl oz	14	7.3	17.2	15.3	279	4829	692
Super Tin 4SC 8fl oz / Proline 5 fl oz + Premier 90 NIS 0.125%v/v / Headline 2.09 EC 9 fl oz	14	8.8	18.1	14.7	266	4816	638
Inspire XT 2.08 EC 7 fl oz/ Super Tin 4SC 8 fl oz / Headline 2.09 EC 9 fl oz	14	8.0	17.4	15.0	270	4704	638
Headline 2.09 EC 9 fl oz / Super Tin 4SC 8 fl oz / Proline 5 fl oz + Premier 90 NIS 0.125%v/v	14	8.9	17.3	14.9	268	4607	615
Super Tin 4SC 8fl oz / Inspire XT 2.08 EC 7 fl oz/ Headline 2.09 EC 9 fl oz	14	9.2	16.6	14.7	269	4482	609
Proline 5 fl oz + Premier 90 NIS 0.125%v/v/ SuperTin 4SC 8fl oz / Headline 2.09 EC 9 fl oz	14	8.9	15.5	15.0	275	4257	595
Eminent 125 SL 13 fl oz + Topsin M 4.5F 7.6 oz / Headline 2.09 EC 9 fl oz/ Super Tin 4SC 8fl oz	14	7.5	16.8	14.0	252	4205	504
Eminent 125 SL 13 fl oz / Super Tin 4SC 8 fl oz / Headline 2.09 EC 9 fl oz	14	9.0	15.1	14.2	257	3912	497
Nontreated Check	-	10	15.3	13.4	238	3636	393
LSD (P=0.05)	**-**	**1.2**	**NS**	**1.0**	**21**	**1387**	**235**

*Cercospora leaf spot measured on 1-10 scale (1 = 1- 5 spots/leaf or 0.1% severity and 10 = 50% severity) on 1 September.
**Gross Return based on American Crystal payment system.
***Proline at 5.7 fl oz + NIS at 0.125%v/v was applied July 1, prior to CLS inoculation

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EFFECT OF AGZYME AND ENHANCE ON SUGARBEET YIELD AND QUALITY

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The objective of this research was to evaluate the effect of AgZyme and Enhance on sugarbeet yield and quality.

MATERIALS AND METHODS

A field trial was conducted in Foxhome, MN, in 2011. The experimental design was a randomized complete block with four replicates. Field plots comprised of six 30-feet long rows spaced 22 inches apart. Plots were planted 10 May, using SESVanderHave 36811RR with 45 g of Tachigaren/kg seed. Terbufos (Counter 15G) was applied modified in-furrow at 6 lbs/A during planting to control sugarbeet root maggot (*Tetanops myopaeformis* von Röder; Diptera: Ulidiidae). Weeds were controlled with glyphosate applied on 14, 28 June and 25 August. Quadris was applied 14 June to help control Rhizoctonia root rot. Cercospora leaf spot was controlled with Topsin, Eminent, and Headline applied 27 July, 8 and 25 August, respectively.

In-furrow application was made at planting on 10 May using StreamJet 0004 nozzles operated at 15 psi and calibrated to deliver 23 gpa spray solution. Foliar treatment was applied 9 June to 2-5 leaf beets with a bicycle sprayer calibrated to deliver 23 gpa of solution at 40 p.s.i pressure to the middle four rows of plots using TeeJet 8002 XR flat fan nozzles. Treatments were applied in-furrow at planting at rates indicated in Table 1.

Plots were defoliated mechanically and harvested using a mechanical harvester on 22 September. The middle two rows of each plot were harvested and weighed for root yield. Twelve to 15 random roots from each plot, not including roots on the ends of the plot, were analyzed for quality at the American Crystal Sugar Company Quality Tare Laboratory, East Grand Forks, MN. The data analysis was performed with the ANOVA procedure of the Agriculture Research Manager, version 8.3.4 software package (Gylling Data Management Inc., Brookings, South Dakota, 2011). The least significant difference (LSD) test was used to compare treatments when the F-test for treatments was significant (*P*=0.05).

RESULTS AND DISCUSSIONS

There were no significant differences in plant stand, root yield, sucrose concentration, sugar loss to molasses, or recoverable sucrose in the plots treated with Agzyme + 10-34-0 or Enhance with 10-34-0 compared to the control that received only 10-34-0. In 2007, the use of AgZyme resulted in significantly higher recoverable sucrose compared to the control at Foxhome, MN. However, in trials done in 2008, 2009, and 2011, AgZyme application did not result in a significant change for any of the parameters evaluated.

Table 1. Effect of AgZyme and Enhance on sugarbeet stand, yield, and quality at Foxhome, MN in 2011.

Treatments and (rate/A)	Application Date	Sept. 22 Stand Count	Root yield	Sucrose concentration	SLM*	Recoverable Sucrose
		beets/100’	Ton/A	%	%	lb/A
10-34-0 (3 gal)	10 May	206	26.9	16.1	1.02	8146
AgZyme (12.8 fl oz) + 10-34-0 (3 gal)	10 May	191	26.8	16.2	1.05	8137
10-34-0 (3 gal) / Enhance (64 fl oz)	10 May 9 June	201	25.1	16.1	1.02	7573
LSD (P= 0.05)		**†NS**	**NS**	**NS**	**NS**	**NS**

*Sugar loss to molasses.
†NS – treatment means in the column were not significantly different.

SMBSC Evaluation of Glyphosate for Weed Control in Sugarbeets Considering with and without Soil Active Herbicides and Timing of Application-2011

Objectives

The objectives of the testing for weed control programs in 2011 were conducted to determine the optimum weed control program with Glyphosate (Roundup).

Methods

Table 1 shows the specifics of activities conducted at the weed control program site in 2011 at Lake Lillian. Table 2 shows the specifics of activities conducted at the weed control program site in 2011 at Sacred Heart, MN. The tests were replicated 4 times and conducted in a randomized complete block experimental design. Plots were 11 ft. (6 rows) wide and 35 ft. long. Sugarbeet stands were 160-200 plants/100 ft. and were not thinned. Evaluation of weed control was conducted at different timings as indicated in the weed control evaluation data tables. Sugarbeets were harvested with a 2 row research harvester at Lake Lillian and Sacred Heart, MN. The sugarbeets were weighed on the two row harvester at Lake Lillian and Sacred Heart for yield and a sub-sample was collected to be analyzed for quality in the SMBSC quality lab.

The treatments were initiated by weed stage and subsequent applications were in accordance with treatment description in data tables. Treatments were applied in 14 GPA mix at 40 psi.

Results and Discussion

Each location will be discussed separately since the statistical analysis for homogeneity indicated the data for the two locations could not be combined. Weeds that evaluated for control at the Sacred Heart and Lake Lillian sites were common lambsquarter and amaranth species. Weeds that evaluated for control at the Sacred Heart site were common lambsquarter and amaranth species. The amaranth species are grouped as one and mostly included red root and smooth pigweed, tall waterhemp and palmer amaranth. Treatments 1-9 show no control at the first evaluation, since these treatments did not have a preplant pre-emergence herbicide applied. The other treatments had preplant or pre-emergence herbicides applied and were evaluated for weed control of the herbicides applied.

Figures 1-24 are presented to give the reader a visual of the results for common lambsquarter and amaranth species weed control and the treatments influence on sugarbeet tons per acre, sugar content and revenue per acre expressed as revenue percent of the mean.

<u>Lake Lillian, MN- location</u>

Weed control *(Table 3 and 3 Continued)*
Treatments 1-9 show 0% control of common lambsquarter and Amaranth Species at the 6-10-11 evaluation since at that timing the herbicide for weed control had not been applied. Differences in weed control between treatments were observed in all other treatment at the 6-10-11 evaluation. The treatments giving weed control at the 6-10-11evaluation timing included preplant incorporated herbicides. Amaranth species and common lambsquarter control was increased to the degree that the efficacy was optimized by the 7-25-11 evaluation timing, Common lambsquarter control at the 7-25-11 evaluation timing was 97% or higher except for treatments 7 and 12 at 90 and 87%, respectively. The lower control realized with treatments 7 and 12 is theorized to be a result of normal variability observed in testing. In the case as that being tested and results of other experiments with similar treatments would not give any reason to believe these results are given the normal frequency of the treatments in question. Amaranth species control at the 7-25-11 evaluation was 96% or higher for all treatments

Sugar beet production *(Table 4 and 4 Continued)*
Sugar percent and purity did not follow any pattern coinciding with treatments. Tons per acre tended to increase with the addition of preemergence or preplant herbicide. The addition of conventional herbicides to the spray mix neither hindered nor enhanced the yield of sugarbeets. However, Betamix applied with Roundup Power Max to supplement control of Amaranth species and common lambsquarter increased tons per acre when the application included Dual Magnum, Warrant or Nortron applied preplant or layby or Roneet or Eptam alone or as a mix applied preplant. Roneet or Eptam applied alone or as a mix along with Dual Magnum, Warrant or Nortron applied layby either did or tended to decrease tons per acre. Treatments with Outlook applied as a layby either did or tended to give lower tons per acre than other treatments with layby applications.

Extractable sucrose per acre and revenue expressed as a percent of means was directly related to the influence on tons per acre since sugar percent and purity were not influenced by treatment.

<u>Sacred Heart, MN- *location*</u>

Weed control *(Table 5 and 5 Continued)*
Treatments with pre-emergence or preplant incorporated herbicide (treatments 10-24) varied in there effectiveness for control of common lambsquarter and Amaranth species. Roneet applied for control of common lambsquarter and amaranth species was not a stand alone product. The addition of Eptam to the preplant incorporated spray mix increased weed control. Eptam, Nortron and Dual Magnum applied preplant incorporated gave higher weed control than Roneet. Weed control increased at the 7-25-11 evaluation so that all treatments gave 96% weed control or higher except for treatments 7 and 12 which gave 90

and 875 weed control, respectively. The lower weed control observed with treatments 7 and 12 was normal variation observed in experimentation. There is no obvious reason for the lower weed control observed with these treatments based on other experiments with similar treatments.

Sugar beet production *(Table 6 and 6 Continued)*
Sugar percent and purity did not vary due to the treatment. The majority of the treatments produced similar tons per acre. All treatments gave statistically similar revenue per acre presented as revenue percent of the mean.

General comments

1. Weed control in general was better and more consistent when glyphosate was applied with a soil active herbicide in at least one of the application timings.
2. General weed control was good. The weeds observed did not express any obvious symptoms of resistance to glyphosate.
3. Revenue tended to increase when a preplant, pre-emergence or layby herbicide was applied in conjunction with Round-up Power Max (glyphosate).

Note: Application timing goes for all tables as follows:
*First application is at 2 leaf sugar beets
*Second application is 14 days after 2 leaf sugar beets
*Third application is 14 days after the second application

Table 1. Site Specifics for Preplant Incorporated, Pre-emergence and Post emergence Herbicide Weed Control in Sugarbeets Lake Lillian, 2011

DATE	PLANTED	VARIETY	SPACING	SOIL	APPLIED	RATE	WEATHER
5/4/2011	X	98RR08	4 9/16"	Lumpy	10-34-0	3 gpa	Cloudy 70' SE-10
					Pre-emergence		
6/9/2011					All Treatments		Sunny 61' RH 65% NE-10-15
6/19/2011					3,6,13,17,20,21,23,24		Sunny 90' RH 78% S-12
7/26/2011					Proline	5.7 oz.	Cloudy 70' E-7
8/3/2011					Agritin	8 oz.	Sunny 83' SE-8
					Manzate	2 lbs	

Table 2. Site Specifics for Preplant Incorporated, Pre-emergence and Post emergence Herbicide Weed Control in Sugarbeets Sacred Heart, 2011

DATE	PLANTED	VARIETY	SPACING	SOIL	APPLIED	RATE	WEATHER
5/4/2011	X	98RR08	4 9/16"	Lumpy	10-34-0	3 gpa	Cloudy 70' SE-10
6/4/2011					Assana	4 oz.	Sunny 75' NW-15
					Quadris	14.7 oz.	
6/14/2011					Select Max	9 oz.	Cloudy 70' SE-11
6/16/2011					All Treatments		Sunny 75' SW-10
7/7/2011					1,2,3,5,9,10,11,16,20,24		Cloudy 77' RH 65% (Sprinkles)
7/18/2011					1,4,8,16,17,18,19,21,22,23		Sunny 82' S-6
7/20/2011					Proline+NIS	5.7 oz.	SE-15-20
8/3/2011					Agritin	8 oz.	Pcloudy 84' N-3
					Powermax	32 oz.	
					Manzate	2 lbs	
8/18/2011					Gem	3.5 oz	

Table 3. Preplant Incorporated, Pre-emergence and Post emergence Herbicide influence on weed Control in Sugarbeets
Lay-by-Herbicide and Glyphosate Influence on Weed Control, Lake Lillian, 2011

Trt	Herbicide	Rate (oz/acre)	Application Timing	% Lambs-quarter 6/2/11	% Amaranth6 /2/11	% Lambs-quarter 7/13/11	% Amaranth 7/13/12	% Lambs-quarter 7/25/11	% Amaranth 7/25/12
1	No ppi/pre			0	0	98	98	97	95
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
2	No ppi/pre			0	0	97	97	97	96
	Roundup PowerMax+Destiny HC+AMS	32+24+2.5%	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
3	No ppi/pre			0	0	95	96	98	98
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	12+4+32+24+ 2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	16+4+22+24+ 2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
4	No ppi/pre			0	0	98	98	97	97
	Outlook+Roundup PowerMax+Destiny HC+AMS	14+32+24+2.5 %	2 inch						
	Outlook+Roundup PowerMax+Destiny HC+AMS	10+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
5	No ppi/pre			0	0	98	96	98	98
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	12+4+14+32+ 24+2.5%	2 inch						
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	16+4+10+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
6	No ppi/pre			0	0	97	98	98	98
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	24+32+24+2.5 %	2 inch						
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
7	No ppi/pre			0	0	98	98	98	98
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	12+4+24+32+ 24+2.5%	2 inch						
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+4+16+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
8	No ppi/pre			0	0	98	98	98	98
	Warrant+Roundup PowerMax+Destiny HC+AMS	48+32+24+2.5 %	2 inch						
	Warrant+Roundup PowerMax+Destiny HC+AMS	32+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
9	No ppi/pre			0	0	97	98	96	98
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	12+4+48+32+ 24+2.5%	2 inch						
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	16+4+32+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
10	Ro-Neet SB	85 oz.	PPI	97	97	97	98	97	97
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
11	Ro-Neet SB	85 oz.	PPI	98	96	98	97	97	97
	Roundup PowerMax+Destiny HC+AMS	32+24+2.5%	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
12	Ro-Neet SB	85 oz.	PPI	98	97	97	98	98	97
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	12+4+32+24+ 2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	16+4+22+24+ 2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						

Table 3.(CONTINUED) Preplant Incorporated, Pre-emergence and Post emergence Herbicide influence on weed Control in Sugarbeets
Lay-by-Herbicide and Glyphosate Influence on Weed Control, Lake Lillian, 2011

Trt	Herbicide	Rate (oz/acre)	Application Timing	% Lambs-quarter 6/2/11	% Amaranth6/2/11	% Lambs-quarter 7/13/11	% Amaranth 7/13/12	% Lambs-quarter 7/25/11	% Amaranth 7/25/12
13	Ro-Neet SB	85 oz.	PPI	98	97	98	98	98	98
	Outlook+Roundup PowerMax+Destiny HC+AMS	14+32+24+2.5 %	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	10+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
14	Ro-Neet SB	85 oz.	PPI	97	95	98	98	97	98
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	12+4+14+32+ 24+2.5%	2 inch						
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	16+4+10+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
15	Ro-Neet SB	85 oz.	PPI	98	97	97	98	97	98
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	24+32+24+2.5 %	2 inch						
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
16	Ro-Neet SB	85 oz.	PPI	98	95	98	98	98	98
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	12+4+24+32+ 24+2.5%	2 inch						
	Betamix + Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+4+16+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
17	Ro-Neet SB	85 oz.	PPI	98	95	91	92	98	98
	Warrant+Roundup PowerMax+Destiny HC+AMS	48+32+24+2.5 %	2 inch						
	Warrant+Roundup PowerMax+Destiny HC+AMS	32+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
18	Ro-Neet SB	85 oz.	PPI	98	97	98	98	98	98
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	12+4+48+32+ 24+2.5%	2 inch						
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	16+4+32+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
19	Eptam	48	PPI	98	97	98	97	97	96
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
20	Ro-Neet SB + Eptam	32+64	PPI	98	97	97	91	98	98
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
21	Nortron	112.5	pre	97	97	97	97	98	98
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
22	Warrant	32	pre	98	97	98	96	97	95
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
23	Nortron	64	pre	98	98	97	97	98	97
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Warrant+Roundup PowerMax+AMS	36+22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
24	Warrant	32	pre	98	98	97	97	98	97
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Warrant + Roundup PowerMax+AMS	32 + 22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
			C.V	1	2	3	4	1	1
			LSD (0.05)	1	2	4	5	1	2

Table 4. Preplant Incorporated, Pre-emergence and Post emergence Herbicide influence For Yield and Quality
Lay-by-Herbicide and Glyphosate Influence on Sugarbeet Production, Lake Lillian, 2011

Trt	Herbicide	Rate (oz/acre)	Application Timing	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	No ppi/pre			21.6	14.02	86.29	4990	98.59
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
2	No ppi/pre			18.2	14.39	87.24	3793	87.76
	Roundup PowerMax+Destiny HC+AMS	32+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
3	No ppi/pre			22.7	14.32	86.82	3694	107.27
	Betamix + Nortron+Roundup PowerMax+Destiny HC+AMS	12+4+32+24+2.5%	2 inch					
	Betamix + Nortron+Roundup PowerMax+Destiny HC+AMS	16+4+22+24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+2.5%	2 inch					
4	No ppi/pre			21.0	13.39	85.73	4933	80.87
	Outlook+Roundup PowerMax+Destiny HC+AMS	14+32+24+2.5%	2 inch					
	Outlook+Roundup PowerMax+Destiny HC+AMS	10+22+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
5	No ppi/pre			22.9	14.19	85.86	4926	102.55
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	12+4+14+32+24+2.5%	2 inch					
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	16+4+10+22+24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+2.5%	2 inch					
6	No ppi/pre			21.6	13.71	86.05	4809	91.86
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	24+32+24+2.5%	2 inch					
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+22+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
7	No ppi/pre			25.1	13.70	85.86	5867	103.53
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	12+4+24+32+24+2.5%	2 inch					
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+4+16+22+24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+2.5%	2 inch					
8	No ppi/pre			24.7	14.15	85.48	5681	107.24
	Warrant+Roundup PowerMax+Destiny HC+AMS	48+32+24+2.5%	2 inch					
	Warrant+Roundup PowerMax+Destiny HC+AMS	32+22+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
9	No ppi/pre			24.1	13.61	87.46	5579	104.08
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	12+4+48+32+24+2.5%	2 inch					
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	16+4+32+22+24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+2.5%	2 inch					
10	Ro-Neet SB	85 oz.	PPI	24.7	14.10	86.30	5507	111.17
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
11	Ro-Neet SB	85 oz.	PPI	25.3	14.04	87.86	5380	115.96
	Roundup PowerMax+Destiny HC+AMS	32+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
12	Ro-Neet SB	85 oz.	PPI	27.0	14.50	87.00	5461	131.88
	Betamix + Nortron+Roundup PowerMax+Destiny HC+AMS	12+4+32+24+2.5%	2 inch					
	Betamix + Nortron+Roundup PowerMax+Destiny HC+AMS	16+4+22+24+2.5%	2 inch					
	Betamix + Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+2.5%	2 inch					

Table 4.(CONTINUED) Preplant Incorporated, Pre-emergence and Post emergence Herbicide influence For Yield and Quality
Lay-by-Herbicide and Glyphosate Influence on Sugarbeet Production, Lake Lillian, 2011

Trt	Herbicide	Rate (oz/acre)	Application Timing	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
13	Ro-Neet SB	85 oz.	PPI	21.9	12.78	87.52	4614	80.55
	Outlook+Roundup PowerMax+Destiny HC+AMS	14+32+24+2.5 %	2 inch					
	Betamix + Nortron+Roundup PowerMax+Destiny HC+AMS	10+22+24+2.5 %	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
14	Ro-Neet SB	85 oz.	PPI	20.8	13.89	85.18	4743	86.09
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	12+4+14+32+ 24+2.5%	2 inch					
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	16+4+10+22+ 24+2.5%	2 inch					
	Betamix + Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
15	Ro-Neet SB	85 oz.	PPI	21.6	13.63	86.68	4869	89.34
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	24+32+24+2.5 %	2 inch					
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+22+24+2.5 %	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
16	Ro-Neet SB	85 oz.	PPI	20.9	13.75	87.35	4417	91.25
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	12+4+24+32+ 24+2.5%	2 inch					
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+4+16+22+ 24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
17	Ro-Neet SB	85 oz.	PPI	21.7	13.45	87.35	4822	90.05
	Warrant+Roundup PowerMax+Destiny HC+AMS	48+32+24+2.5 %	2 inch					
	Warrant+Roundup PowerMax+Destiny HC+AMS	32+22+24+2.5 %	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
18	Ro-Neet SB	85 oz.	PPI	20.4	13.81	85.79	4924	85.07
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	12+4+48+32+ 24+2.5%	2 inch					
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	16+4+32+22+ 24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
19	Eptam	48	PPI	23.4	14.34	87.40	4624	112.89
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
20	Ro-Neet SB + Eptam	32+64	PPI	23.6	13.80	86.44	5815	101.99
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
21	Nortron	112.5	pre	25.1	14.73	87.14	5367	126.20
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
22	Warrant	32	pre	22.3	13.60	87.00	4786	93.50
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
23	Nortron	64	pre	22.3	13.85	87.07	4970	97.36
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Warrant+Roundup PowerMax+AMS	36+22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
24	Warrant	32	pre	23.6	13.96	86.35	5142	102.95
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Warrant + Roundup PowerMax+AMS	32 + 22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
			C.V	9.72	5.50	1.51	12.67	18.97
			LSD (0.05)	3.1	1.08	1.85	890	26.76

Table 5. Preplant Incorporated, Pre-emergence and Post emergence Herbicide influence on weed Control in Sugarbeets Lay-by-Herbicide and Glyphosate Influence on Weed Control, Renville, 2011

Trt	Herbicide	Rate (oz/acre)	Application Timing	% Lambs-quarter 6/10/11	% Amaranth 6/10/11	% Lambs-quarter 7/13/11	% Amaranth 7/13/11	% Lambs-quarter 7/25/11	% Amaranth 7/25/11
1	No ppi/pre			0	0	97	95	98	98
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
2	No ppi/pre			0	0	98	98	98	98
	Roundup PowerMax+Destiny HC+AMS	32+24+2.5%	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
3	No ppi/pre			0	0	98	98	98	98
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	12+4+32+24+ 2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	16+4+22+24+ 2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
4	No ppi/pre			0	0	96	97	98	98
	Outlook+Roundup PowerMax+Destiny HC+AMS	14+32+24+2.5 %	2 inch						
	Outlook+Roundup PowerMax+Destiny HC+AMS	10+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
5	No ppi/pre			0	0	98	98	98	98
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	12+4+14+32+ 24+2.5%	2 inch						
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	16+4+10+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
6	No ppi/pre			0	0	96	98	98	96
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	24+32+24+2.5 %	2 inch						
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
7	No ppi/pre			0	0	94	95	90	97
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	12+4+24+32+ 24+2.5%	2 inch						
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+4+16+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
8	No ppi/pre			0	0	96	96	98	98
	Warrant+Roundup PowerMax+Destiny HC+AMS	48+32+24+2.5 %	2 inch						
	Warrant+Roundup PowerMax+Destiny HC+AMS	32+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
9	No ppi/pre			0	0	98	98	98	98
	Betamix +Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	12+4+48+32+ 24+2.5%	2 inch						
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	16+4+32+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
10	Ro-Neet SB	85 oz.	PPI	80	64	98	98	98	98
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
11	Ro-Neet SB	85 oz.	PPI	75	74	98	98	98	98
	Roundup PowerMax+Destiny HC+AMS	32+24+2.5%	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
12	Ro-Neet SB	85 oz.	PPI	91	82	95	87	87	96
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	12+4+32+24+ 2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	16+4+22+24+ 2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						

Table 5. (CONTINUED) Preplant Incorporated, Pre-emergence and Post emergence Herbicide influence on weed Control in Sugarbeets
Lay-by-Herbicide and Glyphosate Influence on Weed Control, Renville, 2011

Trt	Herbicide	Rate (oz/acre)	Application Timing	% Lambs-quarter 6/10/11	% Amaranth 6/10/11	% Lambs-quarter 7/13/11	% Amaranth 7/13/11	% Lambs-quarter 7/25/11	% Amaranth 7/25/11
13	Ro-Neet SB	85 oz.	PPI	90	87	98	98	98	98
	Outlook+Roundup PowerMax+Destiny HC+AMS	14+32+24+2.5 %	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	10+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
14	Ro-Neet SB	85 oz.	PPI	88	80	97	97	97	97
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	12+4+14+32+ 24+2.5%	2 inch						
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	16+4+10+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
15	Ro-Neet SB	85 oz.	PPI	87	87	98	98	98	98
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	24+32+24+2.5 %	2 inch						
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
16	Ro-Neet SB	85 oz.	PPI	84	81	94	96	98	98
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	12+4+24+32+ 24+2.5%	2 inch						
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+4+16+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
17	Ro-Neet SB	85 oz.	PPI	73	75	97	97	98	98
	Warrant+Roundup PowerMax+Destiny HC+AMS	48+32+24+2.5 %	2 inch						
	Warrant+Roundup PowerMax+Destiny HC+AMS	32+22+24+2.5 %	2 inch						
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch						
18	Ro-Neet SB	85 oz.	PPI	87	80	97	98	98	98
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	12+4+48+32+ 24+2.5%	2 inch						
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	16+4+32+22+ 24+2.5%	2 inch						
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch						
19	Eptam	48	PPI	91	93	87	80	98	98
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
20	Ro-Neet SB + Eptam	32+64	PPI	94	92	98	98	98	98
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
21	Nortron	112.5	pre	95	92	88	84	95	97
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
22	Warrant	32	pre	79	79	96	84	98	98
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
23	Nortron	64	pre	84	82	94	80	98	98
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Warrant+Roundup PowerMax+AMS	36+22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
24	Warrant	32	pre	78	82	98	98	98	98
	Roundup PowerMax+AMS	32+2.5%	2 inch						
	Warrant + Roundup PowerMax+AMS	32+22+2.5%	2 inch						
	Roundup PowerMax+AMS	22+2.5%	2 inch						
			C.V	13	16	4	8	3	1
			LSD (0.05)	10	12	6	10	3	1

Table 6. Preplant Incorporated, Pre-emergence and Post emergence Herbicide influence For Yield and Quality
Lay-by-Herbicide and Glyphosate Influence on Sugarbeet Production, Lake Lillian, 2011

Trt	Herbicide	Rate (oz/acre)	Application Timing	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	No ppi/pre			22.2	14.60	86.35	5091	95.51
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
2	No ppi/pre			22.9	14.47	86.63	5215	99.68
	Roundup PowerMax+Destiny HC+AMS	32+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
3	No ppi/pre			22.5	14.16	85.50	4900	92.85
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	12+4+32+24+ 2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	16+4+22+24+ 2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
4	No ppi/pre			21.8	13.94	85.51	4661	86.51
	Outlook+Roundup PowerMax+Destiny HC+AMS	14+32+24+2.5 %	2 inch					
	Outlook+Roundup PowerMax+Destiny HC+AMS	10+22+24+2.5 %	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
5	No ppi/pre			22.8	14.04	85.79	4948	93.36
	Betamix Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	12+4+14+32+ 24+2.5%	2 inch					
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	16+4+10+22+ 24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
6	No ppi/pre			23.4	14.40	86.26	5287	97.24
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	24+32+24+2.5 %	2 inch					
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+22+24+2.5 %	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
7	No ppi/pre			20.9	14.60	87.03	4806	96.63
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	12+4+24+32+ 24+2.5%	2 inch					
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+4+16+22+ 24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
8	No ppi/pre			23.8	13.93	85.31	5092	90.55
	Warrant+Roundup PowerMax+Destiny HC+AMS	48+32+24+2.5 %	2 inch					
	Warrant+Roundup PowerMax+Destiny HC+AMS	32+22+24+2.5 %	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
9	No ppi/pre			24.3	14.23	85.49	5331	101.66
	Betamix Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	12+4+48+32+ 24+2.5%	2 inch					
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	16+4+32+22+ 24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
10	Ro-Neet SB	85 oz.	PPI	24.3	13.89	85.71	5189	96.20
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
11	Ro-Neet SB	85 oz.	PPI	22.7	14.81	86.22	5257	108.73
	Roundup PowerMax+Destiny HC+AMS	32+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
12	Ro-Neet SB	85 oz.	PPI	21.5	14.58	86.01	4762	89.27
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	12+4+32+24+ 2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	16+4+22+24+ 2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					

Table 6.(CONTINUED) Preplant Incorporated, Pre-emergence and Post emergence Herbicide influence For Yield and Quality
Lay-by-Herbicide and Glyphosate Influence on Sugarbeet Production, Lake Lillian, 2011

Trt	Herbicide	Rate (oz/acre)	Application Timing	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
13	Ro-Neet SB	85 oz.	PPI	24.4	14.40	86.26	5474	111.94
	Outlook+Roundup PowerMax+Destiny HC+AMS	14+32+24+2.5 %	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	10+22+24+2.5 %	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
14	Ro-Neet SB	85 oz.	PPI	24.3	14.19	85.47	5410	108.95
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	12+4+14+32+ 24+2.5%	2 inch					
	Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS	16+4+10+22+ 24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
15	Ro-Neet SB	85 oz.	PPI	22.8	14.68	86.39	5240	106.53
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	24+32+24+2.5 %	2 inch					
	Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+22+24+2.5 %	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
16	Ro-Neet SB	85 oz.	PPI	22.8	14.13	85.62	4968	98.98
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	12+4+24+32+ 24+2.5%	2 inch					
	Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS	16+4+16+22+ 24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
17	Ro-Neet SB	85 oz.	PPI	23.9	14.58	86.72	5489	110.20
	Warrant+Roundup PowerMax+Destiny HC+AMS	48+32+24+2.5 %	2 inch					
	Warrant+Roundup PowerMax+Destiny HC+AMS	32+22+24+2.5 %	2 inch					
	Roundup PowerMax+Destiny HC+AMS	22+24+2.5%	2 inch					
18	Ro-Neet SB	85 oz.	PPI	22.7	14.05	85.70	4922	92.73
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	12+4+48+32+ 24+2.5%	2 inch					
	Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS	16+4+32+22+ 24+2.5%	2 inch					
	Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS	24+4+22+24+ 2.5%	2 inch					
19	Eptam	48	PPI	24.9	14.80	88.41	5957	128.64
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
20	Ro-Neet SB + Eptam	32+64	PPI	22.5	13.85	85.64	4797	84.83
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
21	Nortron	112.5	pre	20.7	14.17	85.97	4556	87.42
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
22	Warrant	32	pre	22.6	15.86	93.59	6238	106.95
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
23	Nortron	64	pre	23.9	17.10	99.97	7723	107.85
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Warrant+Roundup PowerMax+AMS	36+22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
24	Warrant	32	pre	22.8	14.84	86.24	5288	107.29
	Roundup PowerMax+AMS	32+2.5%	2 inch					
	Warrant + Roundup PowerMax+AMS	32+22+2.5%	2 inch					
	Roundup PowerMax+AMS	22+2.5%	2 inch					
			C.V	7.0	8.98	7.57	21	41.09
			LSD (0.05)	2.3	1.84	9.29	1545	57.95

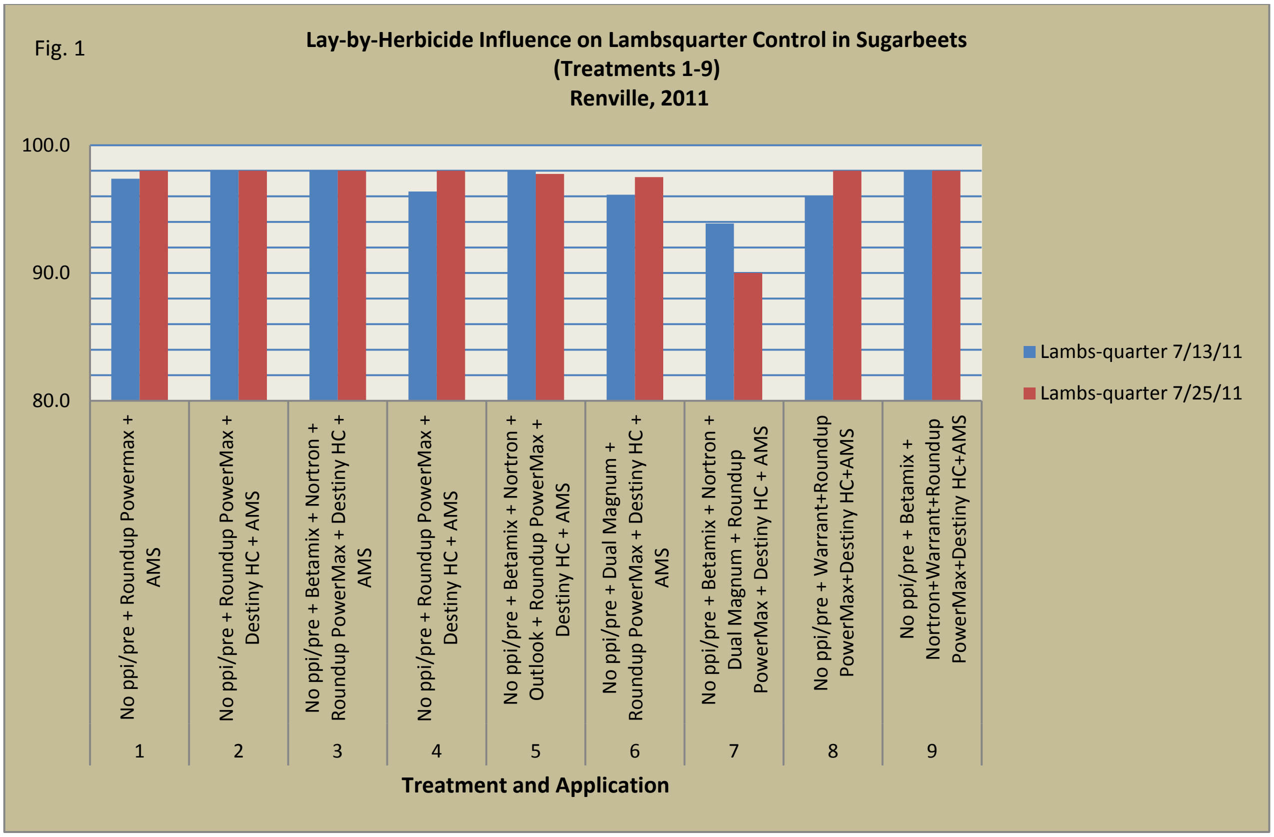
Fig. 1
Lay-by-Herbicide Influence on Lambsquarter Control in Sugarbeets
(Treatments 1-9)
Renville, 2011
100.0
90.0
80.0
Lambs-quarter 7/13/11
Lambs-quarter 7/25/11
No ppi/pre + Roundup Powermax + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Outlook + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Warrant+Roundup PowerMax+Destiny HC+AMS
No ppi/pre + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
1
2
3
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5
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7
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9
Treatment and Application

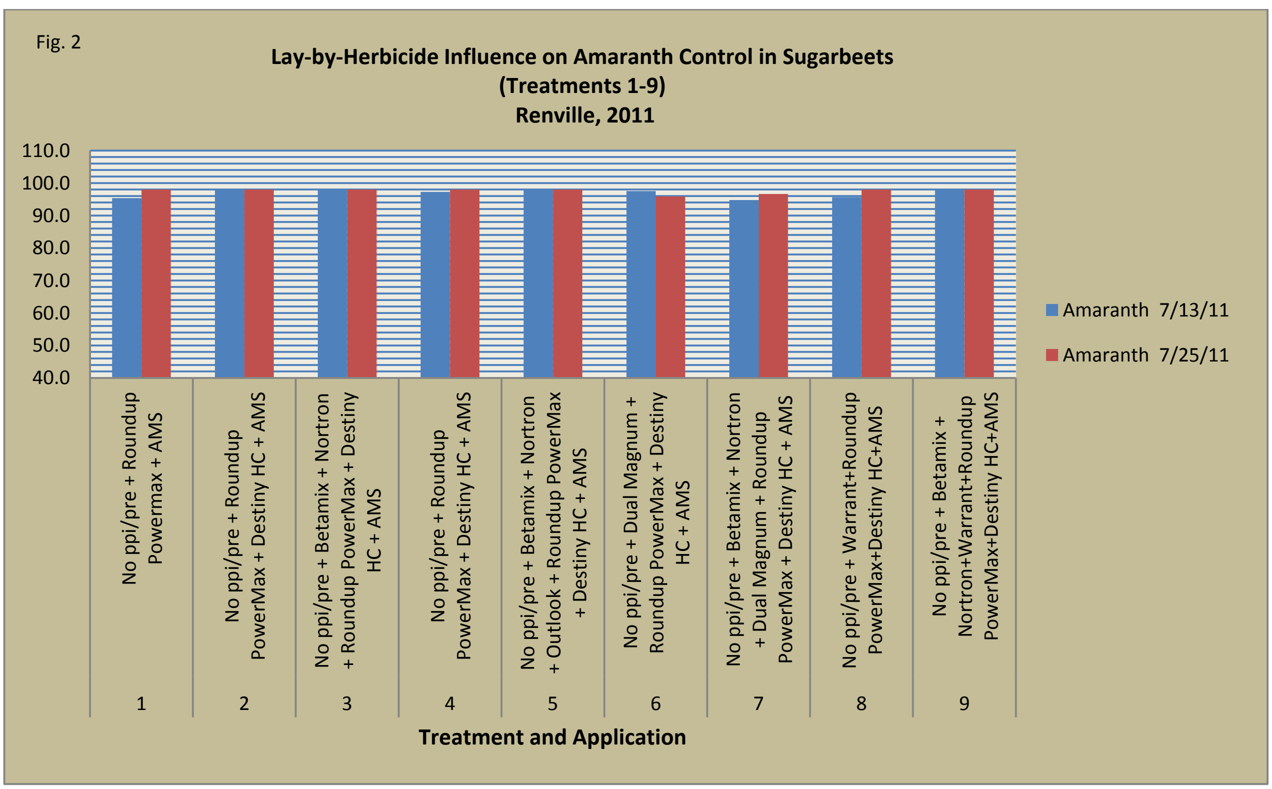


Fig. 2
Lay-by-Herbicide Influence on Amaranth Control in Sugarbeets
(Treatments 1-9)
Renville, 2011
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
Amaranth 7/13/11
Amaranth 7/25/11
No ppi/pre + Roundup Powermax + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Outlook + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Warrant+Roundup PowerMax+Destiny HC+AMS
No ppi/pre + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
1
2
3
4
5
6
7
8
9
Treatment and Application

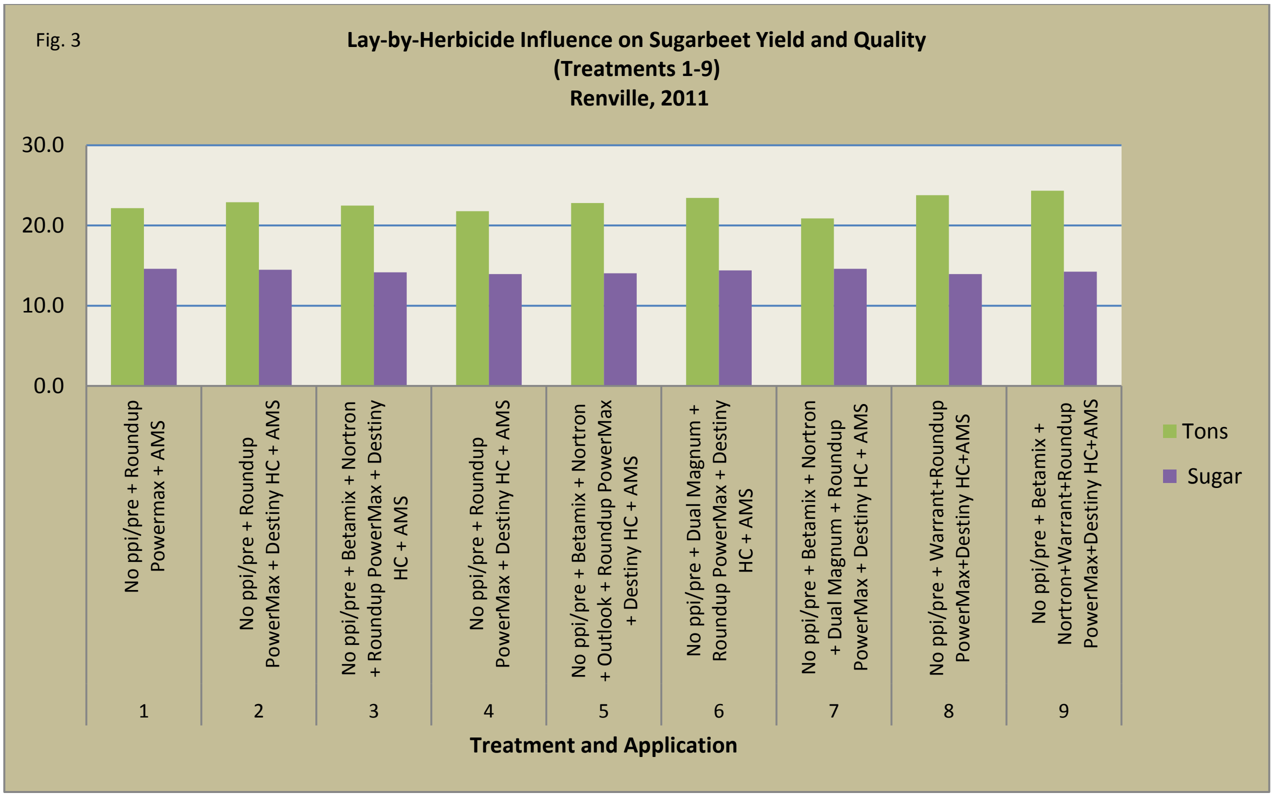


Fig. 3
Lay-by-Herbicide Influence on Sugarbeet Yield and Quality
(Treatments 1-9)
Renville, 2011
30.0
20.0
10.0
0.0
No ppi/pre + Roundup Powermax + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Outlook + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Warrant+Roundup PowerMax+Destiny HC+AMS
No ppi/pre + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
1
2
3
4
5
6
7
8
9
Treatment and Application
Tons
Sugar

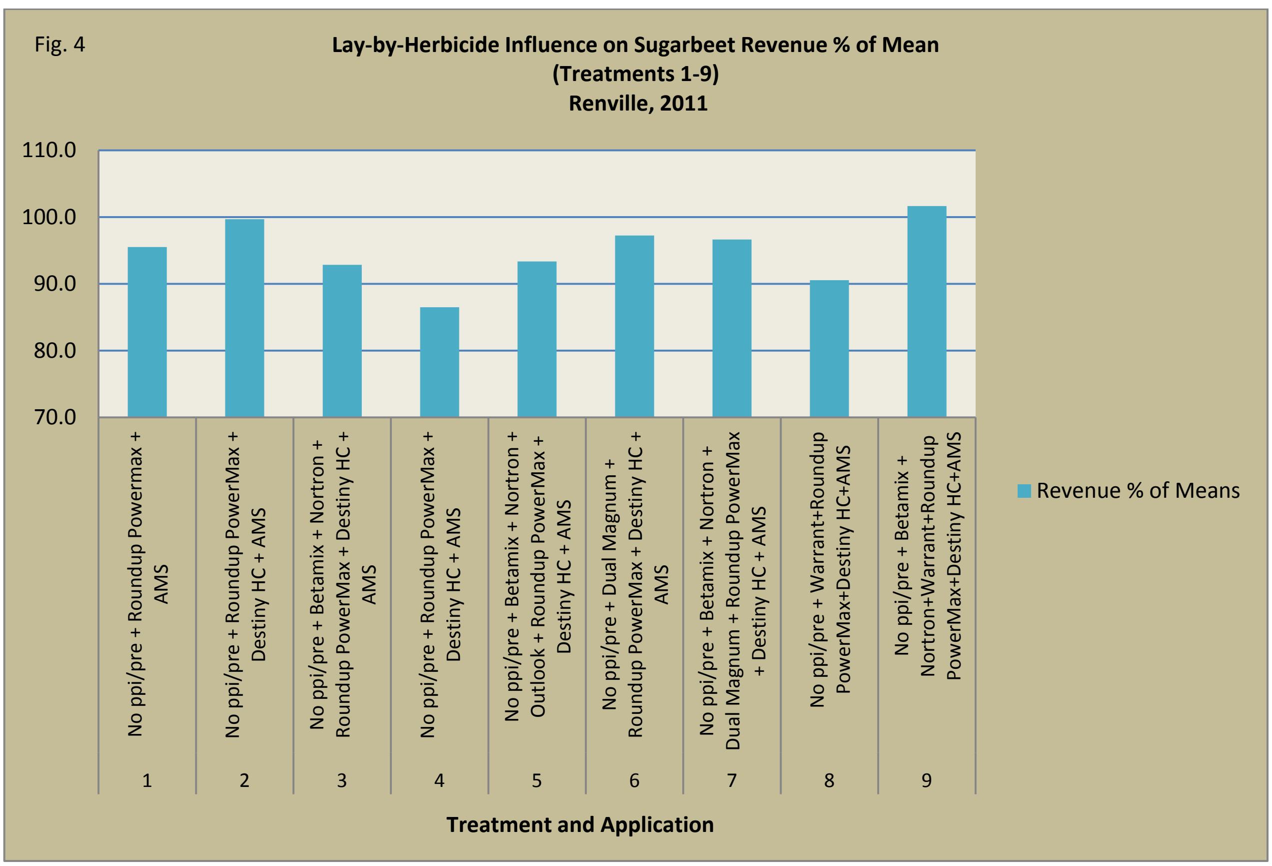


Fig. 4
Lay-by-Herbicide Influence on Sugarbeet Revenue % of Mean
(Treatments 1-9)
Renville, 2011
110.0
100.0
90.0
80.0
70.0
No ppi/pre + Roundup Powermax + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Outlook + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Warrant+Roundup PowerMax+Destiny HC+AMS
No ppi/pre + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
1
2
3
4
5
6
7
8
9
Treatment and Application
Revenue % of Means

Fig. 5

Preplant Incorporated Herbicide Influence on Lambsquarter Control in Sugarbeets (Treatment 10-20) Renville, 2011

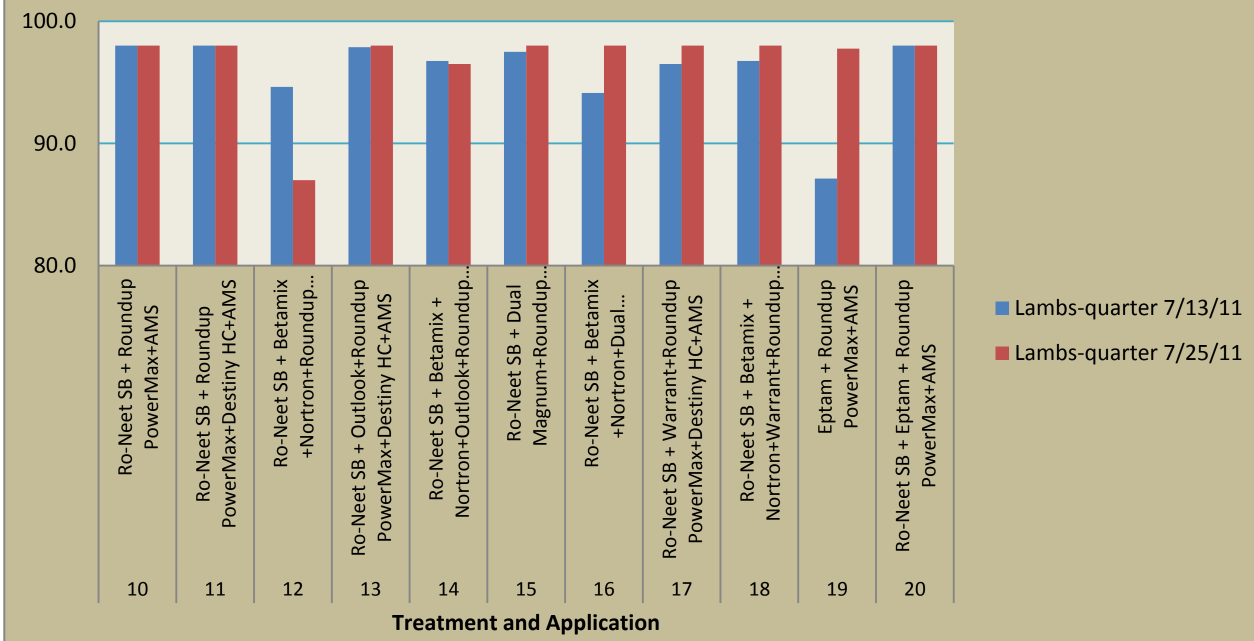
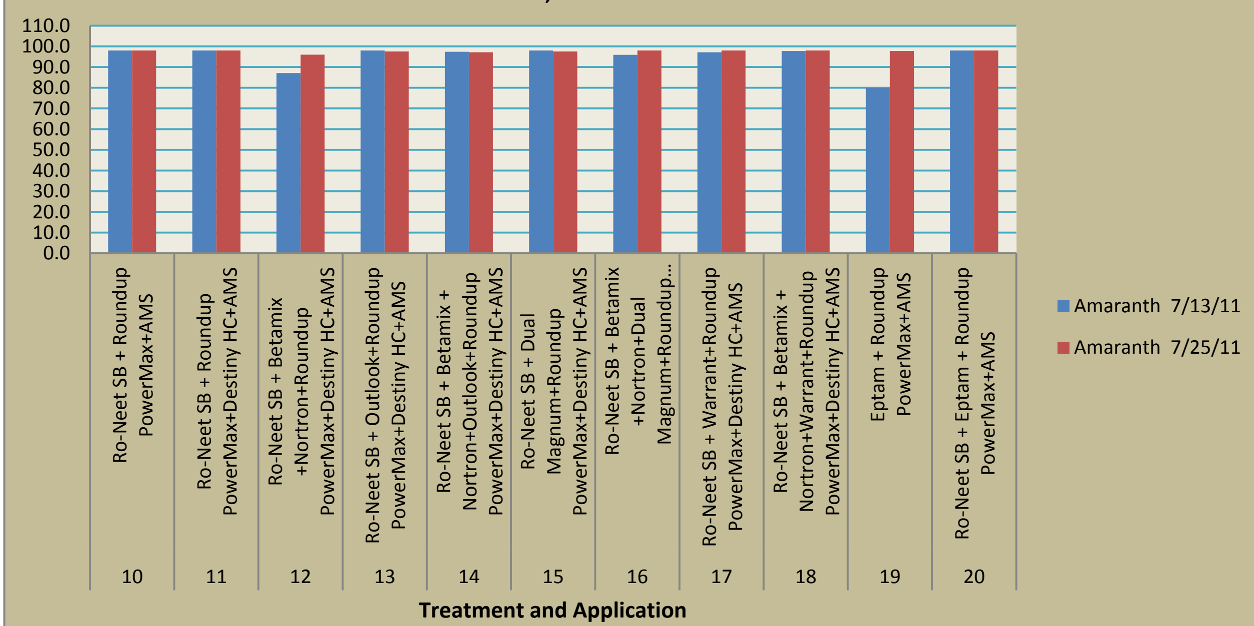


Fig. 6

Pre-plant Incorporated Herbicide Influence on Amaranth Control in Sugarbeets (Treatments 10-20) Renville, 2011



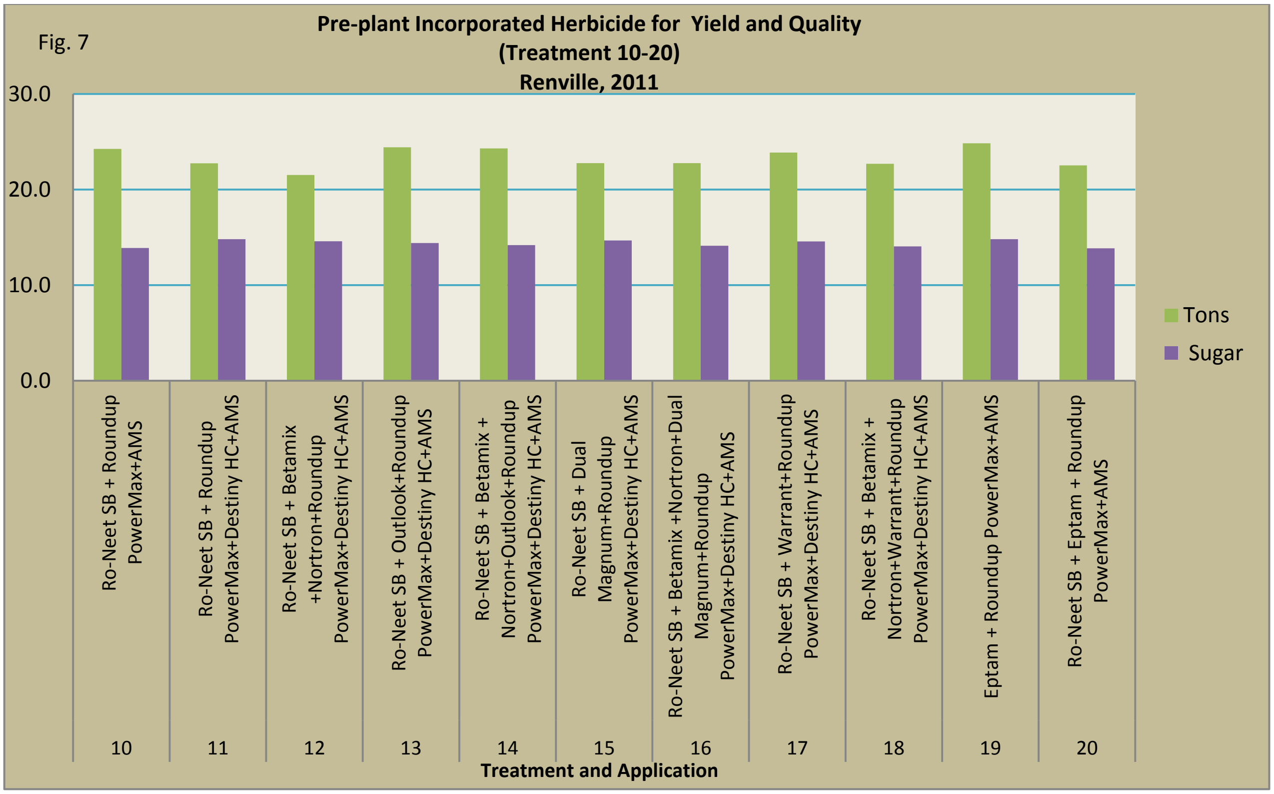


Fig. 7
Pre-plant Incorporated Herbicide for Yield and Quality
(Treatment 10-20)
Renville, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Ro-Neet SB + Roundup PowerMax+AMS
Ro-Neet SB + Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Dual Magnum+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Warrant+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
Eptam + Roundup PowerMax+AMS
Ro-Neet SB + Eptam + Roundup PowerMax+AMS
10
11
12
13
14
15
16
17
18
19
20
Treatment and Application

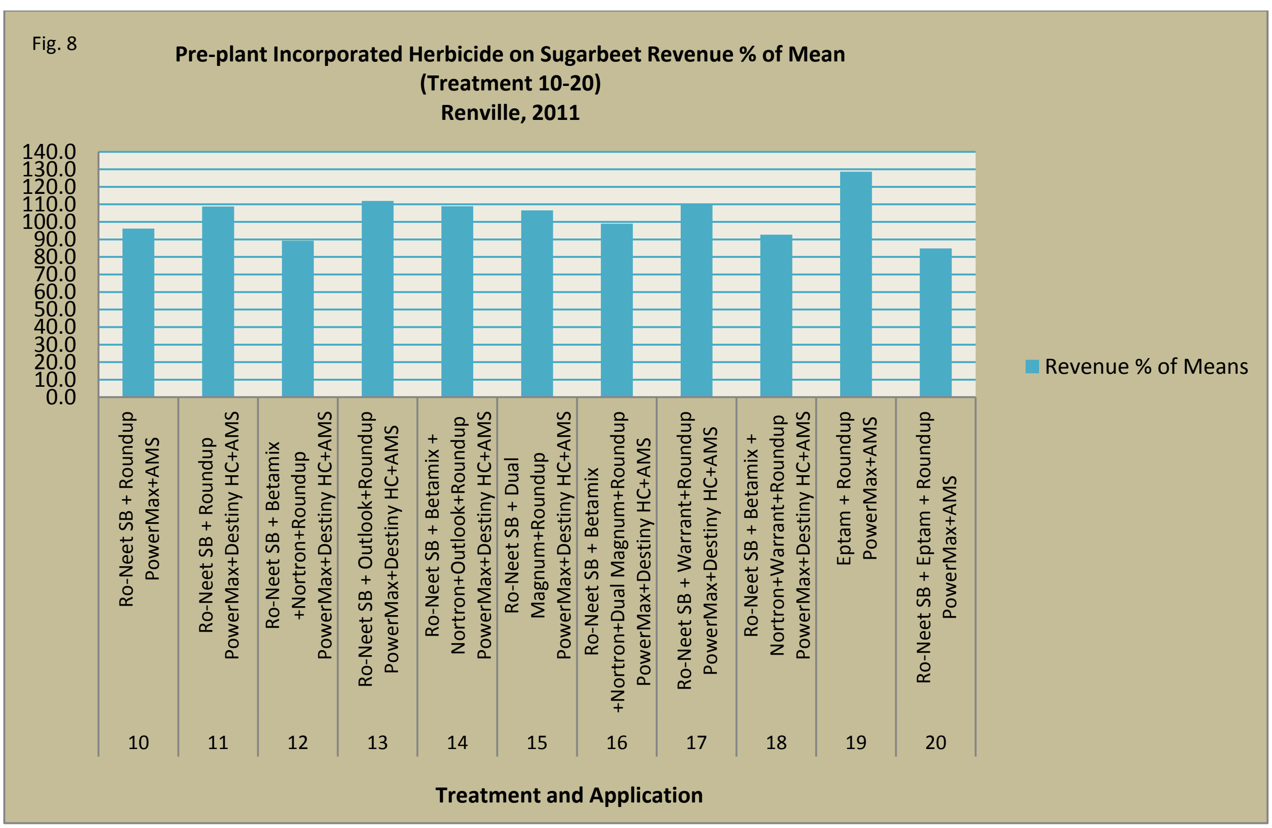


Fig. 8
Pre-plant Incorporated Herbicide on Sugarbeet Revenue % of Mean
(Treatment 10-20)
Renville, 2011
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Revenue % of Means
Ro-Neet SB + Roundup PowerMax+AMS
Ro-Neet SB + Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Dual Magnum+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Warrant+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
Eptam + Roundup PowerMax+AMS
Ro-Neet SB + Eptam + Roundup PowerMax+AMS
10
11
12
13
14
15
16
17
18
19
20
Treatment and Application

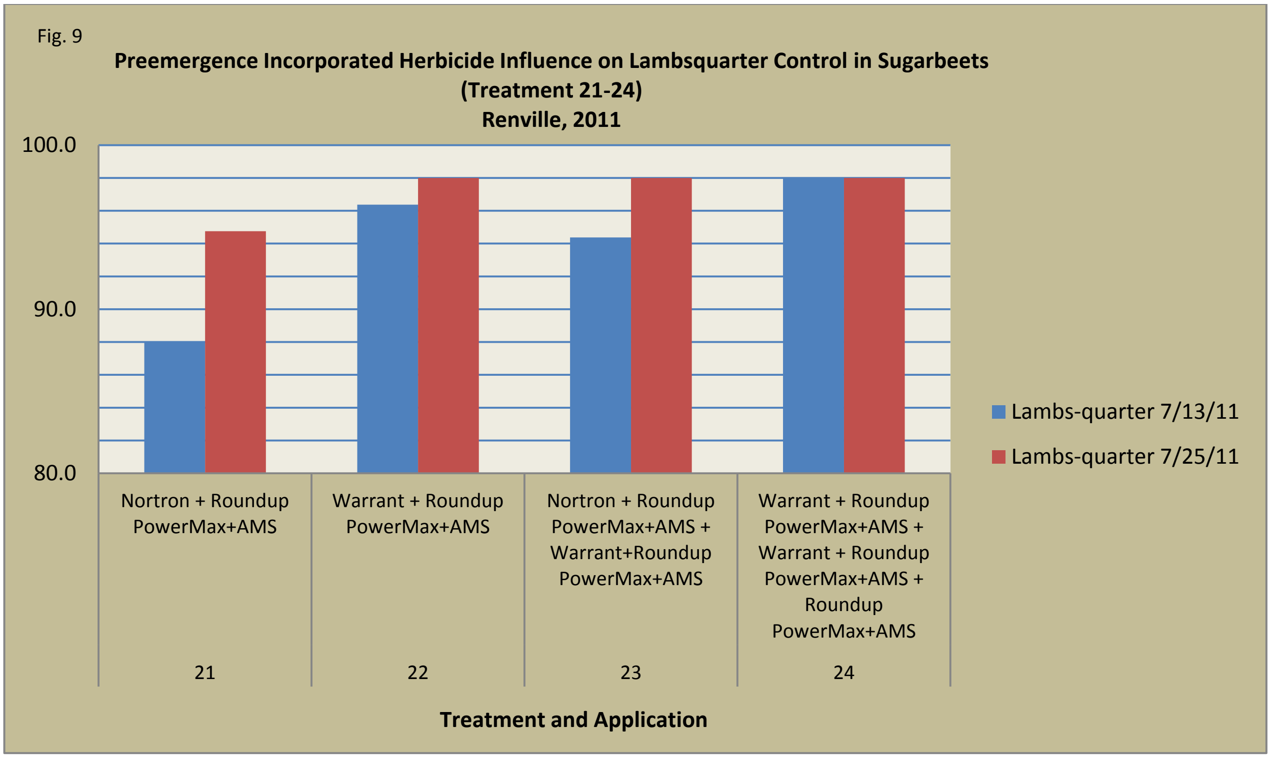


Fig. 9
Preemergence Incorporated Herbicide Influence on Lambsquarter Control in Sugarbeets
(Treatment 21-24)
Renville, 2011
100.0
90.0
80.0
Nortron + Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS
Nortron + Roundup PowerMax+AMS + Warrant+Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS + Warrant + Roundup PowerMax+AMS + Roundup PowerMax+AMS
21
22
23
24
Treatment and Application
Lambs-quarter 7/13/11
Lambs-quarter 7/25/11

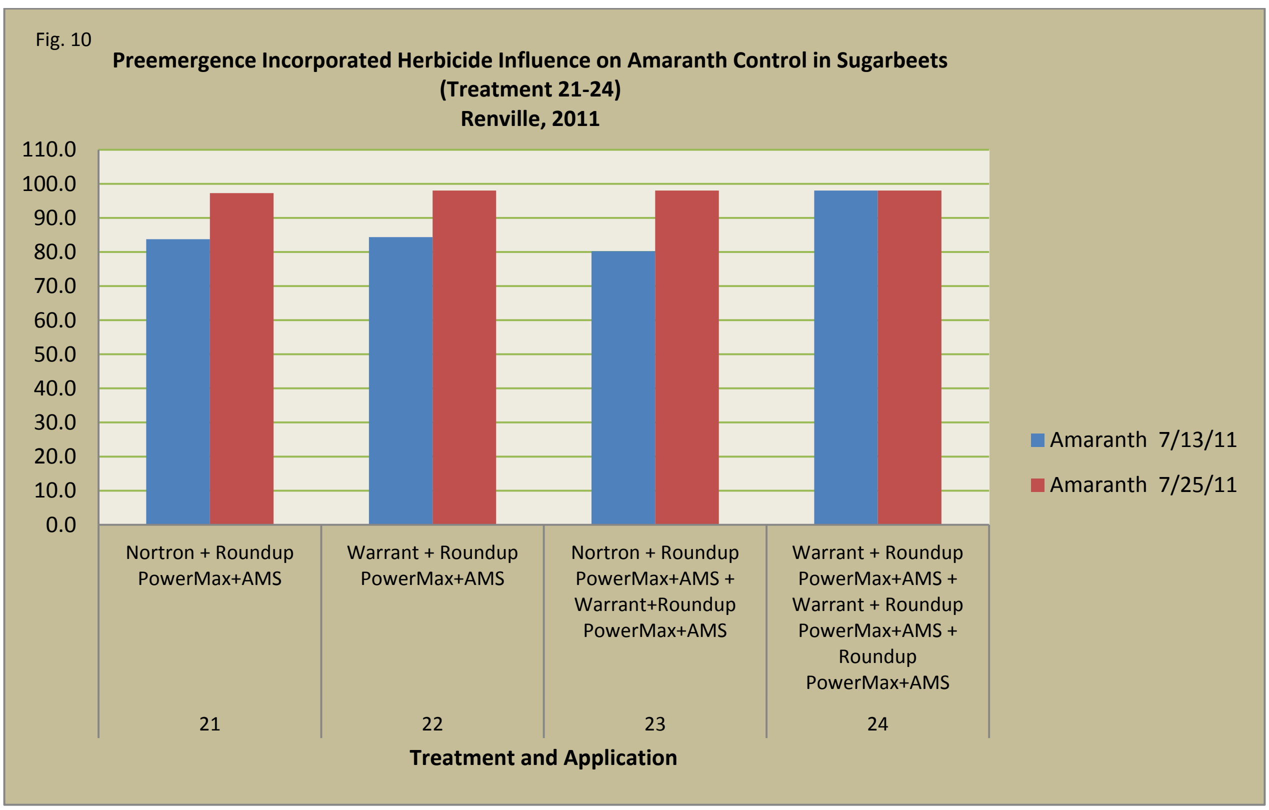


Fig. 10
Preemergence Incorporated Herbicide Influence on Amaranth Control in Sugarbeets
(Treatment 21-24)
Renville, 2011
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Nortron + Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS
Nortron + Roundup PowerMax+AMS + Warrant+Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS + Warrant + Roundup PowerMax+AMS + Roundup PowerMax+AMS
21
22
23
24
Treatment and Application
Amaranth 7/13/11
Amaranth 7/25/11

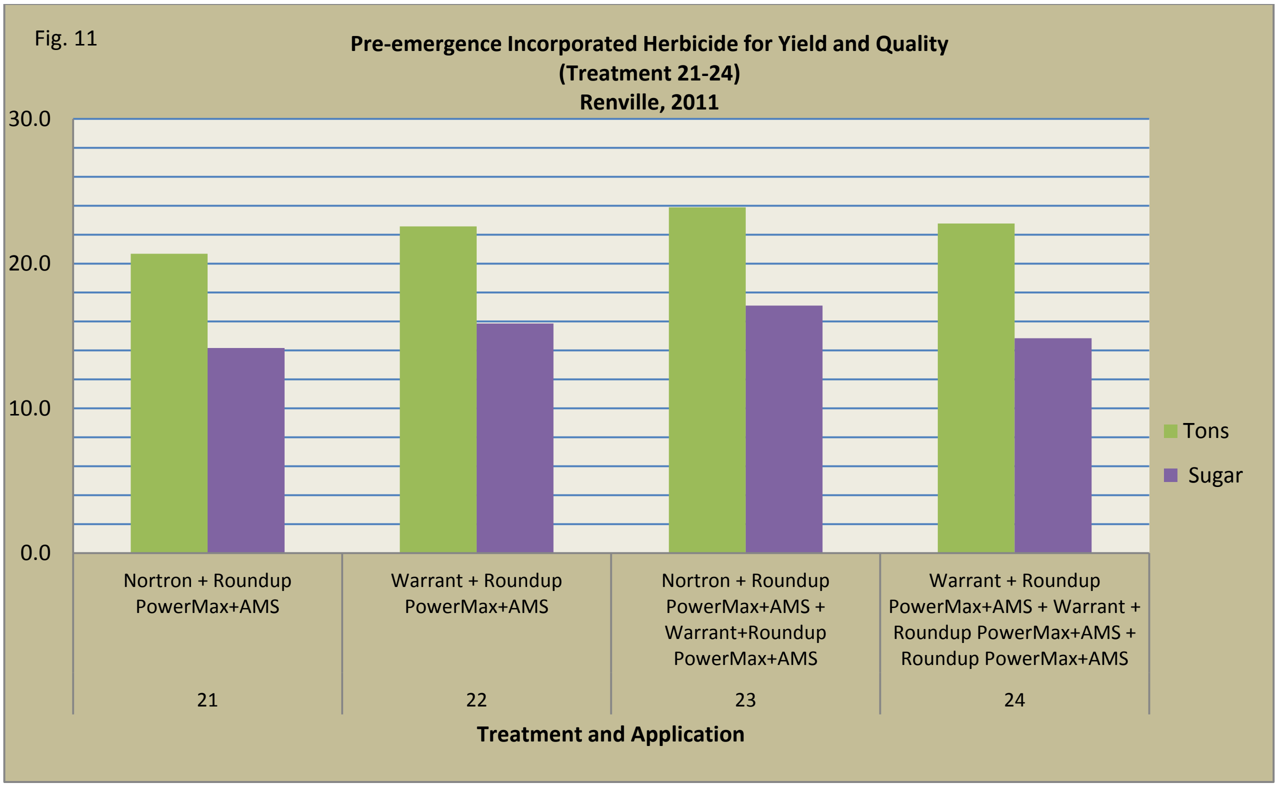


Fig. 11
Pre-emergence Incorporated Herbicide for Yield and Quality
(Treatment 21-24)
Renville, 2011
30.0
20.0
10.0
0.0
Tons
Sugar
Nortron + Roundup PowerMax+AMS
21
Warrant + Roundup PowerMax+AMS
22
Nortron + Roundup PowerMax+AMS + Warrant+Roundup PowerMax+AMS
23
Warrant + Roundup PowerMax+AMS + Warrant + Roundup PowerMax+AMS + Roundup PowerMax+AMS
24
Treatment and Application

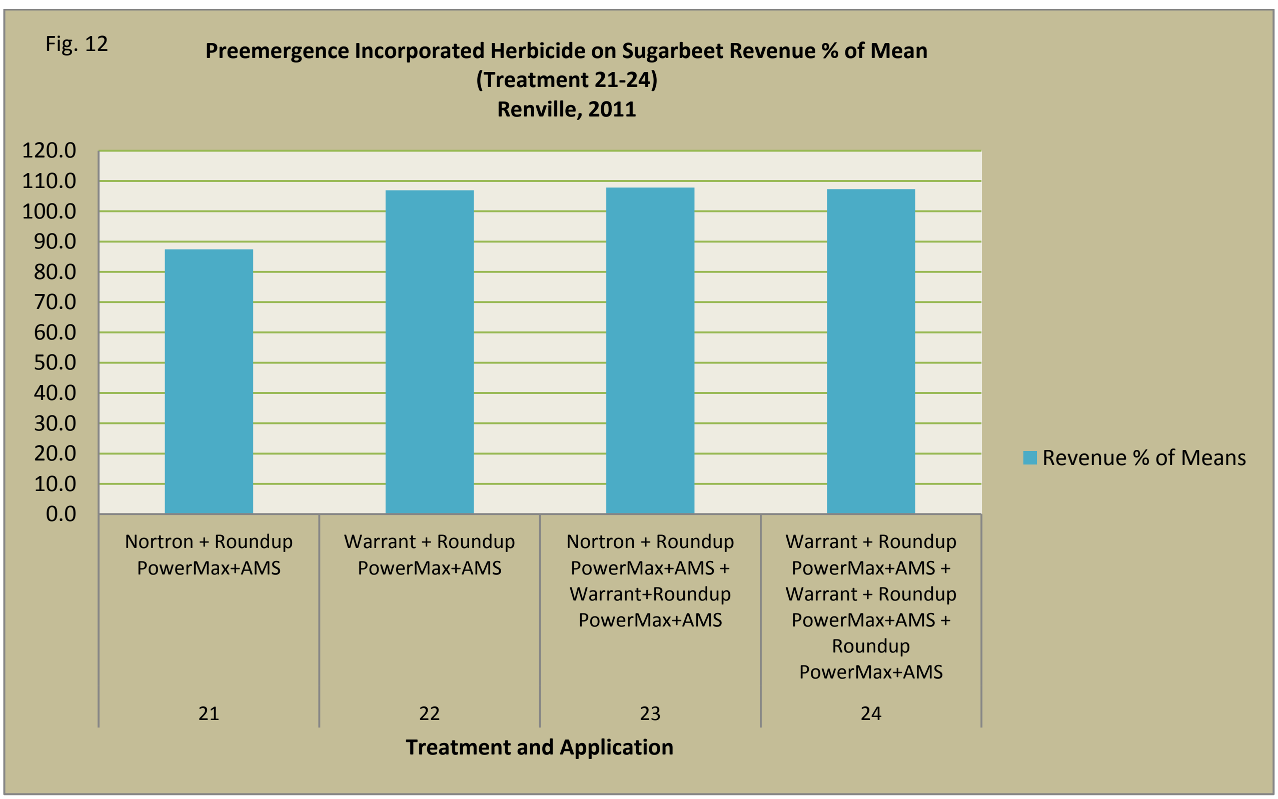


Fig. 12
Preemergence Incorporated Herbicide on Sugarbeet Revenue % of Mean
(Treatment 21-24)
Renville, 2011
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Revenue % of Means
Nortron + Roundup PowerMax+AMS
21
Warrant + Roundup PowerMax+AMS
22
Nortron + Roundup PowerMax+AMS + Warrant+Roundup PowerMax+AMS
23
Warrant + Roundup PowerMax+AMS + Warrant + Roundup PowerMax+AMS + Roundup PowerMax+AMS
24
Treatment and Application

Fig. 13

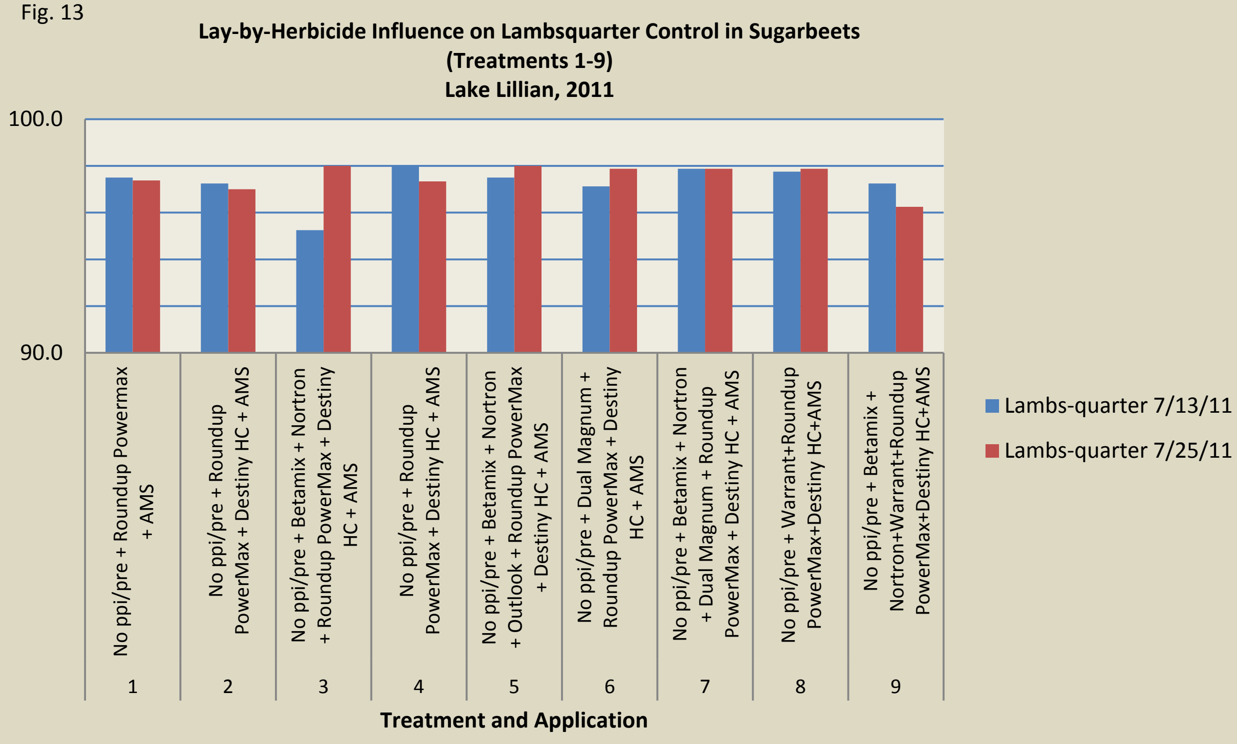

Lay-by-Herbicide Influence on Lambsquarter Control in Sugarbeets
(Treatments 1-9)
Lake Lillian, 2011
100.0
90.0
No ppi/pre + Roundup Powermax + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Outlook + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Warrant+Roundup PowerMax+Destiny HC+AMS
No ppi/pre + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
1
2
3
4
5
6
7
8
9
Treatment and Application
Lambs-quarter 7/13/11
Lambs-quarter 7/25/11

Fig. 14

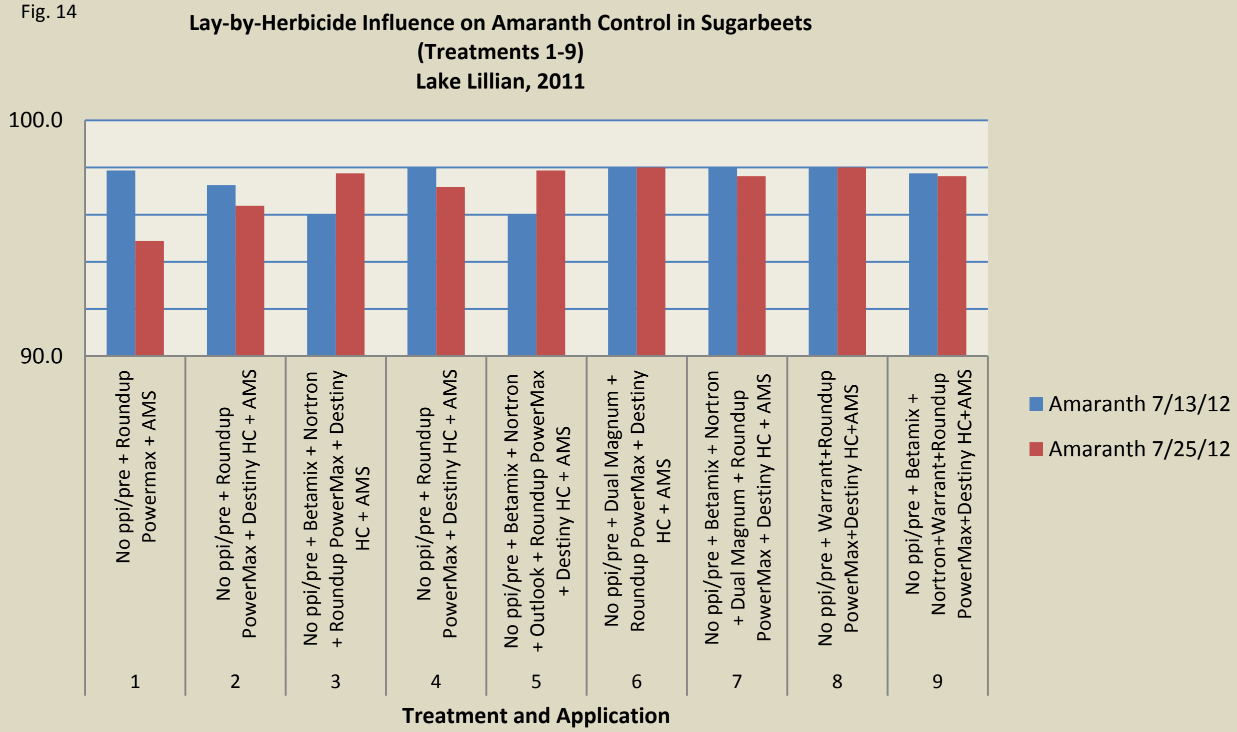

Lay-by-Herbicide Influence on Amaranth Control in Sugarbeets
(Treatments 1-9)
Lake Lillian, 2011
100.0
90.0
No ppi/pre + Roundup Powermax + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Outlook + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Warrant+Roundup PowerMax+Destiny HC+AMS
No ppi/pre + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
1
2
3
4
5
6
7
8
9
Treatment and Application
Amaranth 7/13/12
Amaranth 7/25/12

Fig. 15

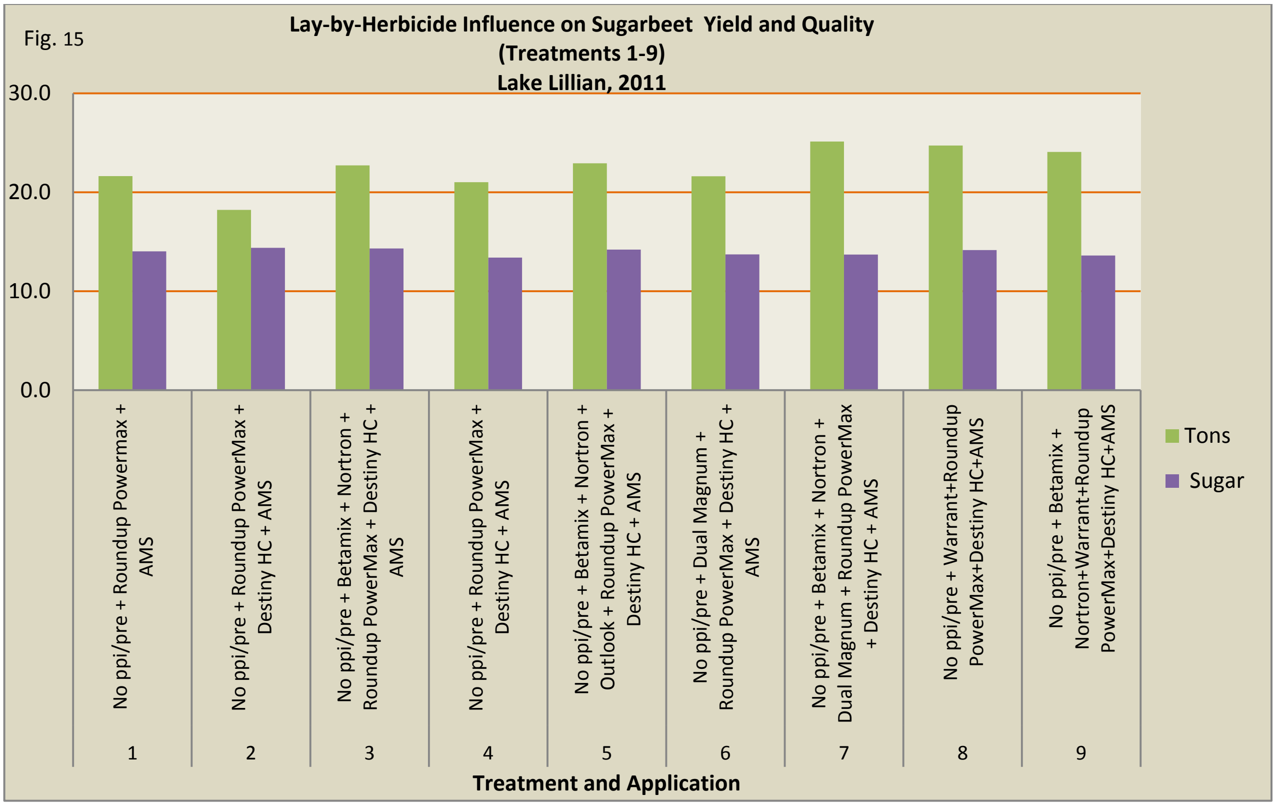

Lay-by-Herbicide Influence on Sugarbeet Yield and Quality
(Treatments 1-9)
Lake Lillian, 2011
30.0
20.0
10.0
0.0
No ppi/pre + Roundup Powermax + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Outlook + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Warrant+Roundup PowerMax+Destiny HC+AMS
No ppi/pre + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
1
2
3
4
5
6
7
8
9
Treatment and Application
Tons
Sugar

Fig. 16

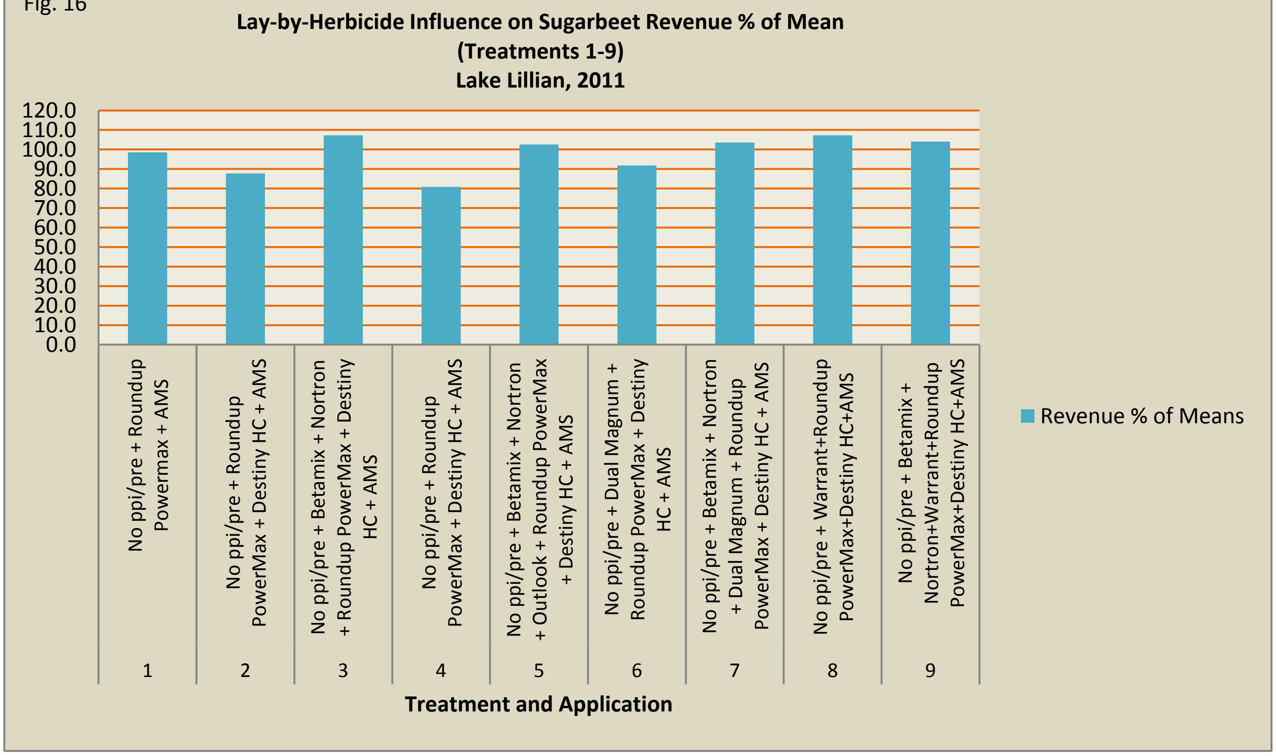
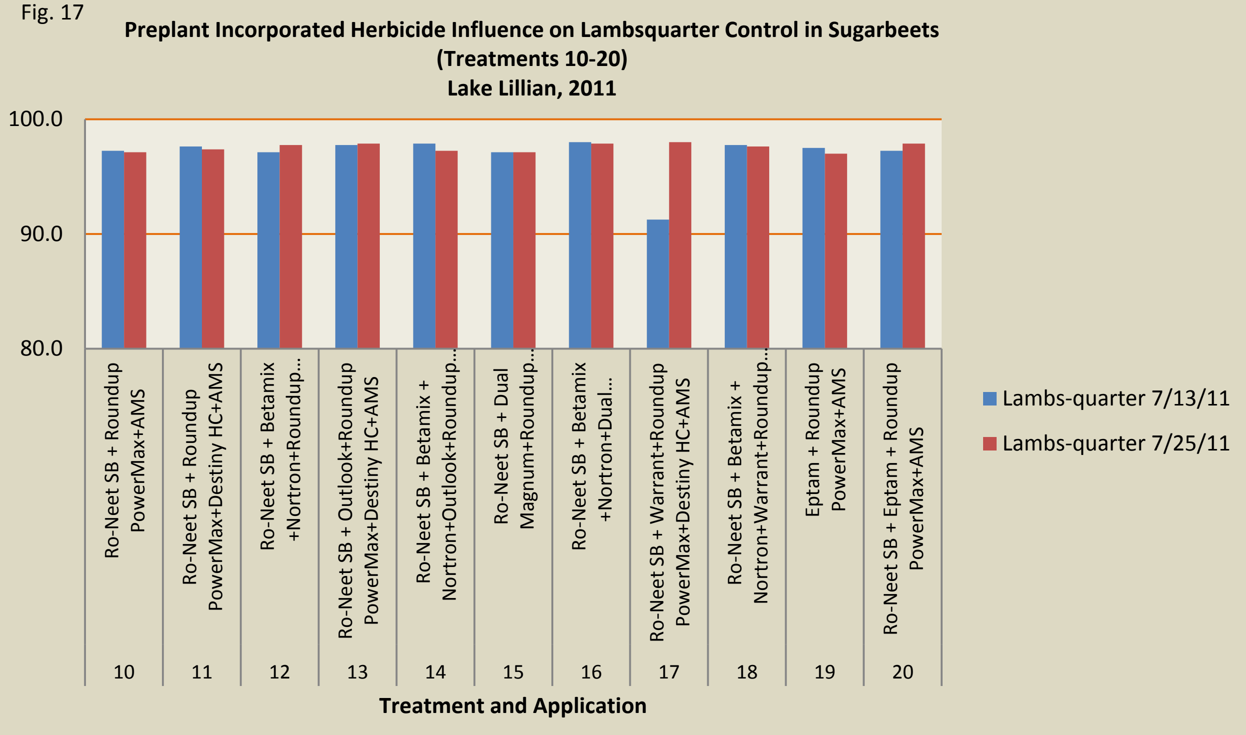

Lay-by-Herbicide Influence on Sugarbeet Revenue % of Mean
(Treatments 1-9)
Lake Lillian, 2011
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
No ppi/pre + Roundup Powermax + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Outlook + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Betamix + Nortron + Dual Magnum + Roundup PowerMax + Destiny HC + AMS
No ppi/pre + Warrant+Roundup PowerMax+Destiny HC+AMS
No ppi/pre + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
1
2
3
4
5
6
7
8
9
Treatment and Application
Revenue % of Means

Fig. 17


Preplant Incorporated Herbicide Influence on Lambsquarter Control in Sugarbeets
(Treatments 10-20)
Lake Lillian, 2011
100.0
90.0
80.0
Ro-Neet SB + Roundup PowerMax+AMS
Ro-Neet SB + Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Roundup...
Ro-Neet SB + Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Outlook+Roundup...
Ro-Neet SB + Dual Magnum+Roundup...
Ro-Neet SB + Betamix +Nortron+Dual...
Ro-Neet SB + Warrant+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Warrant+Roundup...
Eptam + Roundup PowerMax+AMS
Ro-Neet SB + Eptam + Roundup PowerMax+AMS
10
11
12
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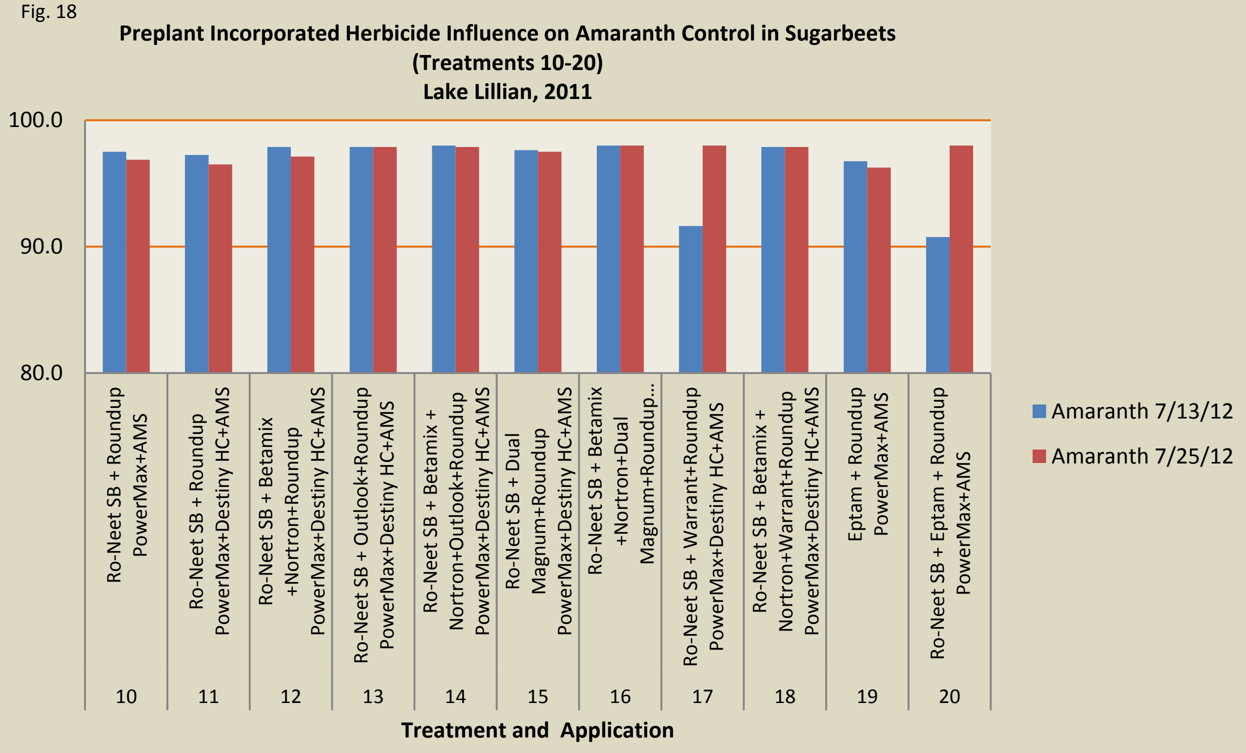
14
15
16
17
18
19
20
Treatment and Application
Lambs-quarter 7/13/11
Lambs-quarter 7/25/11

Fig. 18


Preplant Incorporated Herbicide Influence on Amaranth Control in Sugarbeets
(Treatments 10-20)
Lake Lillian, 2011
100.0
90.0
80.0
Ro-Neet SB + Roundup PowerMax+AMS
Ro-Neet SB + Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Dual Magnum+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Dual Magnum+Roundup...
Ro-Neet SB + Warrant+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
Eptam + Roundup PowerMax+AMS
Ro-Neet SB + Eptam + Roundup PowerMax+AMS
10
11
12
13
14
15
16
17
18
19
20
Treatment and Application
Amaranth 7/13/12
Amaranth 7/25/12

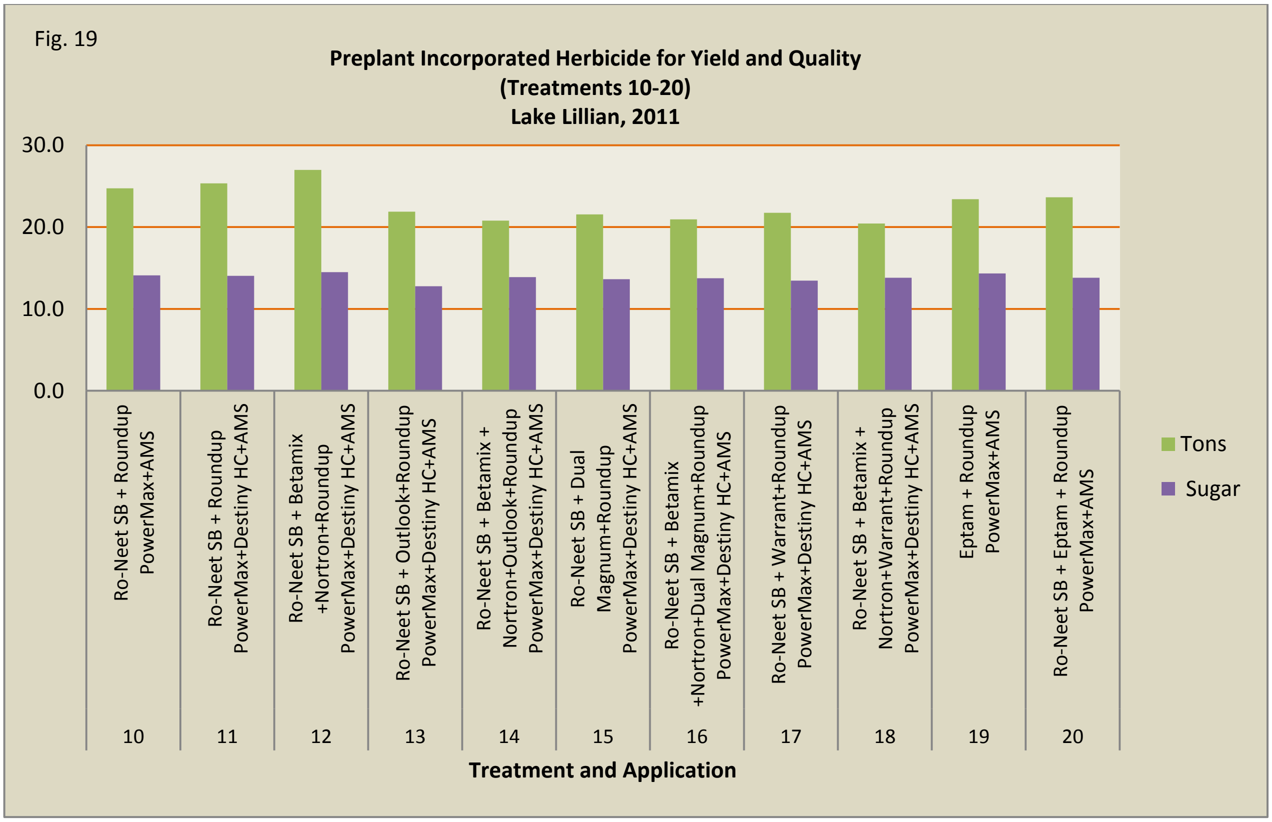


Fig. 19
Preplant Incorporated Herbicide for Yield and Quality
(Treatments 10-20)
Lake Lillian, 2011
30.0
20.0
10.0
0.0
Ro-Neet SB + Roundup PowerMax+AMS
Ro-Neet SB + Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Dual Magnum+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Warrant+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
Eptam + Roundup PowerMax+AMS
Ro-Neet SB + Eptam + Roundup PowerMax+AMS
10
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12
13
14
15
16
17
18
19
20
Treatment and Application
Tons
Sugar

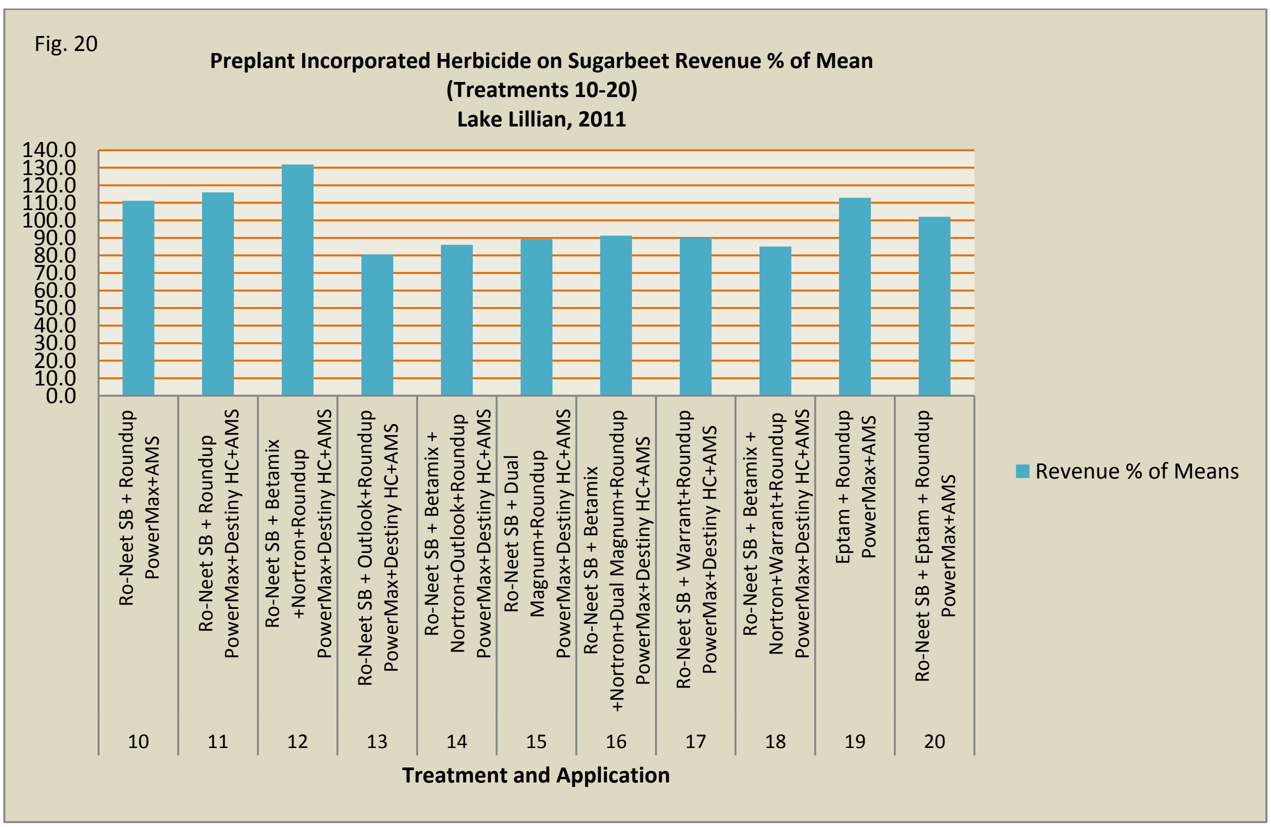
Fig. 20
Preplant Incorporated Herbicide on Sugarbeet Revenue % of Mean
(Treatments 10-20)
Lake Lillian, 2011
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Ro-Neet SB + Roundup PowerMax+AMS
Ro-Neet SB + Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Outlook+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Dual Magnum+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix +Nortron+Dual Magnum+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Warrant+Roundup PowerMax+Destiny HC+AMS
Ro-Neet SB + Betamix + Nortron+Warrant+Roundup PowerMax+Destiny HC+AMS
Eptam + Roundup PowerMax+AMS
Ro-Neet SB + Eptam + Roundup PowerMax+AMS
10
11
12
13
14
15
16
17
18
19
20
Treatment and Application
Revenue % of Means

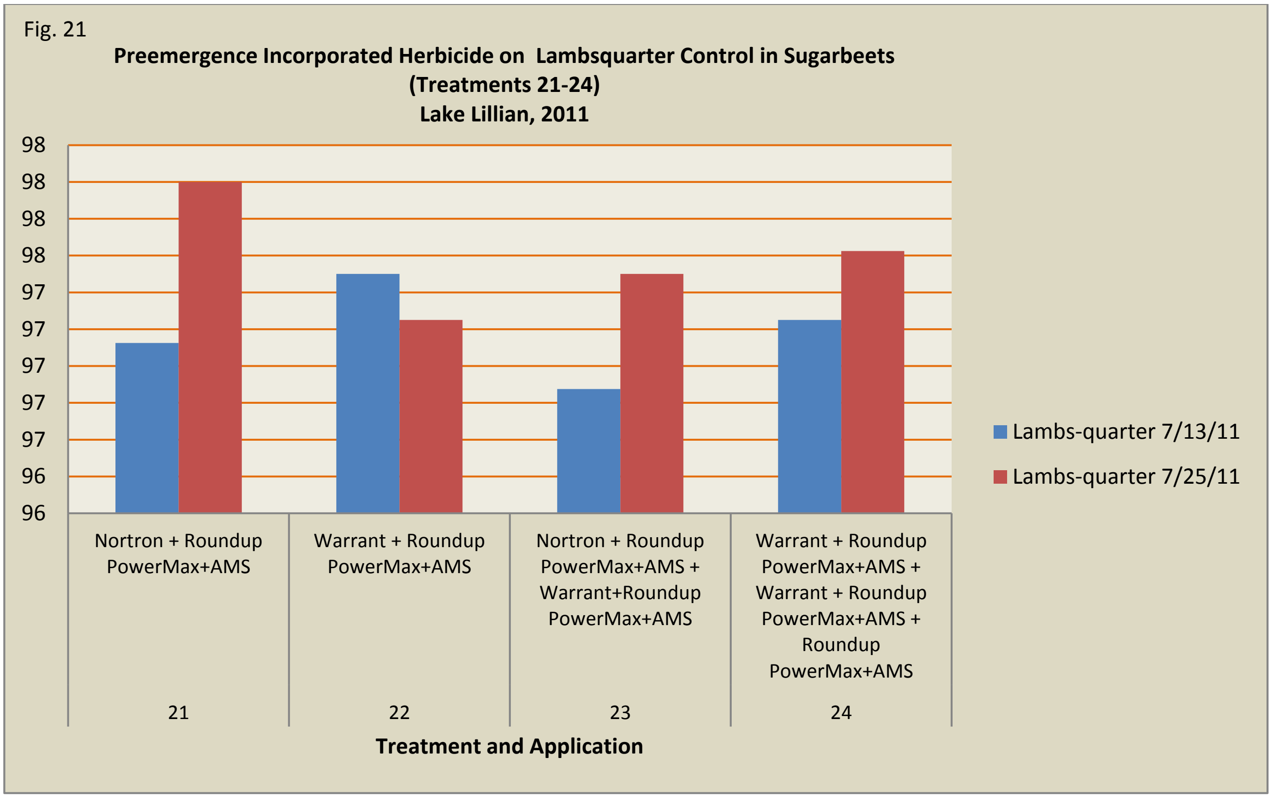
Fig. 21
Preemergence Incorporated Herbicide on Lambsquarter Control in Sugarbeets
(Treatments 21-24)
Lake Lillian, 2011
98
98
98
98
97
97
97
97
97
96
96
Nortron + Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS
Nortron + Roundup PowerMax+AMS + Warrant+Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS + Warrant + Roundup PowerMax+AMS + Roundup PowerMax+AMS
21
22
23
24
Treatment and Application
Lambs-quarter 7/13/11
Lambs-quarter 7/25/11

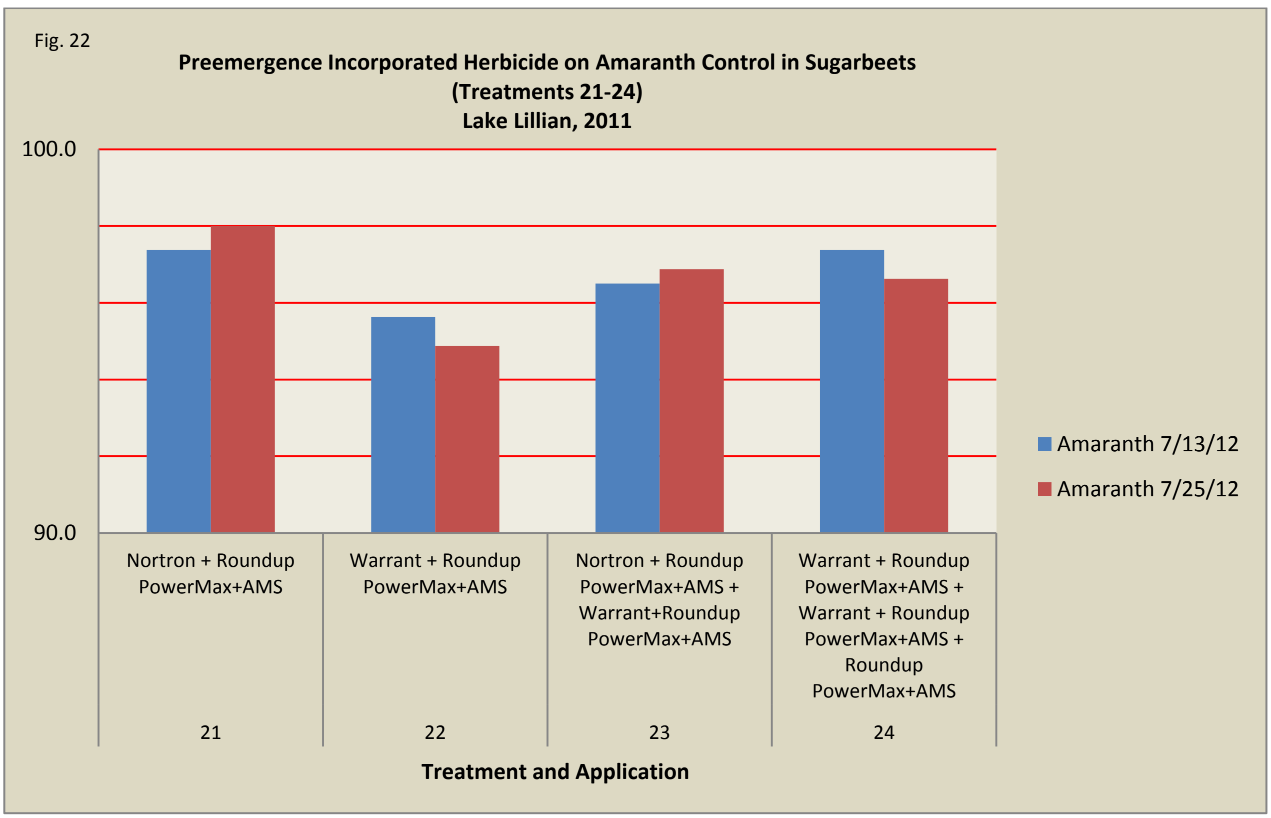
Fig. 22
Preemergence Incorporated Herbicide on Amaranth Control in Sugarbeets
(Treatments 21-24)
Lake Lillian, 2011
100.0
90.0
Nortron + Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS
Nortron + Roundup PowerMax+AMS + Warrant+Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS + Warrant + Roundup PowerMax+AMS + Roundup PowerMax+AMS
21
22
23
24
Treatment and Application
Amaranth 7/13/12
Amaranth 7/25/12

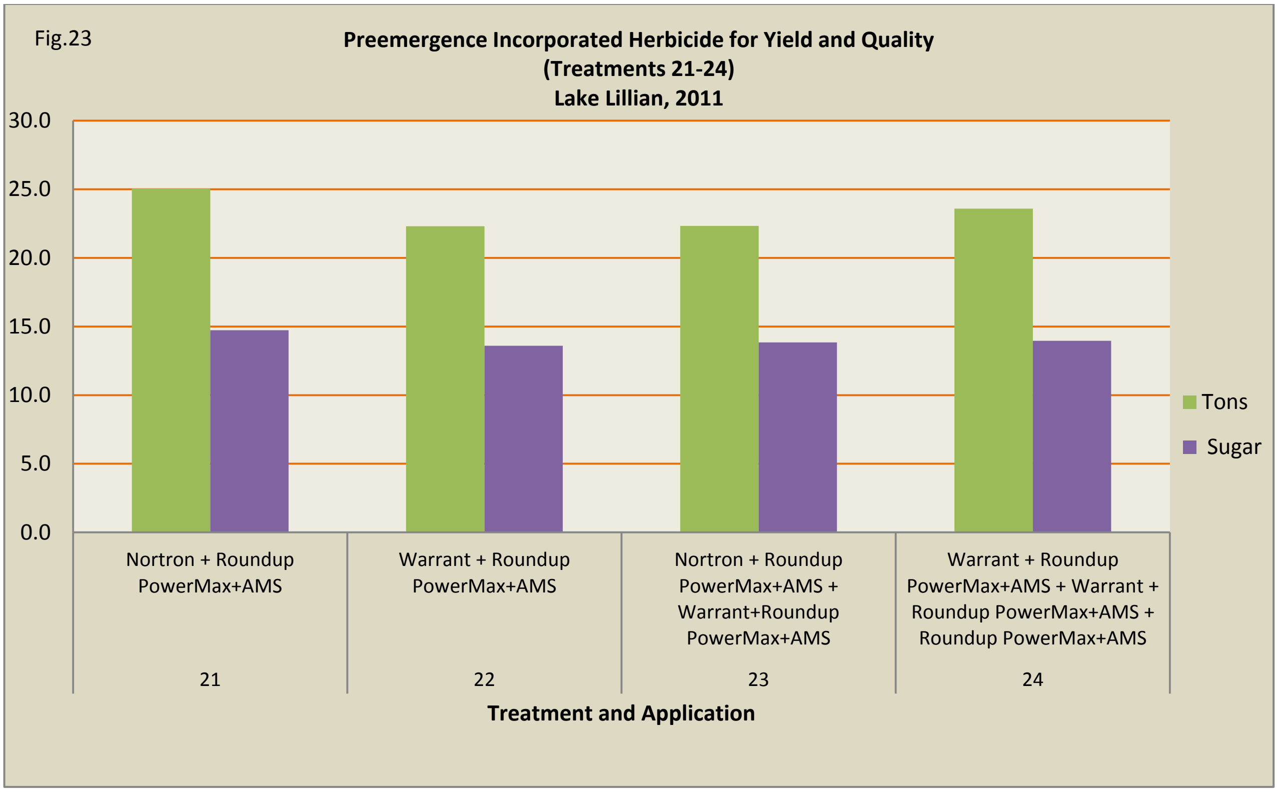
Fig.23
Preemergence Incorporated Herbicide for Yield and Quality
(Treatments 21-24)
Lake Lillian, 2011
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Tons
Sugar
Nortron + Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS
Nortron + Roundup PowerMax+AMS + Warrant+Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS + Warrant + Roundup PowerMax+AMS + Roundup PowerMax+AMS
21
22
23
24
Treatment and Application

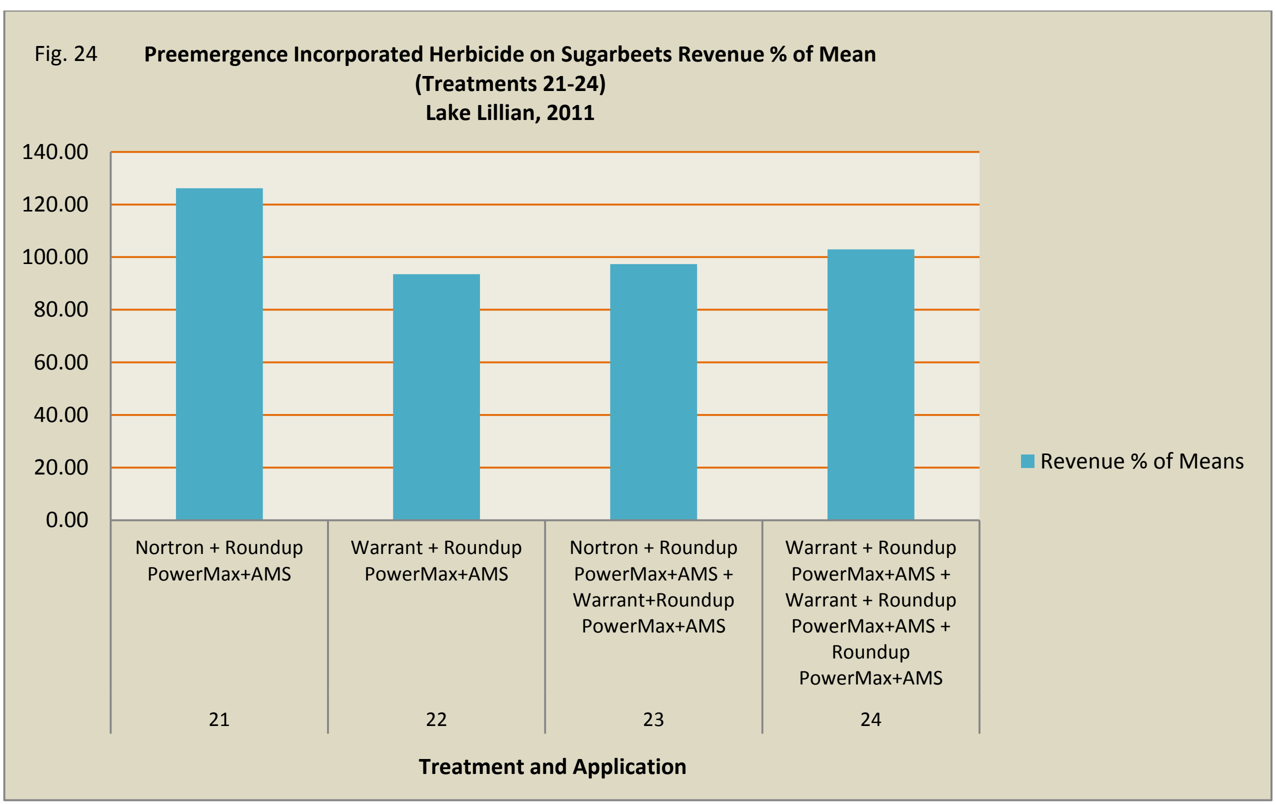
Fig. 24
Preemergence Incorporated Herbicide on Sugarbeets Revenue % of Mean
(Treatments 21-24)
Lake Lillian, 2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Revenue % of Means
Nortron + Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS
Nortron + Roundup PowerMax+AMS + Warrant+Roundup PowerMax+AMS
Warrant + Roundup PowerMax+AMS + Warrant + Roundup PowerMax+AMS + Roundup PowerMax+AMS
21
22
23
24
Treatment and Application

Evaluation of Optimal Weed Control Timing in a Glyphosate Weed Control System-2011

The optimal timing of weed control has been an issue of discussions relative to efficacy of weed control and optimizing production. Comparisons relative to timing of glyphosate application based on weed height has shown earlier application to be more productive. The question arises of whether the addition of preplant incorporated or pre-emergence herbicides would enhance the formation of a glyphosate weed control system. The following research investigates the use of preplant incorporated or pre-emergence herbicides considering the timing of glyphosate application.

Methods

Table 1 and 2 shows the specifics of activities conducted at each of the sites conducted in 2011 at Sacred Heart and Lake Lillian, MN, respectively. Plots were 11 ft. (6 rows) wide and 30 ft. long. Sugarbeet stands were 180-200 plants/100 ft. and were not thinned. Sugarbeets were harvested with a 2 row harvester at both locations. Rows 3 and 4 of the 6 row plot were harvested and the complete length of the plot was harvested. Weights were collected on the harvester and used to calculate yield per acre and a subsample was taken on the harvester to be analyzed for quality in the SMBSC quality lab.

The tests were replicated 4 times and conducted in a randomized complete block experimental design. Evaluation of weed control was conducted as indicated in the weed control evaluation data tables.

The treatments were initiated by weed stage. The timing of treatments is designated in the data tables. Treatments were applied in 14 GPA mix at 40 psi.

Results and Discussion

Statistical analysis was conducted of homogeneity of combinability and determined that the two sites could not be combined. The data is arranged in separate tables showing weed control in a table and production variables; tons per acre, sugar percent, purity, extractable sucrose per acre and revenue per acre expressed as revenue percent of mean for each site is another table. Revenue percent of mean is calculated by taking the experiment mean for revenue per acre divided by treatment revenue per acre multiplied by 100. The discussion will refer to the glyphosate chemistry and will not be specific to a single product name. The rates given however are specific to Roundup Power Max which is a 4.5 a.e. product. The discussion of the results is as follows. Figures 1-6 are presented to give the reader a visual view of the results. These figures will not be referred to directly in the discussion.

<u>Sacred Heart, MN- *location*</u>

(Table 3&4)

Weed control was similar regardless of the treatment. Tons per acre, purity and extractable sucrose per acre were not significantly influenced. Sugar content was similar for most treatments except for treatment 3. This difference does not appear to be a typical response to the treatment and probably is a variance within testing. Revenue percent of mean was enhanced by the presence of Warrant in the spray as a pre-emergence application. The next best treatment included Outlook as a layby treatment with the first application of Roundup Power Max and ammonium sulfate.

Lake Lillian, MN- *location*

(Table 5&6)

All treatments gave inadequate control of common lambsquarter and amaranth species except treatment 2 and 3 which had Warrant applied pre-emergence. Treatment 2 and 3 gave control of common lambsquarter and amaranth species approximately 30% higher. There was a difference in the influence expressed on tons per acre and sugar percent by treatments. Tons per acre influenced to greater degree than sugar percent. Tons per acre were influenced by the presence of Warrant herbicide applied pre-emergence or Outlook and Dual Magnum applied layby in the first application of Round-up Power Max. However, the treatment with the highest revenue was Round-up Power Max plus ammonium sulfate applied at .75 lb. a.e. /acre at the 2 and 6 leaf sugarbeet stage.

General comments

1. General weed control was good. The weeds observed did not express any obvious symptoms of resistance to glyphosate

2. Revenue tended to increase when a preplant, pre-emergence or layby herbicide was applied in conjunction with Round-up Power Max (glyphosate).

3. Production tended to be best when a preplant or pre-emergence herbicide was applied with the Round-up Power Max.

Table 1. Site Specifics for Weed Removal Timing Testing
Sacred Heart, 2011

DATE	PLANTED	VARIETY	SPACING	SOIL	SPRAYED	APPLIED	RATE	WEATHER
5/19/2011	X	98RR08	4 9/16"	Lumpy		10-34-0	3 gpa	
5/19/2011					X	Pre-emergence		Cloudy 70' SE-15-20
6/4/2011					X	Assana	4 oz.	Sunny 75" NW-15
						Quadris	14.7 oz.	
6/14/2011					X	Select Max	9 oz.	Cloudy 70' SE-11
6/16/2011					X	Application B		Sunny 70' S-10
						Application C		
6/28/2011					X	Application D		Sunny 67' S-5, RH 75%
7/1/2011						Application E		Sunny 79' W-5 RH 85%
7/20/2011					X	Proline + NIS		SE-15-20
8/3/2011					X	Agritin	8 oz.	Pcloudy 84' N-3
						Powermax	32 oz.	
						Manzate	2 lbs	
8/18/2011					X	Gem	3.5 oz.	

Table 2. Site Specifics for Weed Removal Timing Testing
Lake Lillian, 2011

DATE	PLANTED	VARIETY	SPACING	SOIL	SPRAYED	APPLIED	RATE	WEATHER
5/4/2011	X	98RR08	4 9/16"	Lumpy		10-34-0	3 gpa	
5/6/2011					X	Pre-emergence		Cloudy 70' SE-10
6/9/2011					X	Application B		Cloudy 57' RH 65% NE-10
6/16/2011						Application C		Sunny 70' S-10
7/1/2011					X	Application D		Sunny 82' W-5 RH 85%
						Application E		
7/26/2011					X	Proline	5.7 oz.	Cloudy 70' E-7
8/3/2011					X	Agritin	8 oz.	Sunny 83' SE-8
						Manzate	2 lbs	
8/22/2011					X	Gem	3.5 oz.	Sunny 74' S-6
						Powermax	32 oz.	

Table 3 . Effect of Weed Removal Timing on Weed Control and Glyphosate Resistant Sugarbeets Yield and Quality
Sacred Heart, 2011

Trt	Product	Rate (oz/acre)	Timing	% Lambs-quarter	% Amaranth
1	RoundUp PowerMax	0.75 ae #/a	2&6 LF	98	98
	AMM-Sulfate	2% w/w			
2	Warrant	1.125 ai #/a	Pre	98	98
	RoundUp PowerMax	0.75 ae #/a	4 &8 LF		
	AMM-Sulfate	2% w/w			
3	Warrant	1.125 ai #/a	Pre	98	98
	RoundUp PowerMax	0.75 ae #/a	2 LF		
	AMM-Sulfate	2% w/w			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
4	Warrant	1.125 ai #/a		97	98
	RoundUp PowerMax	0.75 ae #/a	2 LF		
	AMM-Sulfate	2% w/w			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
5	RoundUp PowerMax	0.75 ae #/a	2 LF	98	98
	AMM-Sulfate	2% w/w			
	Warrant	1.125 ai #/a			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
6	RoundUp PowerMax	0.75 ae #/a	2 lF	98	98
	AMM-Sulfate	2% w/w			
	Outlook	0.98 ai #/a			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
7	RoundUp PowerMax	0.75 ae #/a	2 LF	98	97
	AMM-Sulfate	2% w/w			
	Outlook	0.98 ai #/a			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
8	RoundUp PowerMax	0.75 ae #/a		98	98
	AMM-Sulfate	2% w/w	2 LF		
	Dual Magnum	7.64lb/gal			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
9	RoundUp PowerMax	0.75 ae #/a		98	98
	AMM-Sulfate	2% w/w	2 LF		
	AMM-Sulfate	2% w/w			
	Dual Magnum	1.91 a.i. lb/a	6 lf		
	RoundUp PowerMax	0.75 ae #/a			
10	RoundUp PowerMax	0.75 ae #/a	2 LF	98	98
	AMM-Sulfate	2% w/w			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
			CV	0.6	0.5
			LSD (0.05)	0.8	0.7

Table 4. Effect of Weed Removal Timing on Weed Control and Glyphosate Resistant Sugarbeets Yield and Quality
Sacred Heart, 2011

Trt	Product	Rate (oz/acre)	Timing	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	RoundUp PowerMax	0.75 ae #/a	2 & 6 LF	21.4	14.44	86.54	4860	102.55
	AMM-Sulfate	2% w/w						
2	Warrant	1.125 ai #/a	Pre	19.1	14.43	85.99	4292	90.38
	RoundUp PowerMax	0.75 ae #/a	4 & 8 LF					
	AMM-Sulfate	2% w/w						
3	Warrant	1.125 ai #/a	Pre	21.0	15.42	87.67	5206	120.41
	RoundUp PowerMax	0.75 ae #/a	2 LF					
	AMM-Sulfate	2% w/w						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
4	Warrant	1.125 ai #/a		20.4	13.78	85.81	4342	85.81
	RoundUp PowerMax	0.75 ae #/a	2 LF					
	AMM-Sulfate	2% w/w						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
5	RoundUp PowerMax	0.75 ae #/a		21.6	14.54	86.57	4937	106.08
	AMM-Sulfate	2% w/w	2 LF					
	Warrant	1.125 ai #/a						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
6	RoundUp PowerMax	0.75 ae #/a		21.9	14.96	86.21	5137	112.01
	AMM-Sulfate	2% w/w	2 LF					
	Outlook	0.98 ai #/a						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
7	RoundUp PowerMax	0.75 ae #/a		19.5	14.17	85.92	4292	88.24
	AMM-Sulfate	2% w/w	2 LF					
	Outlook	0.98 ai #/a						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
8	RoundUp PowerMax	0.75 ae #/a		21.3	14.19	86.12	4697	95.75
	AMM-Sulfate	2% w/w	2 LF					
	Dual Magnum	7.64lb/gal						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
9	RoundUp PowerMax	0.75 ae #/a		22.3	14.06	85.62	4834	99.37
	AMM-Sulfate	2% w/w	2 LF					
	AMM-Sulfate	2% w/w						
	Dual Magnum	1.91 a.i. lb/a	6 lf					
	RoundUp PowerMax	0.75 ae #/a						
10	RoundUp PowerMax	0.75 ae #/a	2 LF	21.0	14.51	86.31	4773	99.39
	AMM-Sulfate	2% w/w						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
			CV	15.0	4.82	1.44	15	17.37
			LSD (0.05)	4.6	1.01	1.81	1003	25.20

Table 5. Effect of Weed Removal Timing on Weed Control and Glyphosate Resistant Sugarbeets Yield and Quality
Lake Lillian, 2011

Trt	Product	Rate (oz/acre)	Timing	% Lambs-quarter	% Amaranth
1	RoundUp PowerMax	0.75 ae #/a	2&6 LF	64	64
	AMM-Sulfate	2% w/w			
2	Warrant	1.125 ai #/a	Pre	94	98
	RoundUp PowerMax	0.75 ae #/a	4&8 LF		
	AMM-Sulfate	2% w/w			
3	Warrant	1.125 ai #/a	Pre	94	96
	RoundUp PowerMax	0.75 ae #/a	2 LF		
	AMM-Sulfate	2% w/w			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
4	Warrant	1.125 ai #/a		64	65
	RoundUp PowerMax	0.75 ae #/a	2 LF		
	AMM-Sulfate	2% w/w			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
5	RoundUp PowerMax	0.75 ae #/a		64	65
	AMM-Sulfate	2% w/w	2 LF		
	Warrant	1.125 ai #/a			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
6	RoundUp PowerMax	0.75 ae #/a		65	65
	AMM-Sulfate	2% w/w	2 LF		
	Outlook	0.98 ai #/a			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
7	RoundUp PowerMax	0.75 ae #/a		64	65
	AMM-Sulfate	2% w/w	2 LF		
	Outlook	0.98 ai #/a			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
8	RoundUp PowerMax	0.75 ae #/a		65	65
	AMM-Sulfate	2% w/w	2 LF		
	Dual Magnum	7.64lb/gal			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
9	RoundUp PowerMax	0.75 ae #/a		65	65
	AMM-Sulfate	2% w/w	2 LF		
	AMM-Sulfate	2% w/w			
	Dual Magnum	1.91 a.i. lb/a	6 lf		
	RoundUp PowerMax	0.75 ae #/a			
10	RoundUp PowerMax	0.75 ae #/a	2 LF	63	65
	AMM-Sulfate	2% w/w			
	RoundUp PowerMax	0.75 ae #/a	6 LF		
	AMM-Sulfate	2% w/w			
			C.V	3	2
			LSD (0.05)	3	2

Table 6. Effect of Weed Removal Timing on Weed Control and Glyphosate Resistant Sugarbeets Yield and Quality
Lake Lillian, 2011

Trt	Product	Rate (oz/acre)	Timing	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	RoundUp PowerMax	0.75 ae #/a	2&6 LF	12.7	13.76	85.64	2683	85.32
	AMM-Sulfate	2% w/w						
2	Warrant	1.125 ai #/a	Pre	16.4	13.68	85.04	3418	107.67
	RoundUp PowerMax	0.75 ae #/a	4&8 LF					
	AMM-Sulfate	2% w/w						
3	Warrant	1.125 ai #/a	Pre	13.6	14.29	85.00	2973	101.79
	RoundUp PowerMax	0.75 ae #/a	2 LF					
	AMM-Sulfate	2% w/w						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
4	Warrant	1.125 ai #/a		14.1	12.86	85.27	2763	96.03
	RoundUp PowerMax	0.75 ae #/a	2 LF					
	AMM-Sulfate	2% w/w						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
5	RoundUp PowerMax	0.75 ae #/a		17.1	13.35	84.80	3463	106.29
	AMM-Sulfate	2% w/w	2 LF					
	Warrant	1.125 ai #/a						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
6	RoundUp PowerMax	0.75 ae #/a		12.5	13.79	86.17	2686	91.61
	AMM-Sulfate	2% w/w	2 LF					
	Outlook	0.98 ai #/a						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
7	RoundUp PowerMax	0.75 ae #/a		15.5	13.31	84.65	3119	96.37
	AMM-Sulfate	2% w/w	2 LF					
	Outlook	0.98 ai #/a						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
8	RoundUp PowerMax	0.75 ae #/a		15.7	13.81	85.06	3311	106.15
	AMM-Sulfate	2% w/w	2 LF					
	Dual Magnum	7.64lb/gal						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
9	RoundUp PowerMax	0.75 ae #/a		14.6	13.45	84.92	2975	90.25
	AMM-Sulfate	2% w/w	2 LF					
	AMM-Sulfate	2% w/w						
	Dual Magnum	1.91 a.i. lb/a	6 lf					
	RoundUp PowerMax	0.75 ae #/a						
10	RoundUp PowerMax	0.75 ae #/a	2 LF	16.8	13.58	85.69	3512	118.52
	AMM-Sulfate	2% w/w						
	RoundUp PowerMax	0.75 ae #/a	6 LF					
	AMM-Sulfate	2% w/w						
			C.V	12.8	4.30	1.70	16	21.59
			LSD (0.05)	3.8	0.85	2.10	986	31.19

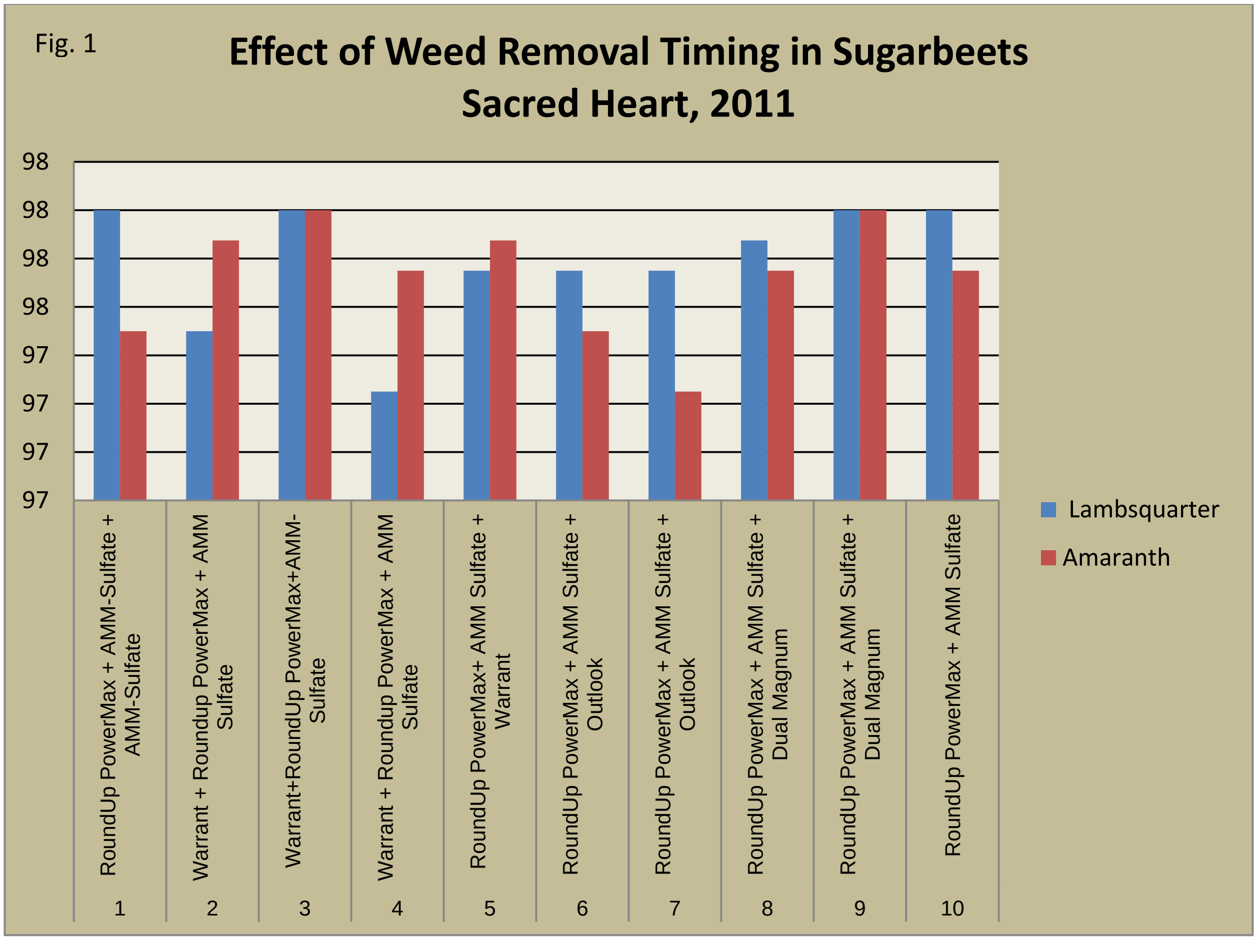

Fig. 1
Effect of Weed Removal Timing in Sugarbeets
Sacred Heart, 2011
98
98
98
98
97
97
97
97
RoundUp PowerMax + AMM-Sulfate + AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
Warrant+RoundUp PowerMax+AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
RoundUp PowerMax+ AMM Sulfate + Warrant
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate
1
2
3
4
5
6
7
8
9
10
Lambsquarter
Amaranth

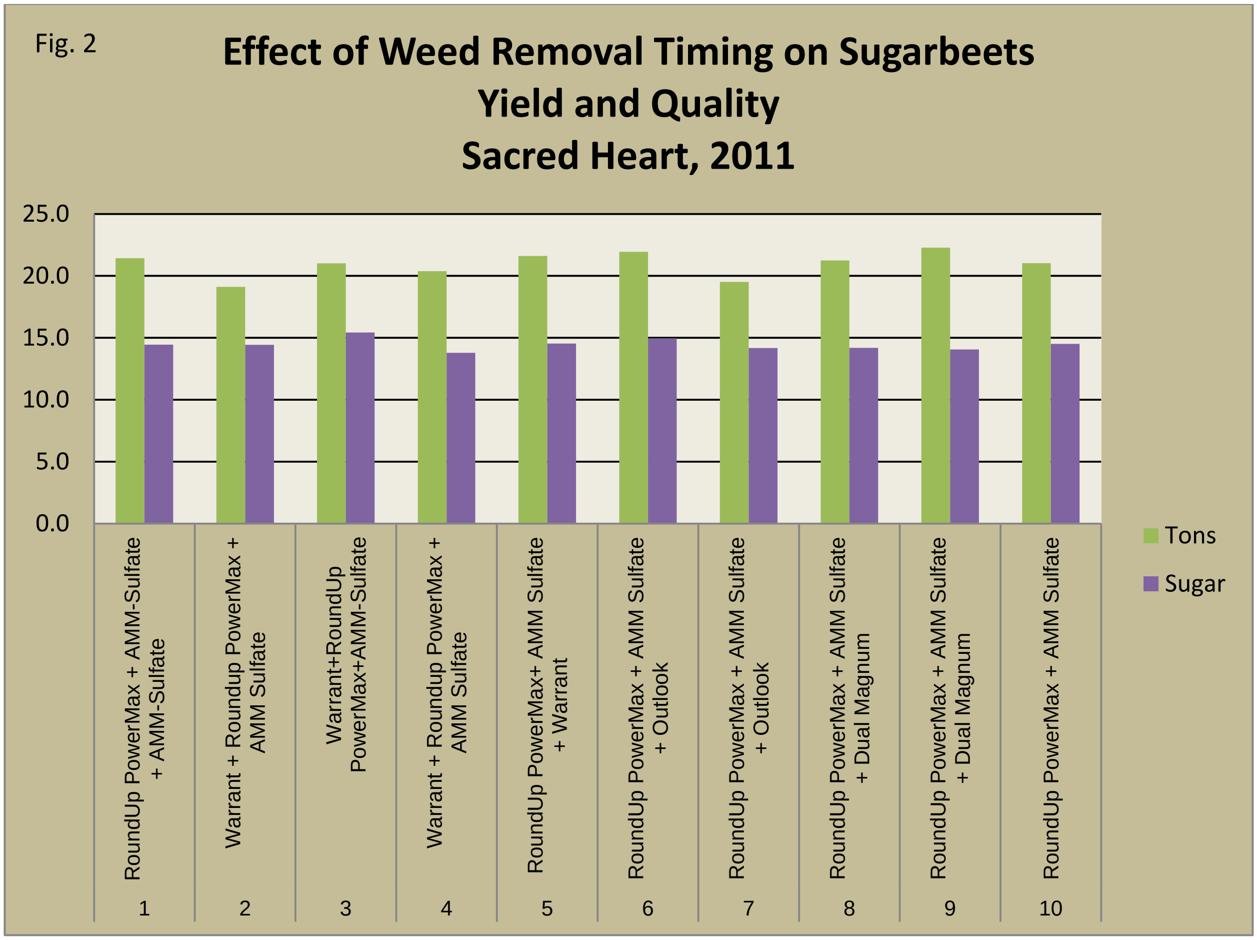

Fig. 2
Effect of Weed Removal Timing on Sugarbeets
Yield and Quality
Sacred Heart, 2011
25.0
20.0
15.0
10.0
5.0
0.0
RoundUp PowerMax + AMM-Sulfate + AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
Warrant+RoundUp PowerMax+AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
RoundUp PowerMax+ AMM Sulfate + Warrant
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate
1
2
3
4
5
6
7
8
9
10
Tons
Sugar

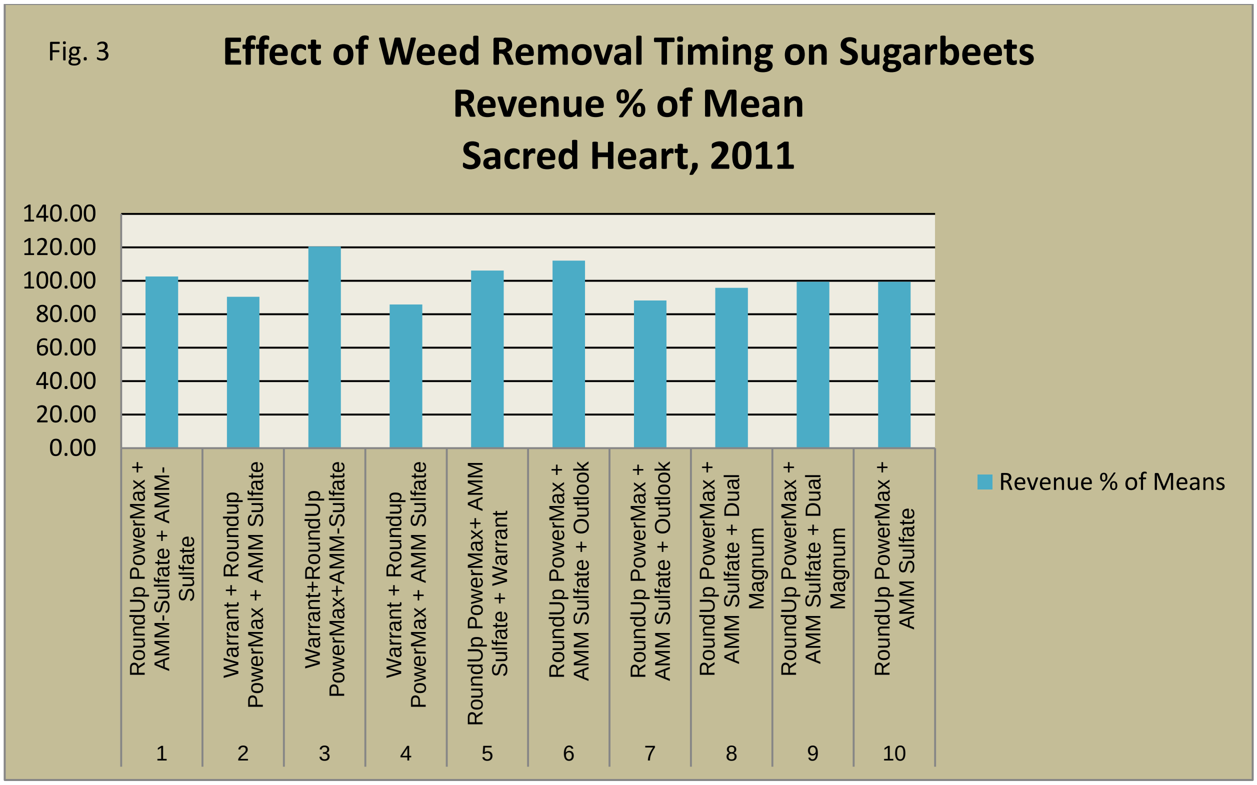

Fig. 3
Effect of Weed Removal Timing on Sugarbeets
Revenue % of Mean
Sacred Heart, 2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
RoundUp PowerMax + AMM-Sulfate + AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
Warrant+RoundUp PowerMax+AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
RoundUp PowerMax+ AMM Sulfate + Warrant
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate
1
2
3
4
5
6
7
8
9
10
Revenue % of Means

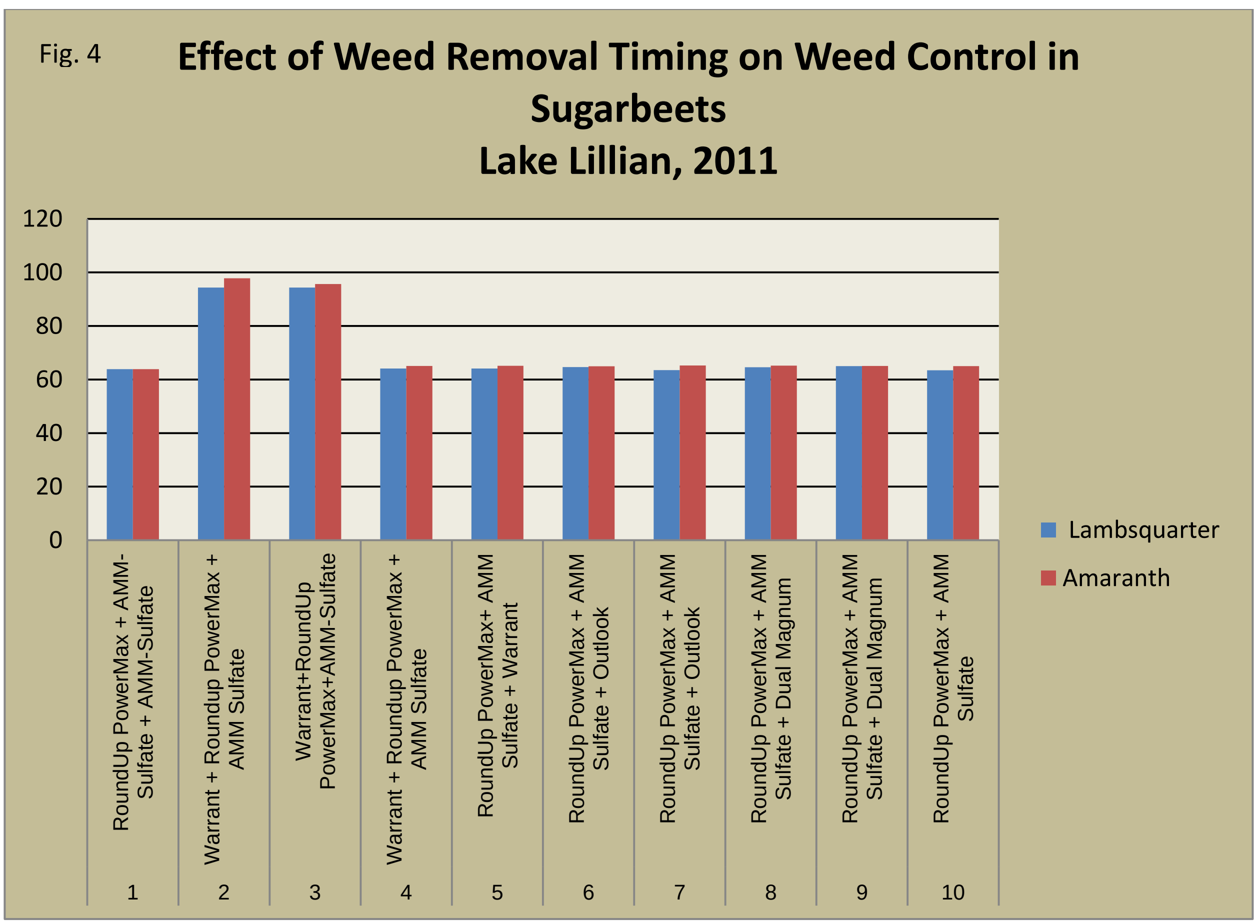

Fig. 4
Effect of Weed Removal Timing on Weed Control in Sugarbeets
Lake Lillian, 2011
120
100
80
60
40
20
0
RoundUp PowerMax + AMM-Sulfate + AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
Warrant+RoundUp PowerMax+AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
RoundUp PowerMax+ AMM Sulfate + Warrant
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate
1
2
3
4
5
6
7
8
9
10
Lambsquarter
Amaranth

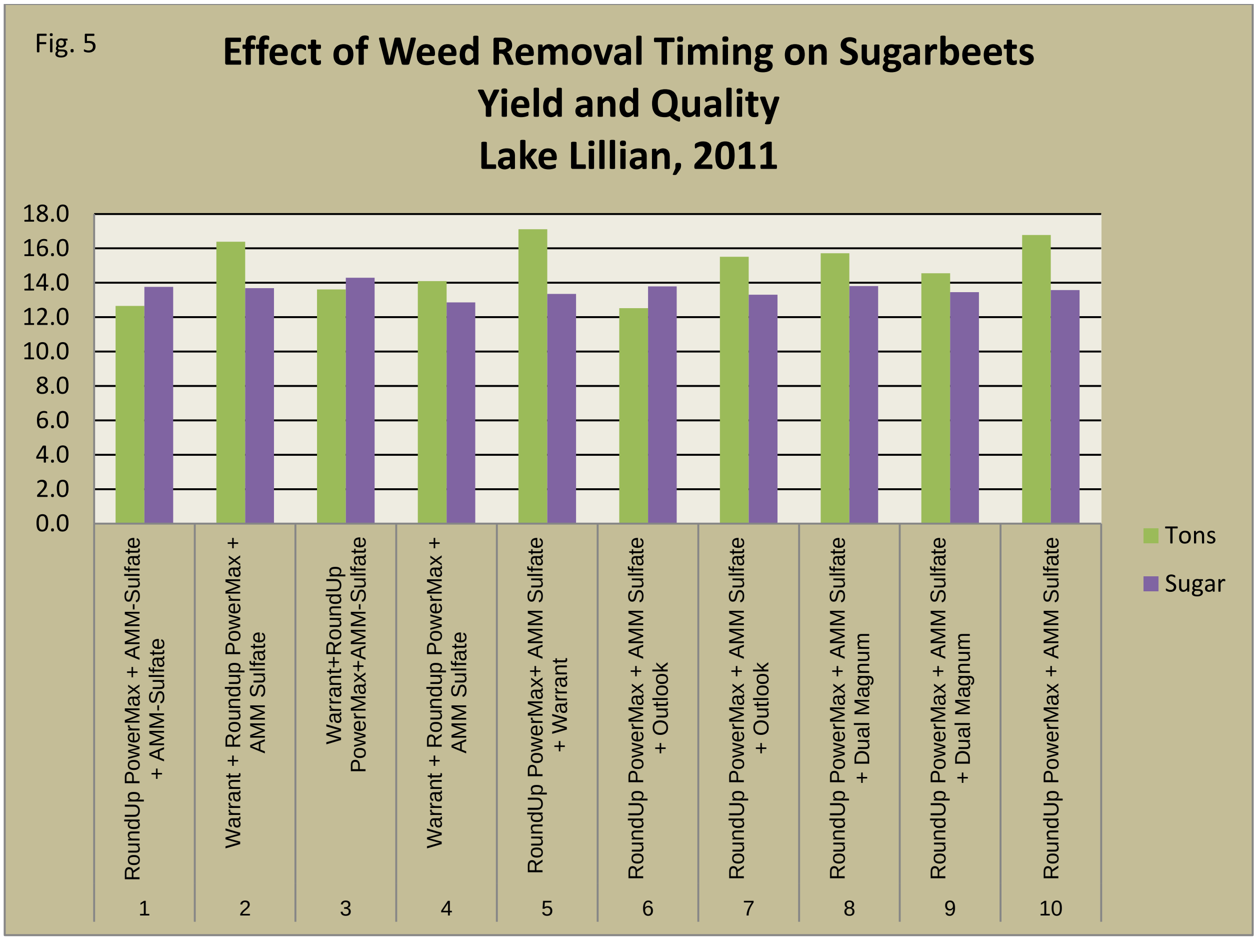
Fig. 5
Effect of Weed Removal Timing on Sugarbeets
Yield and Quality
Lake Lillian, 2011
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
RoundUp PowerMax + AMM-Sulfate + AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
Warrant+RoundUp PowerMax+AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
RoundUp PowerMax+ AMM Sulfate + Warrant
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate
1
2
3
4
5
6
7
8
9
10
Tons
Sugar

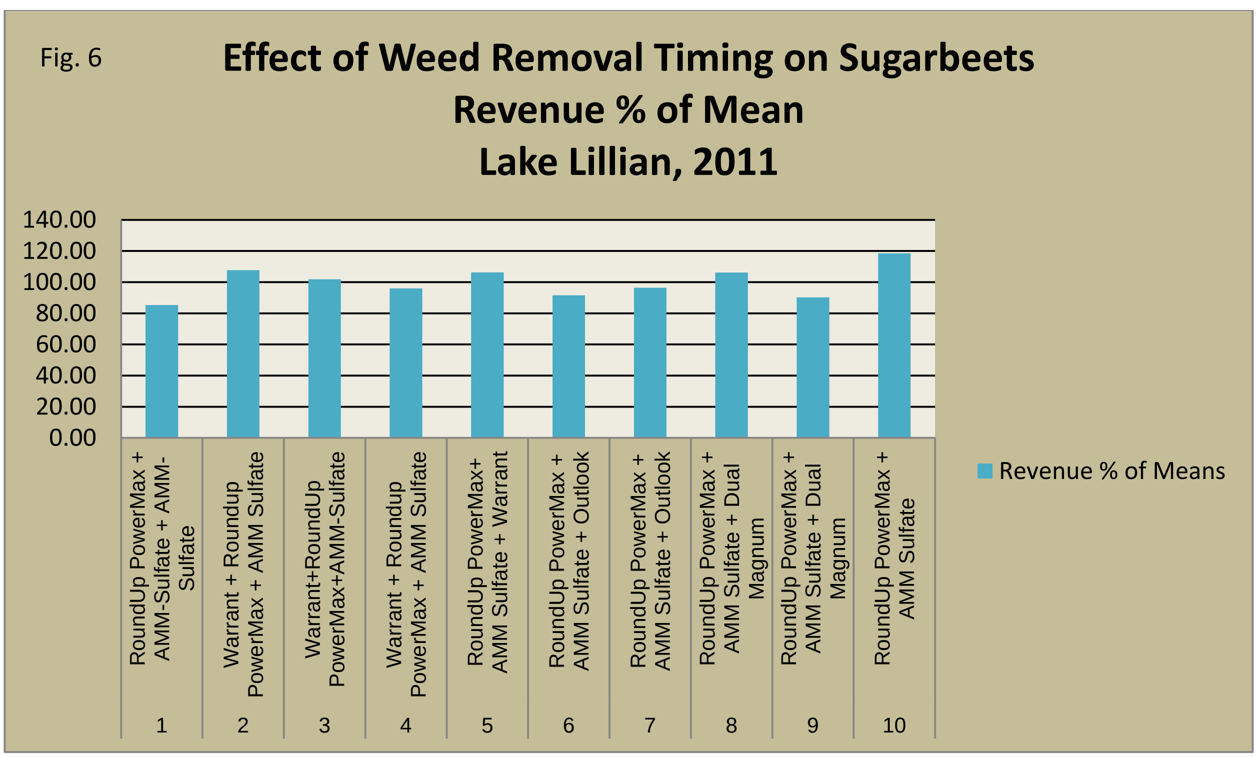
Fig. 6
Effect of Weed Removal Timing on Sugarbeets
Revenue % of Mean
Lake Lillian, 2011
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
RoundUp PowerMax + AMM-Sulfate + AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
Warrant+RoundUp PowerMax+AMM-Sulfate
Warrant + Roundup PowerMax + AMM Sulfate
RoundUp PowerMax+ AMM Sulfate + Warrant
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Outlook
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate + Dual Magnum
RoundUp PowerMax + AMM Sulfate
1
2
3
4
5
6
7
8
9
10
Revenue % of Means

Comparison of Conventional and Glyphosate Weed Control System on Weed Control and Sugar Beet Production, 2010-2011

Weed control in sugar beets has changed significantly over the past years. Comparisons continue to be made in reference to the two systems related to the influence of the herbicides and variety comparisons. A test was initiated in 2010 to investigate the question of differences when considering these comparisons.

Methods

Table 1-4 show the specifics of activities conducted at each of the 4 sites conducted. The test was conducted in 2010 at Clara City and Renville, MN, and 2011 at Sacred Heart and Lake Lillian, MN. Plots were 11 ft. (6 rows) wide and 35 ft. long. Sugarbeet stands were 180-200 plants/100 ft. and were not thinned. Sugarbeets were harvested with a 2 row harvester at all locations. Rows 3 and 4 of the 6 row plot were harvested and the complete length of the plot was harvested. Weights were collected on the harvester and used to calculate yield per acre and a subsample was taken on the harvester to be analyzed for quality in the SMBSC quality lab.

The tests were replicated 4 times and conducted in a randomized complete block experimental design. Evaluation of weed control was conducted at different timings as indicated in the weed control evaluation data tables.

The treatments were initiated by weed stage for both conventional and glyphosate system scenarios. The timing of treatments is designated in the data tables 5-9. Treatments were applied in 14 GPA mix at 40 psi. Post emergence conventional herbicides were applied to cotyledon weeds. Glyphosate product used in this experiment was Roundup Power Max and was applied to 2 inch weeds and again when sugar beets were 6-8 leaf stage.

Three different varieties were used in this testing. There were two conventional varieties (germplasm 1 and germplasm 2) and one glyphosate tolerant variety (RRSB H7-1). One of the glyphosate tolerant varieties is close genetically to the glyphosate tolerant variety. The conventional varieties did not perform significantly different so the two conventional varieties will be discussed as one.

Results and Discussion

Statistical analysis was conducted of homogeneity of combinability and determined that the four sites could not be combined. The results relative to the influence of the treatments were similar disregarding the magnitude differential. Therefore, the results will be discussed in general and not specific to one location. Revenue percent of mean is calculated by taking the experiment mean for revenue per acre divided by treatment revenue per acre multiplied by 100. The discussion will refer to the glyphosate chemistry and will not be specific to a single product name. The rates given however are specific to Roundup Power Max which is a 4.5 a.e. product.

The discussion of the results is as follows and is discussed in general.

1. Weed control tended to greater with glyphosate herbicides systems than with conventional herbicide system.

2. Glyphosate tolerant variety generally performs better than the conventional variety.

3. Percent revenue for conventional variety 1 was greater than conventional variety 2

4. The glyphosate tolerant variety tended to performed similar whether conventional or glyphosate herbicides were applied. Although, there was a greater frequency for the variety to have higher production when glyphosate herbicides were applied compared to when conventional herbicides were applied.

5. The statements from points 3 and 4 indicate that in these tests the reduction in production comparing conventional vs. glyphosate systems was due to the herbicide effect and not due to the variety performance.

6. At all sites the 32 oz. /acre rate of glyphosate (Power Max) in the first application or the addition of a soil active herbicide (Outlook or Warrant) tended to increase percent revenue compared to not using the soil active herbicide or using glyphosate at 22 oz. /acre rate in the first application. This indicates the importance of obtaining effective early control in sugar beets.

Table 1. Site Specific for Weed Control Evaluation of Glyphosate vs. Conventional System Renville, 2010

DATE	PLANTED	SPACING	SOIL	SPRAYED	WEATHER
4/21/2010	X	4 3/8'	MOIST		
5/14/2010				Conv App 1	55' Cloudy RH 55% wind 10-15
5/24/2010				Conv App 2	78' Pcloudy RH 70% wind 10
5/31/2010				Conv App 3	65' Pcloudy RH 75% wind 5-10
6/7/2010				Conv App 4	75' Pcloudy RH 80% wind 0-5
5/24/2010				RR 2 inch app	78' Pcloudy RH 70% wind 10
5/31/2010				RR 4 LF app	78' Pcloudy RH 75% wind 10
6/4/2010				RR 6 LF app	80' Pcloudy RH 75% wind 10

Table 2. Site Specific for Weed Control Evaluation of Glyphosate vs. Conventional System Clara City, 2010

DATE	PLANTED	SPACING	SOIL	SPRAYED	WEATHER
4/22/2010	X	4 3/8"	Moist		
5/14/2010				Conv App 1	50' Cloudy RH 50% w ind 15
5/24/2010				Conv App 2	70' Cloudy RH 70% w ind 10
5/31/2010				Conv App 3	60' Cloudy RH 75% w ind 5-10
6/7/2010				Conv App 4	70' Sunny RH 85% w ind 0-5
5/24/2010				RR 2 inch w eeds	78' PCloudy RH 70% w ind 10
5/31/2010				RR 4 LF	78' PCloudy RH 75% w ind 10
6/4/2010				RR 6 LF	75' PCloudy RH 70% w ind 10
6/21/2010				RR 2 inch w eeds	80' Sunny RH 80% w ind 0-5

Table 3. Site Specific for Weed Control Evaluation of Glyphosate vs. Conventional System Sacred Heart, 2011

DATE	PLANTED	SPACING	SOIL	APPLIED	WEATHER
5/19/2011	X	4 9/16"	Lumpy	10-34-0 (3 gpa)	
5/19/2011				Application B	Cloudy 70' SE-15-20
6/3/2011				Application A	Sunny 70' W-5
6/16/2011				Application A	Sunny 70' S-10
6/28/2011				Application D	Sunny 62' W-5
				Application E	

Table 4. Site Specific for Weed Control Evaluation of Glyphosate vs. Conventional System
Lake Lillian, 2011

DATE	PLANTED	SPACING	SOIL	APPLIED	WEATHER
5/4/2011	X	4 9/16"	Lumpy	10-34-0 (3gpa)	Cloudy 70' SE-10
5/4/2011				Application B	Cloudy 71' SW-5
6/1/2011				Application A	Sunny W-10-15
6/28/2011				Application E	Sunny 61' RH 60% Calm

TABLE 5. Evaluation of Glyphosate System Compared to Conventional Herbicide System
Renville, 2010

Trt	Type	Product	Mix Rate	Appl Code	Appl. Stage	68 DAP % Lambs-quarter	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Conv. Germplasm 1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	95	21.4	15.93	88.67	5579	93.36
2	Conv. Germplasm 2	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	90	18.9	15.86	87.98	4851	80.04
3	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	92	25.3	15.70	88.55	6485	106.70
4	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	97	24.9	15.32	88.29	6164	97.99
5	RRSB H7-1	Roundup fb Roundup	0.75 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	95	26.4	15.95	88.61	6855	114.24
6	RRSB H7-1	Roundup fb Roundup	1.125 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	97	29.0	15.80	88.72	7507	124.63
7	RRSB H7-1	Nortron fb Roundup	3.75 lb ai/ac fb 0.75 lb ae/ac	B/D	Pre emergent and 4 leaf beet	89	24.9	15.69	89.38	6520	109.46
8	RRSB H7-1	Roundup fb Roundup + Stinger	1.125 lb ae/ac fb 0.75 lb ae/ac + 0.093 qt/ac	C/E	1-2 inch WEED & then 6lf SB	95	24.6	15.53	88.11	6211	100.70
9	RRSB H7-1	Roundup fb Roundup +Outlook	0.75 lb ae/ac fb 0.75 lb ae/ac + 21 oz	C/E	1-2 inch WEED & then 6lf SB	86	27.3	15.39	87.87	6806	108.95
10	RRSB H7-1	Roundup fb Roundup+Warrant (MON)	0.75 lb ae/ac fb 1.125 lb ae/ac	C/E	1-2 inch& then 6lf SB	80	26.6	15.92	88.63	6918	115.42
11	RRSB H7-1	Untreated Check				0	8.2	17.15	96.11	2547	48.52
					C.V	18	17.6	4.75	2.58	19	21.84
					LSD (0.05)	21	6.0	NS	3.33	1659	31.54

A. LOCAL STANDARD TIMINGS
B. PRE-EMERGENCE APP.
C. EPO 1-2 LF WEED 2 LF BEETS
D. MPO 4 LF BEETS
E. SECOND APP 6 LF BEETS

TABLE 6. Evaluation of Glyphosate System Compared to Conventional Herbicide System
Clara City, 2010

Trt	Type	Product	Mix Rate	Appl Code	Appl. Stage	68 DAP % Lambs-quarter	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Means
1	Conv. Germplasm 1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	98	23.3	12.90	81.03	4225	72.90
2	Conv. Germplasm 2	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	92	21.1	12.47	81.68	3737	60.76
3	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	73	29.6	11.95	84.71	5303	88.95
4	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	87	30.8	12.23	85.84	5757	105.52
5	RRSB H7-1	Roundup fb Roundup	0.75 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	99	34.2	12.07	85.06	6246	108.95
6	RRSB H7-1	Roundup fb Roundup	1.125 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	84	35.2	12.28	86.71	6729	128.42
7	RRSB H7-1	Nortron fb Roundup	3.75 lb ai/ac fb 0.75 lb ae/ac	B/D	Pre emergent and 4 leaf beet	86	33.8	11.99	85.18	6141	105.93
8	RRSB H7-1	Roundup fb Roundup + Stinger	1.125 lb ae/ac fb 0.75 lb ae/ac + 0.093 qt/ac	C/E	1-2 inch WEED & then 6lf SB	85	36.1	12.30	85.07	6735	122.52
9	RRSB H7-1	Roundup fb Roundup +Outlook	0.75 lb ae/ac fb 0.75 lb ae/ac + 21 oz	C/E	1-2 inch WEED & then 6lf SB	99	38.0	12.54	86.16	7360	143.72
10	RRSB H7-1	Roundup fb Roundup+Warrant (MON)	0.75 lb ae/ac fb 1.125 lb ae/ac	C/E	1-2 inch& then 6lf SB	98	36.1	12.43	86.07	6926	132.71
11	RRSB H7-1	Untreated Check				0	9.0	11.93	86.48	1659	29.63
					C.V	22	4.9	3.85	1.53	8	18.37
					LSD (0.05)	26	2.1	0.68	NS	661	26.53

A. LOCAL STANDARD TIMINGS
B. PREMEMERGENT APP.
C. EPO 1-2 LF WEED 2 LF BEETS
D. MPO 4 LF BEETS
E. SECOND APP 6 LF BEETS

TABLE 7. Evaluation of Glyphosate System Compared to Conventional Herbicide System
Sacred Heart, 2011

Trt	Type	Product	Mix Rate	Appl Code	Appl. Stage	68 DAP % Lambs-quarter	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs)	Revenue % of Mean
1	Conv. Germplasm 1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	83	16.5	13.99	81.80	3345	75.86
2	Conv. Germplasm 2	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	90	13.9	14.08	82.52	2906	68.86
3	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	97	17.8	14.72	86.10	4110	109.10
4	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	96	14.8	14.82	86.86	3550	97.23
5	RRSB H7-1	Roundup fb Roundup	0.75 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	97	17.6	13.98	85.45	3801	93.37
6	RRSB H7-1	Roundup fb Roundup	1.125 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	98	18.5	14.48	86.59	4218	110.48
7	RRSB H7-1	Nortron fb Roundup	3.75 lb ai/ac fb 0.75 lb ae/ac	B/D	Pre emergent and 4 leaf beet	98	18.2	14.39	86.40	4088	105.45
8	RRSB H7-1	Roundup fb Roundup + Stinger	1.125 lb ae/ac fb 0.75 lb ae/ac + 0.093 qt/ac	C/E	1-2 inch WEED & then 6lf SB	98	19.9	14.82	86.49	4631	123.64
9	RRSB H7-1	Roundup fb Roundup +Outlook	0.75 lb ae/ac fb 0.75 lb ae/ac + 21 oz	C/E	1-2 inch WEED & then 6lf SB	90	20.0	14.62	86.67	4606	121.72
10	RRSB H7-1	Roundup fb Roundup+Warrant (MON)	0.75 lb ae/ac fb 1.125 lb ae/ac	C/E	1-2 inch& then 6lf SB	98	18.5	14.53	85.47	4176	107.80
11	RRSB H7-1	Untreated Check				0	14.7	14.35	87.16	3334	86.49
					C.V	7	16.1	3.9	1.1	18.0	20.92
					LSD (0.05)	9	4.0	NS	NS	1011	30.21

A. LOCAL STANDARD TIMINGS
B. PRE-EMERGENCE APP.
C. EPO 1-2 LF WEED 2 LF BEETS
D. MPO 4 LF BEETS
E. SECOND APP 6 LF BEETS

TABLE 8. Evaluation of Glyphosate System Compared to Conventional Herbicide System
Lake Lillian, 2011

Trt	Type	Product	Mix Rate	Appl Code	Appl. Stage	68 DAP % Lambs-quarter	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Conv. Germplasm 1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	85	11.7	14.69	87.32	2721	114.38
2	Conv. Germplasm 2	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	84	6.1	13.88	86.60	1307	50.45
3	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	92	15.5	13.93	86.69	3377	132.62
4	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	92	13.9	13.76	86.31	3023	118.61
5	RRSB H7-1	Roundup fb Roundup	0.75 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	95	16.4	13.25	85.45	3251	113.02
6	RRSB H7-1	Roundup fb Roundup	1.125 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	97	15.6	14.10	87.02	3455	138.51
7	RRSB H7-1	Nortron fb Roundup	3.75 lb ai/ac fb 0.75 lb ae/ac	B/D	Pre emergent and 4 leaf beet	96	10.9	14.30	87.37	2440	99.34
8	RRSB H7-1	Roundup fb Roundup + Stinger	1.125 lb ae/ac fb 0.75 lb ae/ac + 0.093 qt/ac	C/E	1-2 inch WEED & then 6lf SB	96	8.8	14.15	86.12	1955	78.36
9	RRSB H7-1	Roundup fb Roundup +Outlook	0.75 lb ae/ac fb 0.75 lb ae/ac + 21 oz	C/E	1-2 inch WEED & then 6lf SB	96	16.5	14.15	87.10	3698	149.62
10	RRSB H7-1	Roundup fb Roundup+Warrant (MON)	0.75 lb ae/ac fb 1.125 lb ae/ac	C/E	1-2 inch& then 6lf SB	97	10.4	13.85	86.52	2195	83.40
11	RRSB H7-1	Untreated Check				0	2.9	13.02	85.45	597	21.69
					C.V	15	41.0	3.52	1.46	43	45.94
					LSD (0.05)	19	6.9	0.71	1.82	1568	66.34

A. LOCAL STANDARD TIMINGS
B. PRE-EMERGENCE APP.
C. EPO 1-2 LF WEED 2 LF BEETS
D. MPO 4 LF BEETS
E. SECOND APP 6 LF BEETS

TABLE 9. Combined Data for Evaluation of Glyphosate System Compared to Conventional Herbicide System

Trt	Type	Product	Mix Rate	Appl Code	Appl. Stage	68 DAP % Lambs-quarter	Tons/Acre	% Sugar	Purity	Ext. Suc Per Acre (Lbs.)	Revenue % of Mean
1	Conv. Germplasm 1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	90	18.2	14.38	84.71	3968	89.12
2	Conv. Germplasm 2	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	89	15.0	14.07	84.70	3200	65.03
3	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	89	22.0	14.08	86.51	4819	109.34
4	RRSB H7-1	Nortron (PPI) FB Betamix Progress+Stinger+Upbeet+MSO	112 Oz (ppi) FB 5.6 + 1.3 + .125oz + 1.5% v/v	A	cotyledons then every 7 days	93	21.1	14.03	86.82	4623	104.84
5	RRSB H7-1	Roundup fb Roundup	0.75 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	97	23.7	13.81	86.14	5038	107.39
6	RRSB H7-1	Roundup fb Roundup	1.125 lb ae/ac fb 0.75 lb ae/ac	C/E	1-2 Inch WEED & then 6lf SB	94	24.6	14.17	87.26	5477	125.51
7	RRSB H7-1	Nortron fb Roundup	3.75 lb ai/ac fb 0.75 lb ae/ac	B/D	Pre emergent and 4 leaf beet	92	21.9	14.09	87.08	4797	105.04
8	RRSB H7-1	Roundup fb Roundup + Stinger	1.125 lb ae/ac fb 0.75 lb ae/ac + 0.093 qt/ac	C/E	1-2 inch WEED & then 6lf SB	93	22.4	14.20	86.45	4883	106.30
9	RRSB H7-1	Roundup fb Roundup +Outlook	0.75 lb ae/ac fb 0.75 lb ae/ac + 21 oz	C/E	1-2 inch WEED & then 6lf SB	93	25.5	14.17	86.95	5618	131.00
10	RRSB H7-1	Roundup fb Roundup+Warrant (MON)	0.75 lb ae/ac fb 1.125 lb ae/ac	C/E	1-2 inch& then 6lf SB	93	22.9	14.18	86.67	5053	109.83
11	RRSB H7-1	Untreated Check				0	8.7	14.11	88.80	2034	46.58
					C.V	16	17.2	4.11	1.77	20	28.99
					LSD (0.05)	19	5.1	NS	NS	1028	26.07

A. LOCAL STANDARD TIMINGS
B. PRE-EMERGENCE APP.
C. EPO 1-2 LF WEED 2 LF BEETS
D. MPO 4 LF BEETS
E. SECOND APP 6 LF BEETS

<u>Preemergence and preplant incorporated herbicides for Roundup Ready sugarbeet, Holloway, MN, 2011</u>. (Stachler) 'Betaseed 87RR38' Roundup Ready sugarbeet was seeded May 4 at 60,825 seeds per acre in six 22" row plots 30 feet in length in a cooperator's field having glyphosate-resistant waterhemp. Sugarbeet seed was treated with Tachigaren at 45 grams dry product per 100,000 seeds and Poncho Beta. Headline at 12 fl oz/A was applied in-furrow at planting to all plots. Preplant incorporated treatments were applied May 3. A C-shank field cultivator with rolling baskets was set to a depth of 2 to 3" and driven once at approximately 5 mph through the center of all plots to incorporate the applied herbicides. Preemergence treatments were applied May 4. Postemergence treatments were applied June 13 and June 30. All treatments were applied in 17 gpa water at 40 psi through XR8002 nozzles to the center four rows of six row plots. Quadris at 15.4 fl oz/A was applied to the entire experiment June 15. Sugarbeet stand counts were recorded for the middle two rows at a total length of 20 feet on June 1 and 60 feet on August 1.Sugarbeet injury was evaluated May 26, June 13, July 14 and July 20. Waterhemp control was evaluated June 13, June 30, July 14, July 20 and August 24. Lambsquarters, common ragweed, and wild buckwheat were evaluated June 13, June 30, July 14, and July 20. Annual grass (75% white robust foxtail and 25% yellow foxtail) was evaluated June 13. All evaluations are a visual estimate of percent weed control or percent sugarbeet injury in the treated plot compared to the adjacent untreated strips and plots. Proline at 5.7 fl oz/A plus NIS at 0.25 %v/v, Agritin at 8 oz/A plus Manzate at 2 pounds/A, and Headline at 7 fl oz/A were applied on July 19, August 9, and August 26, respectively, over the entire trial area to control Cercospora. Sugarbeet from 20 feet of a center row in each plot was harvested September 7.

Table 1. Application information.

Date of Application	**May 3**	**May 4**	**June 13**	**June 30**
Time of Day	4:00 pm	2:40 pm	12:30 pm	12:15 pm
Air Temperature (^{o}F)	58	66	69	88
Relative Humidity (%)	22	24	65	60
Soil Temp. (^{o}F at 6")	48	41	56	72
Wind Velocity (mph)	5.5	21	11	8
Cloud Cover (%)	0	75	75	85
Soil Moisture	good	good	good	good
Sugarbeet Stage (range/Avg)	PPI	PRE	V8.5 – V8.2/V 10.4	V8.0 – V 18/V 14
Waterhemp (range/Avg) Trt. 2	PPI	PRE	cot-14 lf/10 lf; 0.33-6"/3.9"	cot-12lf/5.5 lf; 0.125-12"/2.8"
Waterhemp (avg. density) Trt. 2	PPI	PRE	150/M^2	9.3/M^2
Waterhemp (range/Avg) Trt. 18	PPI	PRE	cot-12 lf/8.75 lf; 0.75-4"/2.5"	cot-14lf/3.5 lf; 0.5-6"/1.6"
Waterhemp (avg. density) Trt. 18	PPI	PRE	32/M^2	3.75/M^2
Com. Lambsquarters (range/Avg) Trt. 2	PPI	PRE	6 lf-16 lf/10 lf; 1-7"/4.6"	-
Com. Lambsquarters (avg. density) Trt. 2	PPI	PRE	8/M^2	0/M^2
Com. Lambsquarters (range/Avg) Trt. 18	PPI	PRE	4 lf-14 lf/10 lf; 0.5-3.5"/2.6"	-
Com. Lambsquarters (avg. density) Trt. 18	PPI	PRE	9/M^2	0/M^2
Annual Grasses (range/Avg) Trt. 2	PPI	PRE	1-3 tillers/1.5 tillers; 3.5-10"/7.75"	-
Annual Grasses (avg. density) Trt. 2	PPI	PRE	15/M^2	0/M^2
Annual Grasses (range/Avg) Trt. 18	PPI	PRE	3 lf-2 tillers/1 tiller; 1-9"/6"	-
Annual Grasses (avg. density) Trt. 18	PPI	PRE	6/M^2	0/M^2

Summary: Ro-Neet and Ro-Neet plus Eptam applied PPI caused the greatest sugarbeet injury on May 26. Ro-Neet, Ro-Neet plus Eptam, Dual Magnum and Nortron applied PPI caused the greatest sugarbeet injury on June 13. Injury declined over time and only the Ro-Neet plus Eptam seemed to reduce sugarbeet root yield due to injury, otherwise Ro-Neet applied PRE reduced sugarbeet yield, due to the poor control of waterhemp.

On August 24, Roundup PowerMAX applied twice controlled only 54% of waterhemp, indicating the presence of glyphosate-resistant biotype(s) in the population.

At the time of the first postemergence application (June 13), Ro-Neet plut Eptam applied PPI and Nortron applied PRE controlled the most waterhemp. Ro-Neet and Ro-Neet plus Eptam must be incorporated to maximize control of all weed species, but especially waterhemp and annual grasses. Two applications of glyphosate following all PRE and PPI herbicide treatments improved weed control compared to the soil-applied herbicide alone, but the glyphosate-resistant waterhemp was not completely controlled by any treatment, leading to future problems.

Experiment continued on next page.

Table 2. Preemergence and preplant incorporated herbicides for Roundup Ready sugarbeet, Holloway, MN, 2011. (Stachler)

Trt	Treatment[1]	Rate	Date of Applic.	May 26 Sgbt Inju	June 1 Sgbt Popl	July 12 Sgbt Popl
#		lb ai/A or lb ae/A		%	Plt/20’	Plt/60’
1.	Untreated Check	0	---	1	44	125
2.	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	1	50	134
3.	Ro-Neet 4 EC (PPI)	4	May 3			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	12	45	118
4.	Ro-Neet SB (PPI)	4	May 3			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	15	44	123
5.	Ro-Neet 4 EC (PRE)	4	May 4			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	3	51	134
6.	Ro-Neet SB (PRE)	4	May 4			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	3	47	136
7.	Ro-Neet 4 EC (PPI)	4	May 3			
	RUPowerMAX+Outlook+AMS	1.125 + 0.984 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	13	48	122
8.	Ro-Neet 4 EC (PRE)	4	May 4			
	RUPowerMAX+Outlook+AMS	1.125 + 0.984 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	3	51	142
9.	Ro-Neet 4 EC (PPI)	4	May 3			
	RUPowerMAX+Warrant+AMS	1.125 + 1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	21	43	122
10.	Ro-Neet 4 EC (PRE)	4	May 4			
	RUPowerMAX+Warrant+AMS	1.125 + 1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	4	53	142
11.	Ro-Neet 4 EC + Eptam (PPI)	2.5 + 2	May 3			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	22	42	126
12.	Ro-Neet 4 EC + Eptam (PRE)	2.5 + 2	May 4			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	51	137
13.	Nortron (PPI)	3.75	May 3			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	52	137
14.	Nortron (PRE)	3.75	May 4			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	1	48	144
15.	Dual 8 EC (PPI)	1.4	May 3			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	6	46	132
16.	Dual 8 EC (PRE)	1.4	May 4			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	2	52	139
17.	Warrant (PPI)	1.4	May 3			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	1	52	145
18.	Warrant (PRE)	1.4	May 4			
	RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13			
	RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	4	50	138
	LSD (5%)			5.5	NS	NS

[1]AMS=N-Pak AMS (liquid ammonium sulfate from Winfield Solutions), RUPowerMAX=Roundup PowerMAX.

Experiment continued on next page.

Table 3. Preemergence and preplant incorporated herbicides for Roundup Ready sugarbeet, Holloway, MN, 2011. (Stachler)

			June 13					
Treatment[1]	Rate	Date of Applic.	Sgbt Inju	Wahe Cntl	Colq Cntl	Corw Cntl	Wibw Cntl	Grass Cntl
	lb ai/A or lb ae/A		------------------------------ % ------------------------------					
Untreated Check	0	---	0	0	0	0	0	0
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	0	0	0	0	0	0
Ro-Neet 4 EC (PPI)	4	May 3						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	10	78	76	35	35	75
Ro-Neet SB (PPI)	4	May 3						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	17	71	69	43	44	78
Ro-Neet 4 EC (PRE)	4	May 4						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	41	56	33	28	65
Ro-Neet SB (PRE)	4	May 4						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	6	51	61	31	26	56
Ro-Neet 4 EC (PPI)	4	May 3						
RUPowerMAX+Outlook+AMS	1.125 + 0.984 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	12	80	74	44	38	83
Ro-Neet 4 EC (PRE)	4	May 4						
RUPowerMAX+Outlook+AMS	1.125 + 0.984 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	6	48	50	34	31	63
Ro-Neet 4 EC (PPI)	4	May 3						
RUPowerMAX+Warrant+AMS	1.125 + 1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	17	84	68	39	38	83
Ro-Neet 4 EC (PRE)	4	May 4						
RUPowerMAX+Warrant+AMS	1.125 + 1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	48	54	38	31	68
Ro-Neet 4 EC + Eptam (PPI)	2.5 + 2	May 3						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	24	91	83	46	44	91
Ro-Neet 4 EC + Eptam (PRE)	2.5 + 2	May 4						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	9	73	53	35	34	71
Nortron (PPI)	3.75	May 3						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	15	83	71	35	46	78
Nortron (PRE)	3.75	May 4						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	6	89	74	48	46	80
Dual 8 EC (PPI)	1.4	May 3						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	14	76	55	33	32	80
Dual 8 EC (PRE)	1.4	May 4						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	7	82	56	29	34	80
Warrant (PPI)	1.4	May 3						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	8	48	34	30	29	43
Warrant (PRE)	1.4	May 4						
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13						
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	4	71	46	33	34	66
LSD (5%)			5.6	13.4	17.8	12.4	10.0	12.9

[1]AMS=N-Pak AMS (liquid ammonium sulfate from Winfield Solutions), RUPowerMAX=Roundup PowerMAX.

Experiment continued on next page.

Table 4. Preemergence and preplant incorporated herbicides for Roundup Ready sugarbeet, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	Sgbt Inju	Wahe Cntl	July 20 Colq Cntl	Corw Cntl	Wibw Cntl
	lb ai/A or lb ae/A		------------------------- % -------------------------				
Untreated Check	0	---	0	0	0	0	0
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	1	57	99	99	95
Ro-Neet 4 EC (PPI)	4	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	3	86	99	99	97
Ro-Neet SB (PPI)	4	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	72	99	99	95
Ro-Neet 4 EC (PRE)	4	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	9	63	99	99	95
Ro-Neet SB (PRE)	4	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	2	60	99	99	95
Ro-Neet 4 EC (PPI)	4	May 3					
RUPowerMAX+Outlook+AMS	1.125 + 0.984 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	7	90	99	99	98
Ro-Neet 4 EC (PRE)	4	May 4					
RUPowerMAX+Outlook+AMS	1.125 + 0.984 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	0	64	99	99	94
Ro-Neet 4 EC (PPI)	4	May 3					
RUPowerMAX+Warrant+AMS	1.125 + 1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	87	99	99	97
Ro-Neet 4 EC (PRE)	4	May 4					
RUPowerMAX+Warrant+AMS	1.125 + 1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	65	99	99	97
Ro-Neet 4 EC + Eptam (PPI)	2.5 + 2	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	92	99	99	93
Ro-Neet 4 EC + Eptam (PRE)	2.5 + 2	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	3	80	99	99	98
Nortron (PPI)	3.75	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	94	99	99	95
Nortron (PRE)	3.75	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	5	96	99	99	98
Dual 8 EC (PPI)	1.4	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	3	87	99	99	97
Dual 8 EC (PRE)	1.4	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	1	91	94	94	90
Warrant (PPI)	1.4	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	3	73	99	99	99
Warrant (PRE)	1.4	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	1	83	99	99	97
LSD (5%)			NS	18.2	3.2	3.2	5.5

[1]AMS=N-Pak AMS (liquid ammonium sulfate from Winfield Solutions), RUPowerMAX=Roundup PowerMAX.

Experiment continued on next page.

Table 5. Preemergence and preplant incorporated herbicides for Roundup Ready sugarbeet, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	Aug. 24 Wahe Cntl	Sgbt Popl	Sept. 7 Root Yield	Sucrose	Extrac Sucrose
	lb ai/A or lb ae/A		%	Plts/20'	Tons/A	%	lb/A
Untreated Check	0	---	0	29	0.8	-	-
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	54	41	12.7	14.0	2986
Ro-Neet 4 EC (PPI)	4	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	78	40	13.9	13.2	2973
Ro-Neet SB (PPI)	4	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	66	37	13.2	13.4	2953
Ro-Neet 4 EC (PRE)	4	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	59	38	11.5	13.0	2511
Ro-Neet SB (PRE)	4	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	62	41	10.8	13.5	2489
Ro-Neet 4 EC (PPI)	4	May 3					
RUPowerMAX+Outlook+AMS	1.125 + 0.984 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	80	41	13.1	13.0	2732
Ro-Neet 4 EC (PRE)	4	May 4					
RUPowerMAX+Outlook+AMS	1.125 + 0.984 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	57	47	13.3	13.7	3056
Ro-Neet 4 EC (PPI)	4	May 3					
RUPowerMAX+Warrant+AMS	1.125 + 1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	82	41	14.2	13.4	3116
Ro-Neet 4 EC (PRE)	4	May 4					
RUPowerMAX+Warrant+AMS	1.125 + 1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	60	48	12.6	13.4	2768
Ro-Neet 4 EC + Eptam (PPI)	2.5 + 2	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	82	42	12.5	14.0	2907
Ro-Neet 4 EC + Eptam (PRE)	2.5 + 2	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	72	48	14.9	13.4	3346
Nortron (PPI)	3.75	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	88	44	16.6	13.7	3752
Nortron (PRE)	3.75	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	88	49	14.6	13.0	3134
Dual 8 EC (PPI)	1.4	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	82	45	15.1	13.3	3357
Dual 8 EC (PRE)	1.4	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	90	45	15.7	13.3	3442
Warrant (PPI)	1.125	May 3					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	72	52	16.4	13.6	3711
Warrant (PRE)	1.125	May 4					
RUPowerMAX+AMS	1.125 + 2.5% v/v	June 13					
RUPowerMAX+AMS	0.75 + 2.5% v/v	June 30	83	45	15.1	13.5	3350
LSD (5%)			17.0	NS	3.70	0.63	NS

[1]AMS=N-Pak AMS (liquid ammonium sulfate from Winfield Solutions), RUPowerMAX=Roundup PowerMAX.

Postemergence Nortron plus glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (Stachler) 'Hilleshog 4022" sugarbeet seed treated with Tachigaren at 45 grams product per 100,000 seeds and Poncho Beta was seeded May 4 at 60,825 seeds/A in six row plots 30 feet in length in a cooperator's field having glyphosate-resistant waterhemp. Headline at 12 fl oz/A was applied in-furrow at planting to all plots. Treatments were applied June 2, June 16 and June 30. All treatments were applied in 17 gpa water at 40 psi through XR8002 nozzles to the center four rows of six row plots. All treatments included N-Pak AMS (a liquid AMS solution) at 2.5% v/v. Quadris at 15.4 fl oz/A was applied to the entire experiment on June 15. Sugarbeet injury was evaluated June 16, June 30, July 14 and July 20. Common lambsquarters and wild buckwheat control were evaluated June 30, July 14 and July 20. Annual grass control was evaluated July 20. Waterhemp control was evaluated June 16, June 30, July 14, July 20 and August 24. Waterhemp was counted in one meter square at two locations in each plot and averaged together to determine the average waterhemp density per meter squared for each plot July 25. Proline at 5.7 fl oz/A plus NIS at 0.25 %v/v, Agritin at 8 oz/A plus Manzate at 2 pounds/A, and Headline at 7 fl oz/A were applied on July 19, August 9, and August 26, respectively, over the entire trial area to control Cercospora. Sugarbeet from 20 feet of one center row in each plot were harvested September 7.

Table 1. Application information.

Date of Application	**June 2**	**June 16**	**June 30**
Time of Day	11:30 am	11:00 am	12:00 pm
Air Temperature (^oF)	80	68	88
Relative Humidity (%)	44	68	60
Soil Temp. (^oF at 6")	58	57	72
Wind Velocity (mph)	28	4	9
Cloud Cover (%)	90	60	85
Soil Moisture	good	good	good
Sugarbeet Stage (range/Avg)	V1.0-V4.5/V3.6	V6.0-V12.0/V9.5	V6.0-V12.0/V10.0
Waterhemp (range/Avg) Trt. 1	cot-7 lf/4 lf; 0.125-1.25"/0.5"	cot-17 lf/12 lf; 0.25-12.5"/5.5"	cot-24 lf/16 lf; 0.5-25"/14"
Waterhemp (avg. density) Trt. 1	$218/M^2$	$364/M^2$	$41/M^2$
Waterhemp (range/Avg) Trt. 12	cot-7 lf/4 lf; 0.125-1.25"/0.5"	1-16 lf/8 lf; 0.25-5.25"/2"	cot-14 lf/ 7 lf; 0.125-6"/1.75"
Waterhemp (avg. density) Trt. 12	$79/M^2$	$64/M^2$	$17/M^2$
Common Lambsquarters (range/Avg) Trt. 1	2-11 lf/5 lf; 0.25-2"/0.75"	4-21 lf/14 lf; 0.5-15"/7"	-
Common Lambsquarters (avg. density) Trt. 1	$8/M^2$	$21/M^2$	-
Common Lambsquarters (range/Avg) Trt. 12	2-11 lf/5 lf; 0.25-2"/0.75"	6-13 lf/7 lf; 0.75-3"/2"	-
Common Lambsquarters (avg. density) Trt. 12	$6/M^2$	$0.75/M^2$	-
Annual Grasses (range/Avg) Trt. 1	2-4 lf/3 lf; 0.33-1.5"/1"	2-6 Till/3.5 Till; 1-8"/5"	-
Annual Grasses (avg. density) Trt. 1	$7/M^2$	$5/M^2$	-
Annual Grasses (range/Avg) Trt. 12	2-4 lf/3 lf; 0.33-1.5"/1"	4 lf-3T/1T; 0.75-1.5"/1"	-
Annual Grasses (avg. density) Trt. 12	$19/M^2$	$0.75/M^2$	-
Wild Buckwheat (range/Avg) Trt. 1	1-7 lf/4 lf; 0.33-3.5"/1.3"	-	-
Wild Buckwheat (avg. density) Trt. 1	$4/M^2$	-	-
Wild Buckwheat (range/Avg) Trt. 12	1-7 lf/4 lf; 0.33-3.5"/1.3"	-	-
Wild Buckwheat (avg. density) Trt. 12	$5/M^2$	-	-

Experiment continued on next page.

Table 2. Postemergence Nortron plus glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	June 16 Sgbt Inju	June 16 Wahe Cntl	July 14 Sgbt Inju	July 14 Wahe Cntl	July 14 Colq Cntl	July 14 Wibw Cntl
	lb ai/A or lb ae/A		%	%	%	%	%	%
Untreated Check	-	-	0	0	0	0	0	0
Roundup PowerMAX	1.125	June 2						
Roundup PowerMAX	0.75	June 16	2	70	0	60	98	92
Roundup PowerMAX	1.125	June 2						
Roundup PowerMAX	0.75	June 16, 30	1	65	0	74	100	87
Roundup PowerMAX+Nortron	1.125+0.125	June 2						
Roundup PowerMAX+Nortron	0.75+0.125	June 16	3	80	0	73	99	93
Roundup PowerMAX+Nortron	1.125+0.5	June 2						
Roundup PowerMAX+Nortron	0.75+0.5	June 16	5	84	0	78	100	78
Roundup PowerMAX+Nortron	1.125+1	June 2						
Roundup PowerMAX+Nortron	0.75+1	June 16	10	88	2	90	99	93
Roundup PowerMAX+Nortron	1.125+1.5	June 2						
Roundup PowerMAX+Nortron	0.75+1.5	June 16	11	91	5	94	99	89
Roundup PowerMAX+Nortron	1.125+1.875	June 2						
Roundup PowerMAX+Nortron	0.75+1.875	June 16	11	87	3	93	100	88
Roundup PowerMAX+Nortron	1.125+0.25	June 2						
Roundup PowerMAX+Nortron	0.75+0.125	June 16	5	86	1	75	98	85
Roundup PowerMAX+Nortron	1.125+1	June 2						
Roundup PowerMAX+Nortron	0.75+0.5	June 16	6	81	0	76	99	78
Roundup PowerMAX+Nortron	1.125+0.125	June 2						
Roundup PowerMAX+Nortron	0.75+0.125	June 16, 30	3	75	1	64	100	93
Roundup PowerMAX+Nortron	1.125+0.5	June 2						
Roundup PowerMAX+Nortron	0.75+0.5	June 16, 30	4	78	3	85	100	86
LSD (5%)			3.2	7.2	2.3	8.9	2.2	11.7

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 2.5% v/v.

Table continued on next page.

Table 2. Postemergence Nortron plus glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (continued)

Treatment[1]	Rate	Date of Applic.	July 25 Wahe Popl	Aug24 Wahe Cntl	Sept. 7 Root Yield	Sept. 7 Sucr	Sept. 7 Extr Sucr	Sept. 7 Sgbt Popl
	lb ai/A or lb ae/A		plt/M^2	%	ton/A	%	lb/A	plt/20’
Untreated Check	-	-	290 a	0	0	-	0	-
Roundup PowerMAX	1.125	June 2						
Roundup PowerMAX	0.75	June 16	28 b	42	14.4	14.1	3401	51
Roundup PowerMAX	1.125	June 2						
Roundup PowerMAX	0.75	June 16, 30	6 bc	62	15.2	13.8	3459	52
Roundup PowerMAX+Nortron	1.125+0.125	June 2						
Roundup PowerMAX+Nortron	0.75+0.125	June 16	5 bc	49	13.4	13.3	2886	46
Roundup PowerMAX+Nortron	1.125+0.5	June 2						
Roundup PowerMAX+Nortron	0.75+0.5	June 16	13 bc	51	14.1	13.9	3243	44
Roundup PowerMAX+Nortron	1.125+1	June 2						
Roundup PowerMAX+Nortron	0.75+1	June 16	2 c	70	15.2	13.7	3445	51
Roundup PowerMAX+Nortron	1.125+1.5	June 2						
Roundup PowerMAX+Nortron	0.75+1.5	June 16	1 c	78	15.7	13.5	3430	55
Roundup PowerMAX+Nortron	1.125+1.875	June 2						
Roundup PowerMAX+Nortron	0.75+1.875	June 16	2 c	77	14.8	13.6	3286	50
Roundup PowerMAX+Nortron	1.125+0.25	June 2						
Roundup PowerMAX+Nortron	0.75+0.125	June 16	5 bc	48	12.9	13.7	2881	49
Roundup PowerMAX+Nortron	1.125+1	June 2						
Roundup PowerMAX+Nortron	0.75+0.5	June 16	8 bc	50	13.2	13.6	2921	54
Roundup PowerMAX+Nortron	1.125+0.125	June 2						
Roundup PowerMAX+Nortron	0.75+0.125	June 16, 30	15 bc	51	15.2	13.6	3409	53
Roundup PowerMAX+Nortron	1.125+0.5	June 2						
Roundup PowerMAX+Nortron	0.75+0.5	June 16, 30	6 bc	65	13.1	13.5	2878	52
LSD (5%)			-	11.0	3.3	NS	745	NS

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 2.5% v/v.

Summary: Nortron applied twice at greater than or equal to 2.0 lb ai/A caused the greatest sugarbeet injury of the season on June 16. Injury declined over time reaching nearly negligible levels for nearly all treatments by July 14. On June 16, Roundup PowerMAX applied at 1.125 lb ae/A caused 75% (data not shown) mortality of ten flagged waterhemp plants/plot and controlled 67% of waterhemp, indicating the presence of glyphosate-resistant waterhemp in this research trial. Waterhemp mortality improved to 92% (data not shown) by August 24, however Roundup PowerMAX applied two or three times only controlled 42 and 62% of waterhemp, respectively. On June 16, Nortron mixed at all rates with Roundup PowerMAX improved waterhemp control compared to Roundup PowerMAX alone. By August 24, only Nortron mixed at a total of 2.0 lb ai/A or greater improved waterhemp control compared to Roundup PowerMAX alone. Sugarbeet root yield and extractable sucrose was similar for all treatments with Nortron at 1.5 lb ai/A plus Roundup PowerMAX producing the greatest root yield. The lack of treatment differences in root yield and extractable sucrose was likely caused by inconsistent control of Cercospora and frequency of resistant waterhemp plants in each plot.

<u>Ro-Neet followed by postemergence and lay-by herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011</u>. (Stachler) 'Hilleshog 4022' Roundup Ready sugarbeet seed treated with Tachigaren at 45 grams product per 100,000 seeds and Poncho Beta was seeded May 4 at 60,825 seeds/A in six row plots 30 feet long in a cooperator's field having glyphosate-resistant waterhemp. Headline at 12 fl oz/A was applied in-furrow at planting to all plots. Preplant incorporated treatments were applied May 3 and incorporated 2 inches deep with a field cultivator with rolling baskets. Postemergence herbicide treatments were applied May 25, June 9 and June 24. All treatments were applied in 17 gpa water at 40 psi through XR8002 nozzles to the center four rows of six row plots. All postemergence treatments included N-Pak AMS at 2.5% v/v and Destiny HC at 1.5 pt/A. Quadris at 15.4 fl oz/A was applied to the entire experiment June 15. Sugarbeet injury and common lambsquarters control were evaluated May 26, June 9, June 24, July 8 and July 20. Waterhemp control was evaluated May 26, June 9, June 24, July 8, July 20 and August 24. Annual grass control was evaluated May 26 and July 20. Wild buckwheat control was evaluated May 26, June 24, July 8 and July 20. Common ragweed control was evaluated July 8 and July 20. Proline at 5.7 fl oz/A plus NIS at 0.25 %v/v, Agritin at 8 oz/A plus Manzate at 2 pounds/A, and Headline at 7 fl oz/A were applied on July 19, August 9, and August 26, respectively, over the entire trial area to control Cercospora. Sugarbeet from 20 feet of a center row in each plot was harvested September 7.

Table 1. Application information.

Date of Application	May 3	May 26	June 9	June 24
Time of Day	5:00 pm	2:45 pm	11:00 am	12:35 pm
Air Temperature (^oF)	58	70	61	69
Relative Humidity (%)	22	31	47	59
Soil Temp. (^oF at 6")	48	58	58	63
Wind Velocity (mph)	8	3	12	7
Cloud Cover (%)	0	10	95	90
Soil Moisture	Good	Good	Good	Good
Sugarbeet Stage (range/Avg)	PPI	V1.0-V2.3/V2.0	V6.0-V10.0/V8.5	-
Waterhemp (range/Avg) Trt. 1	PPI	cot-3 lf/2 lf; 0-0.25"/0.125"	cot-13 lf/9 lf; 0.125-5"/3"	-
Waterhemp (avg. density) Trt. 1	PPI	$96/M^2$	$166/M^2$	-
Waterhemp (range/Avg) Trt. 2	PPI	cot-3 lf/2 lf; 0-0.33"/0.125"	cot-10 lf/6 lf; 0.125-2"/1.25"	-
Waterhemp (avg. density) Trt. 2	PPI	$104/M^2$	$44/M^2$	-
Waterhemp (range/Avg) Trt. 14	PPI	cot-2 lf/1 lf; 0-0.125/0.125	cot-10 lf/6 lf; 0.125-2"/1"	-
Waterhemp (avg. density) Trt. 14	PPI	$10/M^2$	$7/M^2$	-
Com. Lambsquarters (range/Avg) Trt. 1	PPI	2-4 lf/2 lf; 0.25-0.75"/0.5"	2-17 lf/12 lf; 0.25-7.5"/3"	-
Com. Lambsquarters (avg. density) Trt. 1	PPI	$6/M^2$	$18/M^2$	-
Com. Lambsquarters (range/Avg) Trt. 2	PPI	cot-4 lf/2 lf; 0.125-0.5"/0.33"	4-8 lf/5 lf; 0.5-0.75"/0.67"	-
Com. Lambsquarters (avg. density) Trt. 2	PPI	$5/M^2$	$1/M^2$	-
Com. Lambsquarters (range/Avg) Trt. 14	PPI	cot-2 lf/2 lf; 0.125-0.33"/0.25"	3-6 lf/4.5 lf; 0.33-0.75"/0.5"	-
Com. Lambsquarters (avg. density) Trt. 14	PPI	$0.5/M^2$	$0.5/M^2$	-
Annual Grasses (range/Avg) Trt. 1	PPI	1-3 lf/2 lf; 0.25-1.25"/0.5"	1-7 Till/4 Till; 1-5"/3"	-
Annual Grasses (avg. density) Trt. 1	PPI	$7/M^2$	$9/M^2$	-
Annual Grasses (range/Avg) Trt. 2	PPI	1-3 lf/2 lf; 0.25-1"/0.75"	3 lf-1T/1T; 0.75-1.75"/1.25"	-
Annual Grasses (avg. density) Trt. 2	PPI	$5/M^2$	$0.5/M^2$	-
Annual Grasses (range/Avg) Trt. 14	PPI	-	-	-
Annual Grasses (avg. density) Trt. 14	PPI	$0/M^2$	$0/M^2$	-
Wild Buckwheat (range/Avg) Trt. 1	PPI	cot-2 lf/1 lf; 0.33-1"/0.5"	1-11 lf/3 lf; 0.75-11"/3"	-
Wild Buckwheat (avg. density) Trt. 1	PPI	$13/M^2$	$16/M^2$	-
Wild Buckwheat (range/Avg) Trt. 2	PPI	1 lf/1 lf; 0.25-0.75"/0.5"	2-3 lf/3 lf; 0.75-1.5"/1.25"	-
Wild Buckwheat (avg. density) Trt. 2	PPI	$4/M^2$	$1/M^2$	-
Wild Buckwheat (range/Avg) Trt. 14	PPI	cot-2 lf/1 lf; 0.25-1"/0.5"	2-5 lf/3 lf; 0.5-3"/1.25"	-
Wild Buckwheat (avg. density) Trt. 14	PPI	$9/M^2$	$4/M^2$	-
Common Ragweed (range/Avg) Trt. 1	PPI	1 N/1 N; 0.33"/0.33"	-	-
Common Ragweed (avg. density) Trt. 1	PPI	$0.5/M^2$	-	-
Common Ragweed (range/Avg) Trt. 2	PPI	1 N/1 N; 0.5"/0.5"	-	-
Common Ragweed (avg. density) Trt. 2	PPI	$1/M^2$	-	-
Common Ragweed (range/Avg) Trt. 14	PPI	cot/cot; 0.25"/0.25"	-	-
Common Ragweed (avg. density) Trt. 14	PPI	$0.25/M^2$	-	-

Summary: Significant sugarbeet injury was caused by Ro-Neet due to the soil being sandier than most soils in the area. Significant sugarbeet injury persisted during the growing season, especially treatments containing Ro-Neet followed by a lay-by herbicide mixed with Betamix plus Nortron or Betanex, however sugarbeet yield was not different for most treatments.

Roundup PowerMAX applied three times controlled 93 to 99% of wild buckwheat, common lambsquarters, and annual grass on July 20, but only controlled 51% of waterhemp on August 24, indicating the presence of glyphosate-resistant waterhemp at this location. Treatments containing Ro-Neet followed by Betamix plus Nortron or Betanex plus a lay-by herbicide controlled the most waterhemp.

Experiment continued on next page.

Table 2. Ro-Neet followed by POST and Lay-by Herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	(1) May26 Sgbt Inju	(2) May26 Wahe Cntl	(3) May26 Colq Cntl	(4) May26 Grass Cntl	(5) May26 Wibw Cntl
	lb ai/A or lb ae/A		%	%	%	%	%
Untreated Check	-	-	0	0	0	0	0
Roundup PM	1.125	May 25					
Roundup PM	0.75	June 9, 24	0	0	0	0	0
Roundup PM+Betanex	1.125+12 fl oz/A	May 25					
Roundup PM+Betanex	0.75+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	0	0	0	0	0
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	May 25					
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 9					
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	June 24	0	0	0	0	0
Roundup PM+Outlook	1.125+14 fl oz/A	May 25					
Roundup PM+Outlook	0.75+10 fl oz/A	June 9					
Roundup PM	0.75	June 24	0	0	0	0	0
Roundup PM+Outlook+Betanex	1.125+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Outlook+Betanex	0.75+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	0	0	0	0	0
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	0	0	0	0	0
Roundup PM+Dual Magnum	1.125+1.5 pt/A	May 25					
Roundup PM+Dual Magnum	0.75+1 pt/A	June 9					
Roundup PM	0.75	June 24	0	0	0	0	0
Roundup PM+Dual Magnum+Betanex	1.125+1.5 pt/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Betanex	0.75+1 pt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	0	0	0	0	0
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	0	0	0	0	0
Roundup PM+Warrant	1.125+1.5 qt/A	May 25					
Roundup PM+Warrant	0.75+1 qt/A	June 9					
Roundup PM	0.75	June 24	0	0	0	0	0
Roundup PM+Warrant+Betanex	1.125+1.5 qt/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Betanex	0.75+1 qt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	0	0	0	0	0
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	0	0	0	0	0
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM	1.125	June 9					
Roundup PM	0.75	June 24	22	85	88	95	26
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Betanex	1.125+12 fl oz/A	May 25					
Roundup PM+Betanex	0.75+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	23	87	92	96	28

Table continued on next page.

Table 2. Ro-Neet followed by POST and Lay-by Herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (continued)

			(1)	(2)	(3)	(4)	(5)
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	May 25					
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 9					
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	June 24	21	86	88	95	29
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Outlook	1.125+14 fl oz/A	May 25					
Roundup PM+Outlook	0.75+10 fl oz/A	June 9					
Roundup PM	0.75	June 24	19	87	91	95	28
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Outlook+Betanex	1.125+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Outlook+Betanex	0.75+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	22	87	90	96	30
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	25	86	90	95	30
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Dual Magnum	1.125+1.5 pt/A	May 25					
Roundup PM+Dual Magnum	0.75+1 pt/A	June 9					
Roundup PM	0.75	June 24	25	88	90	96	30
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Dual Magnum+Betanex	1.125+1.5 pt/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Betanex	0.75+1 pt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	23	88	89	95	30
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	19	85	87	93	29
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Warrant	1.125+1.5 qt/A	May 25					
Roundup PM+Warrant	0.75+1 qt/A	June 9					
Roundup PM	0.75	June 24	22	86	90	95	30
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Warrant+Betanex	1.125+1.5 qt/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Betanex	0.75+1 qt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	20	87	88	95	30
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	22	84	90	95	30
LSD (5%)			4	2	3	1	3

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 2.5% v/v. Destiny HC (methylated seed oil from Winfield Solutions) was included in all postemergence treatments at 1.5 pt/A. Roundup PM=Roundup PowerMax formulation of glyphosate.

Experiment continued on next page.

Table 3. Ro-Neet followed by POST and Lay-by Herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	(6) June 9 Sgbt Inju	(7) June 9 Wahe Cntl	(8) June 9 Colq Cntl	(9) July 20 Sgbt Inj	(10) July 20 Wahe Cntl
	lb ai/A or lb ae/A		%	%	%	%	%
Untreated Check	-	-	0	0	0	0	0
Roundup PM	1.125	May 25					
Roundup PM	0.75	June 9, 24	2	71	91	0	51
Roundup PM+Betanex	1.125+12 fl oz/A	May 25					
Roundup PM+Betanex	0.75+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	7	74	90	8	74
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	May 25					
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 9					
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	June 24	7	71	93	14	61
Roundup PM+Outlook	1.125+14 fl oz/A	May 25					
Roundup PM+Outlook	0.75+10 fl oz/A	June 9					
Roundup PM	0.75	June 24	7	86	95	11	73
Roundup PM+Outlook+Betanex	1.125+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Outlook+Betanex	0.75+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	7	92	93	10	92
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	9	94	96	16	88
Roundup PM+Dual Magnum	1.125+1.5 pt/A	May 25					
Roundup PM+Dual Magnum	0.75+1 pt/A	June 9					
Roundup PM	0.75	June 24	6	88	92	9	79
Roundup PM+Dual Magnum+Betanex	1.125+1.5 pt/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Betanex	0.75+1 pt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	13	82	94	14	80
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	11	86	94	12	87
Roundup PM+Warrant	1.125+1.5 qt/A	May 25					
Roundup PM+Warrant	0.75+1 qt/A	June 9					
Roundup PM	0.75	June 24	4	84	91	9	73
Roundup PM+Warrant+Betanex	1.125+1.5 qt/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Betanex	0.75+1 qt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	7	79	94	11	87
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	8	87	96	13	91
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM	1.125	June 9					
Roundup PM	0.75	June 24	6	86	94	9	74
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Betanex	1.125+12 fl oz/A	May 25					
Roundup PM+Betanex	0.75+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	14	94	96	10	90
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	May 25					
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 9					
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	June 24	15	93	97	10	83
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Outlook	1.125+14 fl oz/A	May 25					
Roundup PM+Outlook	0.75+10 fl oz/A	June 9					
Roundup PM	0.75	June 24	10	98	99	18	97

Table continued on next page.

Table 3. Ro-Neet followed by POST and Lay-by Herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (continued)

			(6)	(7)	(8)	(9)	(10)
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Outlook+Betanex	1.125+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Outlook+Betanex	0.75+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	15	97	97	12	99
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	16	98	96	16	97
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Dual Magnum	1.125+1.5 pt/A	May 25					
Roundup PM+Dual Magnum	0.75+1 pt/A	June 9					
Roundup PM	0.75	June 24	13	98	99	15	97
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Dual Magnum+Betanex	1.125+1.5 pt/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Betanex	0.75+1 pt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	18	98	97	11	98
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	18	95	99	10	94
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Warrant	1.125+1.5 qt/A	May 25					
Roundup PM+Warrant	0.75+1 qt/A	June 9					
Roundup PM	0.75	June 24	5	68	74	9	83
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Warrant+Betanex	1.125+1.5 qt/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Betanex	0.75+1 qt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	15	96	97	12	95
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	17	98	97	15	98
LSD (5%)			5	7	6	9	10

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 2.5% v/v. Destiny HC (methylated seed oil from Winfield Solutions) was included in all postemergence treatments at 1.5 pt/A. Roundup PM=Roundup PowerMax formulation of glyphosate.

Experiment continued on next page.

Table 4. Ro-Neet followed by POST and Lay-by Herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	(11) July 20 Colq Cntl	(12) July 20 Wibw Cntl	(13) July 20 Cora Cntl	(14) July 20 Grass Cntl	(15) Aug 24 Wahe Cntl
	lb ai/A or lb ae/A		%	%	%	%	%
Untreated Check	-	-	0	0	0	0	0
Roundup PM	1.125	May 25					
Roundup PM	0.75	June 9, 24	99	93	99	99	51
Roundup PM+Betanex	1.125+12 fl oz/A	May 25					
Roundup PM+Betanex	0.75+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	98	84	99	97	60
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	May 25					
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 9					
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	June 24	99	98	99	98	54
Roundup PM+Outlook	1.125+14 fl oz/A	May 25					
Roundup PM+Outlook	0.75+10 fl oz/A	June 9					
Roundup PM	0.75	June 24	99	83	99	99	64
Roundup PM+Outlook+Betanex	1.125+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Outlook+Betanex	0.75+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	99	86	99	99	80
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	99	97	99	99	79
Roundup PM+Dual Magnum	1.125+1.5 pt/A	May 25					
Roundup PM+Dual Magnum	0.75+1 pt/A	June 9					
Roundup PM	0.75	June 24	99	81	99	99	70
Roundup PM+Dual Magnum+Betanex	1.125+1.5 pt/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Betanex	0.75+1 pt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	99	93	98	99	68
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	99	99	99	99	73
Roundup PM+Warrant	1.125+1.5 qt/A	May 25					
Roundup PM+Warrant	0.75+1 qt/A	June 9					
Roundup PM	0.75	June 24	99	89	99	98	68
Roundup PM+Warrant+Betanex	1.125+1.5 qt/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Betanex	0.75+1 qt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	99	94	99	99	72
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	99	99	99	99	80
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM	1.125	June 9					
Roundup PM	0.75	June 24	99	78	99	99	72
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Betanex	1.125+12 fl oz/A	May 25					
Roundup PM+Betanex	0.75+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	99	93	99	99	80

Table continued on next page.

Table 4. Ro-Neet followed by POST and Lay-by Herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (continued)

			(11)	(12)	(13)	(14)	(15)
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	May 25					
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 9					
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	June 24	99	99	99	99	79
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Outlook	1.125+14 fl oz/A	May 25					
Roundup PM+Outlook	0.75+10 fl oz/A	June 9					
Roundup PM	0.75	June 24	99	93	99	99	92
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Outlook+Betanex	1.125+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Outlook+Betanex	0.75+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	98	92	98	98	98
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	99	99	99	99	94
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Dual Magnum	1.125+1.5 pt/A	May 25					
Roundup PM+Dual Magnum	0.75+1 pt/A	June 9					
Roundup PM	0.75	June 24	99	80	99	99	95
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Dual Magnum+Betanex	1.125+1.5 pt/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Betanex	0.75+1 pt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	96	89	95	96	96
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	99	99	99	99	90
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Warrant	1.125+1.5 qt/A	May 25					
Roundup PM+Warrant	0.75+1 qt/A	June 9					
Roundup PM	0.75	June 24	94	82	94	94	84
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Warrant+Betanex	1.125+1.5 qt/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Betanex	0.75+1 qt/A+16 fl oz/A	June 9					
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	98	93	99	99	93
Ro-Neet SB (PPI)	5.3 pt/A	May 3					
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	May 25					
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 9					
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	99	98	99	99	98
LSD (5%)			3	9	3	4	10

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 2.5% v/v. Destiny HC (methylated seed oil from Winfield Solutions) was included in all postemergence treatments at 1.5 pt/A. Roundup PM=Roundup PowerMax formulation of glyphosate.

Experiment continued on next page.

Table 5. Ro-Neet followed by POST and Lay-by Herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	(16) Sept.7 Sgbt Popl	(17) Sept.7 Root Yield	(18) Sept.7 Extract Sucrose	(19) Sept.7 Sucrose
	lb ai/A or lb ae/A		plts/20'	tons/A	lb/A	%
Untreated Check	-	-	8	0.4	0	0
Roundup PM	1.125	May 25				
Roundup PM	0.75	June 9, 24	47	13.5	3086	13.9
Roundup PM+Betanex	1.125+12 fl oz/A	May 25				
Roundup PM+Betanex	0.75+16 fl oz/A	June 9				
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	47	12.6	3028	13.7
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	May 25				
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	June 24	51	10.9	2637	12.1
Roundup PM+Outlook	1.125+14 fl oz/A	May 25				
Roundup PM+Outlook	0.75+10 fl oz/A	June 9				
Roundup PM	0.75	June 24	50	13.0	3072	13.0
Roundup PM+Outlook+Betanex	1.125+14 fl oz/A+12 fl oz/A	May 25				
Roundup PM+Outlook+Betanex	0.75+10 fl oz/A+16 fl oz/A	June 9				
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	52	15.1	3383	13.6
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	May 25				
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 9				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	49	14.7	3353	14.4
Roundup PM+Dual Magnum	1.125+1.5 pt/A	May 25				
Roundup PM+Dual Magnum	0.75+1 pt/A	June 9				
Roundup PM	0.75	June 24	50	14.2	3257	13.2
Roundup PM+Dual Magnum+Betanex	1.125+1.5 pt/A+12 fl oz/A	May 25				
Roundup PM+Dual Magnum+Betanex	0.75+1 pt/A+16 fl oz/A	June 9				
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	50	14.4	3296	14.1
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	May 25				
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 9				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	51	14.2	3237	14.4
Roundup PM+Warrant	1.125+1.5 qt/A	May 25				
Roundup PM+Warrant	0.75+1 qt/A	June 9				
Roundup PM	0.75	June 24	53	16.3	3890	15.2
Roundup PM+Warrant+Betanex	1.125+1.5 qt/A+12 fl oz/A	May 25				
Roundup PM+Warrant+Betanex	0.75+1 qt/A+16 fl oz/A	June 9				
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	55	15.1	3431	14.7
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	May 25				
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 9				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	57	14.3	3278	15.2
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM	1.125	June 9				
Roundup PM	0.75	June 24	51	12.7	2999	14.6
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Betanex	1.125+12 fl oz/A	May 25				
Roundup PM+Betanex	0.75+16 fl oz/A	June 9				
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	44	12.6	3007	14.9
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	May 25				
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	June 24	46	16.3	3969	15.2
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Outlook	1.125+14 fl oz/A	May 25				
Roundup PM+Outlook	0.75+10 fl oz/A	June 9				
Roundup PM	0.75	June 24	56	14.7	3501	15.7

Table continued on next page.

Table 5. Ro-Neet followed by POST and Lay-by Herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (continued)

			(16)	(17)	(18)	(19)
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Outlook+Betanex	1.125+14 fl oz/A+12 fl oz/A	May 25				
Roundup PM+Outlook+Betanex	0.75+10 fl oz/A+16 fl oz/A	June 9				
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	51	14.8	3480	14.9
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	May 25				
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 9				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	53	14.2	3337	14.9
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Dual Magnum	1.125+1.5 pt/A	May 25				
Roundup PM+Dual Magnum	0.75+1 pt/A	June 9				
Roundup PM	0.75	June 24	46	13.4	3203	15.4
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Dual Magnum+Betanex	1.125+1.5 pt/A+12 fl oz/A	May 25				
Roundup PM+Dual Magnum+Betanex	0.75+1 pt/A+16 fl oz/A	June 9				
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	51	14.5	3379	13.8
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	May 25				
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 9				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	55	14.1	3352	14.0
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Warrant	1.125+1.5 qt/A	May 25				
Roundup PM+Warrant	0.75+1 qt/A	June 9				
Roundup PM	0.75	June 24	57	15.3	3491	14.4
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Warrant+Betanex	1.125+1.5 qt/A+12 fl oz/A	May 25				
Roundup PM+Warrant+Betanex	0.75+1 qt/A+16 fl oz/A	June 9				
Roundup PM+Betanex	0.75+24 fl oz/A	June 24	50	12.8	2958	13.9
Ro-Neet SB (PPI)	5.3 pt/A	May 3				
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	May 25				
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 9				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	June 24	53	14.0	3239	13.9
LSD (5%)			10	3.4	813	2.4

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 2.5% v/v. Destiny HC (methylated seed oil from Winfield Solutions) was included in all postemergence treatments at 1.5 pt/A. Roundup PM=Roundup PowerMax formulation of glyphosate.

<u>Ro-Neet versus Nortron followed by postemergence and lay-by herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011</u>. (Stachler) 'Hilleshog 4022" Roundup Ready sugarbeet seed treated with Tachigaren at 45 grams product per 100,000 seeds and Poncho Beta was seeded May 16 at 60,825 seeds/A in six row plots 30 feet in length in a cooperator's field having glyphosate-resistant waterhemp. Headline at 12 fl oz/A was applied in-furrow at planting to all plots. Preplant incorporated treatments were applied May 16 and incorporated 2 inches deep with a field cultivator with rolling baskets. Postemergence herbicide treatments were applied June 9 June 27 and July 12. All treatments were applied in 17 gpa water at 40 psi through XR8002 nozzles to the center four rows of six row plots. All postemergence treatments included N-Pak AMS at 2.5% v/v and Destiny HC at 1.5 pt/A (except treatment 15). Quadris at 15.4 fl oz/A was applied June 15 to the entire experiment. Sugarbeet injury was evaluated June 27, July 12, July 20, and August 9. Waterhemp control was evaluated June 27, July 12, July 20, August 9 and August 24. Sugarbeet stand counts were recorded for the middle two rows at a total length of 60 feet on June 30 and August 1. All evaluations are a visual estimate of percent weed control or percent sugarbeet injury in the treated plot compared to the adjacent untreated strips and plots. Proline at 5.7 fl oz/A plus NIS at 0.25 %v/v, Agritin at 8 oz/A plus Manzate at 2 pounds/A, and Headline at 7 fl oz/A were applied on July 19, August 9, and August 26, respectively, over the entire trial area to control Cercospora. Sugarbeet from 20 feet of a center row in each plot was harvested September 7.

Table 1. Application information.

Date of Application	**May 16**	**June 9**	**June 27**	**July 12**
Time of Day	5:00 pm	3:45 pm	2:15 pm	1:15 pm
Air Temperature (^{o}F)	66	63	71	76
Relative Humidity (%)	23	45	62	45
Soil Temp. (^{o}F at 6")	46	57	58	72
Wind Velocity (mph)	9	16	15	3
Cloud Cover (%)	0	95	50	10
Soil Moisture	good	good	wet	good
Sugarbeet Stage (range/Avg)	PPI	V1.0-V2.7/V2.0	-	V10-V23/V15
Waterhemp (range/Avg) Trt. 1	PPI	cot-5 lf/2 lf; 0.125-0.25"/0.125"	-	cot-28 lf/13.5 lf; 0.125-21"/7.75"
Waterhemp (avg. density) Trt. 1	PPI	9/M^2	-	25/M^2
Waterhemp (range/Avg) Trt. 2	PPI	-	-	cot-21 lf/6.5 lf; 0.125-9"/1.9"
Waterhemp (avg. density) Trt. 2	PPI	-	-	3.8/M^2
Waterhemp (range/Avg) Trt. 3	PPI	-	-	4 lf; 0.75"
Waterhemp (avg. density) Trt. 3	PPI	-	-	0.1/M^2
Waterhemp (range/Avg) Trt. 7	PPI	-	-	cot-5 lf/3 lf; 0.125-1"/0.67"
Waterhemp (avg. density) Trt. 7	PPI	-	-	0.4/M^2

Summary: Sugarbeet injury was greatest on June 27 and declined to almost no injury by August 9. All treatments having a preplant herbicide caused more sugarbeet injury than glyphosate alone and Ro-Neet followed by Warrant plus Roundup PowerMAX plus Betamix plus Nortron caused the greatest injury. Treatments having Outlook mixed postemergence caused the next greatest sugarbeet injury regardless of the preplant herbicide. No treatment caused a reduction in sugarbeet stand at any time recorded.

Roundup PowerMAX caused 82 and 92% mortality of ten flagged waterhemp plants per plot and controlled 80 and 61% of waterhemp on June 27 and August 24, respectively, indicating the presence of glyphosate-resistant waterhemp. Roundup PowerMAX reduced waterhemp density and size compared to the untreated check. Nortron and Ro-Neet followed by Betamix plus Nortron plus Roundup PowerMAX reduced waterhemp density and size compared to Roundup PowerMAX alone on July 12. All treatments containing Ro-Neet and Nortron alone controlled waterhemp greater than Ro-Neet plus Eptam.

Treatments 5, 8, 10, 11, and 12 reduced extractable sucrose compared to Roundup PowerMAX alone and Ro-Neet followed by Betamix plus Nortron plus Roundup PowerMAX.

Experiment continued on next page.

Table 2. Ro-Neet versus Nortron followed by postemergence and lay-by herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	June 27 Sgbt Inju	June 27 Wahe Cntl	June 30 Sgbt Popl	Aug. 1 Sgbt Popl
	lb ai/A or lb ae/A		%	%	/60ft row	/60ft row
1. Untreated Check	-	-	0	0	107	106
2. Roundup PM	1.125	June 9				
Roundup PM	0.75	June 27				
		July 12	0	80	100	102
3. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 27				
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	July 12	3	99	104	112
4. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	10	99	95	101
5. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	7	99	104	110
6. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	8	99	111	111
7. Ro-Neet SB (PPI)	5.3 pt/A	May 16				
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 27				
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	July 12	3	98	96	104
8. Ro-Neet SB (PPI)	5.3 pt/A	May 16				
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	10	99	96	103
9. Ro-Neet SB (PPI)	5.3 pt/A	May 16				
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	6	99	106	11
10. Ro-Neet SB (PPI)	5.3 pt/A	May 16				
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	16	99	106	109
11. Eptam + Ro-Neet SB (PPI)	2.3 + 3.3 pt/A	May 16				
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 27				
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	July 12	3	97	108	117
12. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Betamix+Nortron (No Destiny HC)	1.125+2 pt/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron (No Destiny HC)	0.75+3pt/A+4 fl oz/A	June 27				
Roundup PM+Betamix+Nortron (No Destiny HC)	0.75+4 pt/A+4 fl oz/A	July 12	7	99	109	109
LSD (5%)			2.2	1.4	NS	NS

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) at 2.5% v/v and Destiny HC (HSOC {MSO based}) from Winfield Solutions) at 1.5 pt/A [except treatment 15] was included in all postemergence treatments. Roundup PM=Roundup PowerMAX formulation of glyphosate.

Table continued on next page.

Table 2. Ro-Neet versus Nortron followed by postemergence and lay-by herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	Aug. 9 Sgbt Inju	Aug. 9 Wahe Cntl	Aug. 24 Wahe Cntl
	lb ai/A or lb ae/A		%	%	%
1. Untreated Check	-	-	0	0	0
2. Roundup PM	1.125	June 9			
Roundup PM	0.75	June 27			
		July 12	0	68	61
3. Nortron (PPI)	7.5 pt/A	May 16			
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	June 9			
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 27			
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	July 12	0	99	99
4. Nortron (PPI)	7.5 pt/A	May 16			
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	June 9			
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 27			
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	1	99	99
5. Nortron (PPI)	7.5 pt/A	May 16			
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	June 9			
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 27			
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	1	99	99
6. Nortron (PPI)	7.5 pt/A	May 16			
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	June 9			
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 27			
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	0	99	99
7. Ro-Neet SB (PPI)	5.3 pt/A	May 16			
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	June 9			
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 27			
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	July 12	1	99	98
8. Ro-Neet SB (PPI)	5.3 pt/A	May 16			
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	June 9			
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 27			
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	1	99	99
9. Ro-Neet SB (PPI)	5.3 pt/A	May 16			
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	June 9			
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 27			
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	1	99	99
10. Ro-Neet SB (PPI)	5.3 pt/A	May 16			
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	June 9			
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 27			
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	2	99	99
11. Eptam + Ro-Neet SB (PPI)	2.3 + 3.3 pt/A	May 16			
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	June 9			
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 27			
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	July 12	2	96	95
12. Nortron (PPI)	7.5 pt/A	May 16			
Roundup PM+Betamix+Nortron (No Destiny HC)	1.125+2 pt/A+4 fl oz/A	June 9			
Roundup PM+Betamix+Nortron (No Destiny HC)	0.75+3pt/A+4 fl oz/A	June 27			
Roundup PM+Betamix+Nortron (No Destiny HC)	0.75+4 pt/A+4 fl oz/A	July 12	2	99	99
LSD (5%)			NS	2.2	2.9

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) at 2.5% v/v and Destiny HC (HSOC {MSO based}) from Winfield Solutions) at 1.5 pt/A [except treatment 15] was included in all postemergence treatments. Roundup PM=Roundup PowerMAX formulation of glyphosate.

Table continued on next page.

Table 2. Ro-Neet versus Nortron followed by postemergence and lay-by herbicides mixed with glyphosate to control glyphosate-resistant waterhemp, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	Sept. 7 Sgbt Popl	Sept. 7 Root Yield	Sept. 7 Sucrose	Sept. 7 Extrac Sucrose
	lb ai/A or lb ae/A		Plts/20'	Tons/A	%	lb/A
1. Untreated Check	-	-	38	12.8	13.5	2807
2. Roundup PM	1.125	June 9				
Roundup PM	0.75	June 27				
		July 12	41	19.8	14.7	4730
3. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 27				
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	July 12	36	19.8	14.3	4612
4. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	39	18.7	14.2	4220
5. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	42	17.7	14.0	4027
6. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	41	18.2	14.5	4296
7. Ro-Neet SB (PPI)	5.3 pt/A	May 16				
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 27				
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	July 12	37	21.0	14.0	4798
8. Ro-Neet SB (PPI)	5.3 pt/A	May 16				
Roundup PM+Nortron+Outlook+Betamix	1.125+4 fl oz/A+14 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Nortron+Outlook+Betamix	0.75+4 fl oz/A+10 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	37	17.7	14.2	4016
9. Ro-Neet SB (PPI)	5.3 pt/A	May 16				
Roundup PM+Dual Magnum+Nortron+Betamix	1.125+1.5 pt/A+4 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Dual Magnum+Nortron+Betamix	0.75+1 pt/A+4 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	43	19.2	14.3	4514
10. Ro-Neet SB (PPI)	5.3 pt/A	May 16				
Roundup PM+Warrant+Nortron+Betamix	1.125+1.5 qt/A+4 fl oz/A+12 fl oz/A	June 9				
Roundup PM+Warrant+Nortron+Betamix	0.75+1 qt/A+4 fl oz/A+16 fl oz/A	June 27				
Roundup PM+Nortron+Betamix	0.75+4 fl oz/A+24 fl oz/A	July 12	36	17.3	14.5	3996
11. Eptam + Ro-Neet SB (PPI)	2.3 + 3.3 pt/A	May 16				
Roundup PM+Betamix+Nortron	1.125+12 fl oz/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron	0.75+16 fl oz/A+4 fl oz/A	June 27				
Roundup PM+Betamix+Nortron	0.75+24 fl oz/A+4 fl oz/A	July 12	44	18.1	14.1	4081
12. Nortron (PPI)	7.5 pt/A	May 16				
Roundup PM+Betamix+Nortron (No Destiny HC)	1.125+2 pt/A+4 fl oz/A	June 9				
Roundup PM+Betamix+Nortron (No Destiny HC)	0.75+3pt/A+4 fl oz/A	June 27				
Roundup PM+Betamix+Nortron (No Destiny HC)	0.75+4 pt/A+4 fl oz/A	July 12	35	17.8	13.8	3974
LSD (5%)			NS	2.73	NS	641.5

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) at 2.5% v/v and Destiny HC (HSOC {MSO based}) from Winfield Solutions) at 1.5 pt/A [except treatment 15] was included in all postemergence treatments. Roundup PM=Roundup PowerMAX formulation of glyphosate.

Management of glyphosate-resistant waterhemp in Roundup Ready soybean with preemergence herbicides followed by Flexstar GT 3.5, Holloway, MN, 2011. (Stachler) 'Asgrow A1026649' Roundup Ready soybean at 139,500 seeds per acre was seeded May 4 in six row plots 30 feet in length in a cooperator's field having glyphosate-resistant waterhemp. Preemergence treatments were applied May 5. Postemergence treatments were applied June 13. All treatments were applied in 17 gpa water at 40 psi through XR8002 nozzles to the center four rows of six row plots. All postemergence treatments included AMS at 2.5% v/v. Soygreen at 1.5 pounds product per acre plus Premier 90 at 0.25% v/v was applied to the entire experiment June 15. Soybean injury was evaluated May 26, June 13, June 24, June 27 and July 12. Waterhemp, common lambsquarters and annual grass (75% white robust foxtail and 25% yellow foxtail) control were evaluated June 13, June 27, July 12 and September 27. Wild buckwheat and common ragweed were evaluated June 27, July 12 and September 27. All evaluations are a visual estimate of percent weed control or percent soybean injury in the treated plot compared to the adjacent untreated strips and plots. Soybean from the center four rows in each plot was harvested September 29.

Table 1. Application information.

Date of Application	**May 4**	**June 13**
Time of Day	2:40 pm	12:30 pm
Air Temperature (^oF)	66	69
Relative Humidity (%)	24	65
Soil Temp. (^oF at 6")	41	56
Wind Velocity (mph)	21	11
Cloud Cover (%)	75	75
Soil Moisture	good	good
Soybean Stage (range/Avg)	PRE	2-3 Trifoliate / 3 Trifoliate
Waterhemp (range/Avg) Trt. 1	PRE	3-16 lf/10 lf; 0.5-7"/5"
Waterhemp (avg. density) Trt. 1	PRE	109/M^2
Waterhemp (range/Avg) Trt. 13	PRE	2-7 lf/5 lf; 1.25-1.5"/1"
Waterhemp (avg. density) Trt. 13	PRE	0.75/M^2
Common Lambsquarters (range/Avg) Trt. 1	PRE	6-22 lf/12 lf; 1.5-9"/5"
Common Lambsquarters (avg. density) Trt. 1	PRE	17/M^2
Common Lambsquarters (range/Avg) Trt. 13	PRE	-/14 lf; 2.5-9"/5.75"
Common Lambsquarters (avg. density) Trt. 13	PRE	0.5/M^2
Annual Grasses (range/Avg) Trt. 1	PRE	3 lf-7lf Tiller/7lf Tiller; 1.5-10"/10"
Annual Grasses (avg. density) Trt. 1	PRE	6/M^2
Annual Grasses (range/Avg) Trt. 13	PRE	-/Tillering; -/5"
Annual Grasses (avg. density) Trt. 13	PRE	0.25/M^2
Common Ragweed (range/Avg) Trt. 1	PRE	Cotyledon-5 node/3 node; 0.5-5"/4"
Common Ragweed (avg. density) Trt. 1	PRE	2/M^2
Wild Buckwheat (range/Avg) Trt. 1	PRE	1-12 lf/3 lf; 1-13"/4"
Wild Buckwheat (avg. density) Trt. 1	PRE	2/M^2

Experiment continued on next page.

Table 2. Management of glyphosate-resistant waterhemp in Roundup Ready soybean with preemergence herbicides followed by Flexstar GT 3.5, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	June 13 Soyb Inj	June 13 Wahe Cntl	June 13 Colq Cntl	June 13 Ann. Grs. Cntl
	lb ai/A or lb ae/A		%	%	%	%
1. Untreated Check	0	---	0	0	0	0
2. Boundry (PRE)	1.8 pt/A	May 4				
Touchdown Total	30.7 fl oz/A	June 13	5	89	91	94
3. Boundry (PRE)	1.8 pt/A	May 4				
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	4	92	86	92
4. Boundry (PRE)	1.8 pt/A	May 4				
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	3	95	85	83
5. Valor SX (PRE)	2 oz/A	May 4				
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	6	92	91	69
6. Valor SX (PRE)	2 oz/A	May 4				
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	7	79	91	63
7. Authority MTZ (PRE)	11 oz/A	May 4				
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	1	85	91	58
8. Authority MTZ (PRE)	11 oz/A	May 4				
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	1	77	87	59
9. Outlook+Verdict (PRE)	8+5 fl oz/A	May 4				
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	4	95	94	90
10. Outlook+Verdict (PRE)	8+5 fl oz/A	May 4				
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	4	93	87	88
11. Boundry (PRE)	1.8 pt/A	May 4				
RUPowerMax+Cobra+COC	28.4+10 fl oz/A+1	June 13	5	87	87	83
12. Valor SX (PRE)	2 oz/A	May 4				
RUPowerMax+Warrant	28.4 fl oz/A+3 pt/A	June 13	7	90	88	73
13. Boundry (PRE)	1.8 pt/A	May 4				
Flexstar GT 3.5+MSO	2.65 pt/A+1	June 13	4	96	92	90
14. Boundry (PRE)	1.8 pt/A	May 4				
Sequence	2.5 pt/A	June 13	5	89	85	81
15. Sharpen (PRE)	1 fl oz/A	May 4				
Touchdown Total+Prefix	30.7 fl oz/A+2 pt/A	June 13	0	78	76	40
LSD (5%)			2.2	8	11.1	14.9

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 2.5% v/v. RUPowerMAX=Roundup PowerMAX; MSO=Leci-Tech methylated seed oil from Loveland; COC=Premium COC from West Central; Ann. Grs.=Annual grasses (75% white robust foxtail & 25% yellow foxtail).

Table continued on next page.

Table 2. Management of glyphosate-resistant waterhemp in Roundup Ready soybean with preemergence herbicides followed by Flexstar GT 3.5, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	June 27 Soyb Inj	June 27 Wahe Cntl	June 27 Colq Cntl	June 27 Wibw Cntl	June 27 Corw Cntl	June 27 Ann. Grs. Cntl
	lb ai/A or lb ae/A		%	%	%	%	%	%
Untreated Check	0	---	0	0	0	0	0	0
Boundry (PRE)	1.8 pt/A	May 4						
Touchdown Total	30.7 fl oz/A	June 13	9	91	99	92	100	100
Boundry (PRE)	1.8 pt/A	May 4						
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	29	100	100	100	100	100
Boundry (PRE)	1.8 pt/A	May 4						
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	37	100	100	100	100	100
Valor SX (PRE)	2 oz/A	May 4						
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	28	100	100	99	100	100
Valor SX (PRE)	2 oz/A	May 4						
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	39	100	100	100	100	100
Authority MTZ (PRE)	11 oz/A	May 4						
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	24	100	100	100	100	100
Authority MTZ (PRE)	11 oz/A	May 4						
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	35	100	100	100	100	99
Outlook+Verdict (PRE)	8+5 fl oz/A	May 4						
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	27	100	100	100	100	100
Outlook+Verdict (PRE)	8+5 fl oz/A	May 4						
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	36	100	100	100	100	100
Boundry (PRE)	1.8 pt/A	May 4						
RUPowerMax+Cobra+COC	28.4+10 fl oz/A+1	June 13	51	100	99	99	100	100
Valor SX (PRE)	2 oz/A	May 4						
RUPowerMax+Warrant	28.4 fl oz/A+3 pt/A	June 13	13	100	98	99	100	100
Boundry (PRE)	1.8 pt/A	May 4						
Flexstar GT 3.5+MSO	2.65 pt/A+1	June 13	21	100	98	99	100	100
Boundry (PRE)	1.8 pt/A	May 4						
Sequence	2.5 pt/A	June 13	12	96	98	99	100	100
Sharpen (PRE)	1 fl oz/A	May 4						
Touchdown Total+Prefix	30.7 fl oz/A+2 pt/A	June 13	31	100	100	100	100	99
LSD (5%)			6.4	2.1	2	3.9	NS	1

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 2.5% v/v. RUPowerMAX=Roundup PowerMAX; MSO=Leci-Tech methylated seed oil from Loveland; COC=Premium COC from West Central; Ann. Grs.=Annual grasses (75% white robust foxtail & 25% yellow foxtail).

Table continued on next page.

Table 2. Management of glyphosate-resistant waterhemp in Roundup Ready soybean with preemergence herbicides followed by Flexstar GT 3.5, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	July 7 Soyb Inj	Sept. 27 Wahe Cntl	Sept. 27 Colq Cntl	Sept. 27 Wibw Cntl	Sept. 27 Ann. Grs. Cntl	Sept. 29 Soyb Yield
	lb ai/A or lb ae/A		%	%	%	%	%	Bu/A
Untreated Check	0	---	0	0	0	0	0	2
Boundry (PRE)	1.8 pt/A	May 4						
Touchdown Total	30.7 fl oz/A	June 13	1	85	97	100	100	37.9
Boundry (PRE)	1.8 pt/A	May 4						
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	9	100	100	98	100	42.6
Boundry (PRE)	1.8 pt/A	May 4						
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	18	100	100	100	100	35.8
Valor SX (PRE)	2 oz/A	May 4						
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	13	100	100	100	100	40.3
Valor SX (PRE)	2 oz/A	May 4						
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	19	100	100	99	100	42.2
Authority MTZ (PRE)	11 oz/A	May 4						
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	8	100	99	100	100	40.4
Authority MTZ (PRE)	11 oz/A	May 4						
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	16	100	100	99	100	42.9
Outlook+Verdict (PRE)	8+5 fl oz/A	May 4						
Flexstar GT 3.5+MSO	3.5 pt/A+1	June 13	14	100	100	100	100	40.6
Outlook+Verdict (PRE)	8+5 fl oz/A	May 4						
Flexstar GT 3.5+MSO	5.3 pt/A+1	June 13	21	100	100	98	100	37.7
Boundry (PRE)	1.8 pt/A	May 4						
RUPowerMax+Cobra+COC	28.4+10 fl oz/A+1	June 13	33	91	93	91	100	30.6
Valor SX (PRE)	2 oz/A	May 4						
RUPowerMax+Warrant	28.4 fl oz/A+3 pt/A	June 13	3	100	99	98	100	37.9
Boundry (PRE)	1.8 pt/A	May 4						
Flexstar GT 3.5+MSO	2.65 pt/A+1	June 13	6	100	97	98	100	38.7
Boundry (PRE)	1.8 pt/A	May 4						
Sequence	2.5 pt/A	June 13	1	94	100	100	100	42.1
Sharpen (PRE)	1 fl oz/A	May 4						
Touchdown Total+Prefix	30.7 fl oz/A+2 pt/A	June 13	10	98	99	95	100	37.8
LSD (5%)			4	3.8	3.6	4.8	NS	6.1

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 2.5% v/v. RUPowerMAX=Roundup PowerMAX; MSO=Leci-Tech methylated seed oil from Loveland; COC=Premium COC from West Central; Ann. Grs.=Annual grasses (75% white robust foxtail & 25% yellow foxtail).

Summary:

Up to 10 waterhemp plants were flagged per plot prior to the application of Touchdown following Boundary. Touchdown caused 72 and 83% mortality of flagged waterhemp plants on June 29 and September 27, respectively, indicating the presence of glyphosate-resistant waterhemp at this site. Minimal soybean injury was observed on June 13 from the preemergence herbicides, although Valor caused the greatest injury. The greatest soybean injury of the season was observed on June 27 from Cobra followed by Flexstar GT at 5.3 pt/A. Injury declined over time, but was still high on July 7.

Outlook plus Verdict, Boundary, and Valor controlled glyphosate-resistant waterhemp similarly and most effectively at the time of the postemergence application. Touchdown (30.7 fl oz/A) controlled only 85% of waterhemp on September 27 following Boundary, indicating that glyphosate applied alone, even following a preemergence herbicide will not control all resistant waterhemp. On September 27, all treatments controlled greater than 97% waterhemp, except those postemergence treatments with Touchdown, Cobra, and Sequence. Flexstar GT 3.5 at all rates improved control of waterhemp compared to Touchdown applied alone. Due to the severe soybean injury from Cobra, weed emergence occurred after treatment. Soybean yield was similar for all treatments, except Boundary followed by Flexstar GT 3.5 (5.3 pt/A) and Cobra (10 fl oz/A) plus Roundup PowerMAX. Glyphosate-resistant waterhemp can be managed in Roundup Ready soybean when an effective preemergence herbicide is applied followed by Flexstar GT as long as the waterhemp is not resistant to the Flexstar.

Management of glyphosate-resistant waterhemp with preemergence herbicides in LibertyLink soybean, Holloway, MN, 2011. (Stachler) 'Croplan LC 2060 HS05-628' LibertyLink soybean were seeded May 4 at 139,500 seeds per acre in six row plots 30 feet in length in a cooperator's field having glyphosate-resistant waterhemp. Preemergence treatments were applied May 4. Postemergence treatments were applied June 2 and June 24. All treatments were applied in 17 gpa water at 40 psi through XR8002 nozzles to the center four rows of six row plots. All post treatments included AMS at 5.2% v/v. Soygreen plus Premier 90 (1.5 lb product per acre+0.25% v/v) was applied to the entire experiment June 15. Soybean injury was evaluated May 26, June 24, July 8 and July 20. Common lambsquarters, waterhemp and annual grass control was evaluated June 24, July 8, July 20 and September 27. Wild buckwheat control was evaluated June 24, July 8 and July 20. All evaluations are a visual estimate of percent weed control or percent soybean injury in the treated plot compared to the adjacent untreated strips and plots. Soybean from the center four rows in each plot was harvested September 29.

Table 1. Application information.

Date of Application	**May 4**	**June 2**	**June 24**
Time of Day	2:40 pm	11:45 am	12:35 pm
Air Temperature (°F)	66	80	69
Relative Humidity (%)	24	45	59
Soil Temp. (°F at 6")	41	58	63
Wind Velocity (mph)	21	28	7
Cloud Cover (%)	75	90	90
Soil Moisture	good	good	good
Soybean Stage (range/Avg)	PRE	unifol-1 Trif / early 1 Trif	3-5 Trif / 4 Trif
Waterhemp (range/Avg) Trt. 1	PRE	-	2-20 lf/12 lf; 0.25-20"/7.5"
Waterhemp (avg. density) Trt. 1	PRE	-	19/M^2
Waterhemp (range/Avg) Trt. 17	PRE	cot-7 lf/4 lf; 0.125-1.25"/0.5"	cot-19 lf/14 lf; 0.125-15"/8"
Waterhemp (avg. density) Trt. 17	PRE	95/M^2	20/M^2
Waterhemp (range/Avg) Trt. 18	PRE	cot-7 lf/4 lf; 0.125-1.25"/0.5"	cot-22 lf/17 lf; 0.125-22"/16"
Waterhemp (avg. density) Trt. 18	PRE	88/M^2	75/M^2
Common Lambsquarters (range/Avg) Trt. 1	PRE	-	6-24lf/17 lf; 1-18"/9.5"
Common Lambsquarters (avg. density) Trt. 1	PRE	-	5/M^2
Common Lambsquarters (range/Avg) Trt. 17	PRE	4-6 lf/6 lf; 0.25-1"/0.75"	4-22lf/16 lf; 0. 25-13"/6.5"
Common Lambsquarters (avg. density) Trt. 17	PRE	2/M^2	1/M^2
Common Lambsquarters (range/Avg) Trt. 18	PRE	cot-11 lf/7 lf; 0.25-2"/0.75"	6-25lf/20 lf; 1-24"/17"
Common Lambsquarters (avg. density) Trt. 18	PRE	4/M^2	5/M^2
Annual Grasses (range/Avg) Trt. 1	PRE	-	2 lf-12T/6T; 1-14"/11"
Annual Grasses (avg. density) Trt. 1	PRE	-	7/M^2
Annual Grasses (range/Avg) Trt. 17	PRE	4 lf-1T/4 lf; 1-1.75"/1.25"	-/ 6.5T; - / 5"
Annual Grasses (avg. density) Trt. 17	PRE	5/M^2	0.5/M^2
Annual Grasses (range/Avg) Trt. 18	PRE	4 lf-1T/4 lf; 1-1.75"/1.25"	2-13 T/5T; 1-14"/9"
Annual Grasses (avg. density) Trt. 18	PRE	5/M^2	6/M^2
Wild Buckwheat (range/Avg) Trt. 1	PRE	-	-
Wild Buckwheat (avg. density) Trt. 1	PRE	-	0/M^2
Wild Buckwheat (range/Avg) Trt. 17	PRE	1-4 lf/3 lf; 0.5-2"/1"	-
Wild Buckwheat (avg. density) Trt. 17	PRE	6/M^2	0/M^2
Wild Buckwheat (range/Avg) Trt. 18	PRE	cot-3 lf/3 lf; 0. 5-2.5"/1.25"	-/beg. flower; 8-24"/20"
Wild Buckwheat (avg. density) Trt. 18	PRE	14/M^2	3/M^2

Experiment continued on next page.

Table 2. Management of glyphosate-resistant waterhemp with preemergence herbicides in LibertyLink soybean, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	May 26 Soyb Inj	June24 Soyb Inj	June24 Wahe Cntl	June24 Colq Cntl	June24 Wibw Cntl	June24 Grass Cntl
	lb ai/A or lb ae/A		%	%	%	%	%	%
1. Sharpen (PRE)	1 fl oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	1	3	73	77	71	0
2. Sharpen (PRE)	2 fl oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	2	5	84	88	94	0
3. Sharpen+Zidua (PRE)	1 fl oz/A+2 oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	0	6	99	93	85	88
4. Sharpen+Zidua (PRE)	1 fl oz/A+2.5 oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	0	5	97	93	92	86
5. Sharpen+Zidua (PRE)	2 fl oz/A+2 oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	2	7	98	99	98	81
6. Zidua+Verdict (PRE)	2.5 oz/A+5 fl oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	1	4	99	96	87	90
7. Verdict+Outlook (PRE)	5 fl oz/A+8 fl oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	0	5	99	98	91	88
8. Verdict+Outlook (PRE)	5 fl oz/A+14 fl oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	2	6	99	98	97	91
9. Sharpen+Dual MagnumII (PRE)	1 fl oz/A+1.67 pt/A	May 4						
Ignite 280	22 fl oz/A	June 24	2	5	99	95	98	89
10. Valor SX (PRE)	2.5 oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	14	6	87	95	78	81
11. Zidua+Valor SX (PRE)	1.5+2 oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	14	9	96	98	77	89
12. Prefix (PRE)	2 pt/A	May 4						
Ignite 280	22 fl oz/A	June 24	1	3	93	87	55	74
13. Sharpen+Dimetric (PRE)	1 fl oz/A+5.33 oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	2	5	91	92	85	26
14. Sharpen+Dimetric+Zidua (PRE)	1 fl oz/A+5.33+2 oz/A	May 4						
Ignite 280	22 fl oz/A	June 24	2	4	99	99	87	76
15. Sharpen+Zidua (PRE)	1 fl oz/A+2.5 oz/A	May 4						
Ignite 280+Zidua	22 fl oz/A+1 oz/A	June 24	1	5	98	95	77	80
16. Zidua+Valor SX (PRE)	1.5+2 oz/A	May 4						
Ignite 280+Warrant	22 fl oz/A+1.25 qt/A	June 24	15	7	98	97	91	93
17. Ignite 280	22 fl oz/A	June 2						
Ignite 280	22 fl oz/A	June 24	1	4	68	92	75	85
18. Untreated Check	-	-	0	0	0	0	0	0
LSD (5%)			2	3.4	5.1	9.3	17.2	17.8

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 5.2% v/v. Grass = annual grass (75% white robust foxtail & 25% yellow foxtail).

Table continued on next page.

Table 2. Management of glyphosate-resistant waterhemp with preemergence herbicides in LibertyLink soybean, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	July 8 Soyb Inj	Sept. 27 Wahe Cntl	Sept. 27 Colq Cntl	Sept. 27 Grass Cntl	Sept. 29 Soyb Yield
	lb ai/A or lb ae/A		%	%	%	%	Bu/A
1. Sharpen (PRE)	1 fl oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	2	90	98	96	47.6
2. Sharpen (PRE)	2 fl oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	3	99	100	100	51.8
3. Sharpen+Zidua (PRE)	1 fl oz/A+2 oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	1	100	100	100	44.1
4. Sharpen+Zidua (PRE)	1 fl oz/A+2.5 oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	2	100	100	100	45.6
5. Sharpen+Zidua (PRE)	2 fl oz/A+2 oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	4	100	100	100	44.8
6. Zidua+Verdict (PRE)	2.5 oz/A+5 fl oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	1	100	100	100	43.6
7. Verdict+Outlook (PRE)	5 fl oz/A+8 fl oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	2	100	100	100	46.8
8. Verdict+Outlook (PRE)	5 fl oz/A+14 fl oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	3	100	100	100	44.6
9. Sharpen+Dual MagnumII (PRE)	1 fl oz/A+1.67 pt/A	May 4					
Ignite 280	22 fl oz/A	June 24	0	100	100	100	45.4
10. Valor SX (PRE)	2.5 oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	2	100	100	100	54.4
11. Zidua+Valor SX (PRE)	1.5+2 oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	2	100	100	100	43.3
12. Prefix (PRE)	2 pt/A	May 4					
Ignite 280	22 fl oz/A	June 24	0	98	100	100	44.4
13. Sharpen+Dimetric (PRE)	1 fl oz/A+5.33 oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	1	100	100	100	46.0
14. Sharpen+Dimetric+Zidua (PRE)	1 fl oz/A+5.33+2 oz/A	May 4					
Ignite 280	22 fl oz/A	June 24	2	100	100	100	44.5
15. Sharpen+Zidua (PRE)	1 fl oz/A+2.5 oz/A	May 4					
Ignite 280+Zidua	22 fl oz/A+1 oz/A	June 24	3	100	100	100	40.7
16. Zidua+Valor SX (PRE)	1.5+2 oz/A	May 4					
Ignite 280+Warrant	22 fl oz/A+1.25 qt/A	June 24	4	100	100	100	42.5
17. Ignite 280	22 fl oz/A	June 2					
Ignite 280	22 fl oz/A	June 24	1	92	100	100	48.2
18. Untreated Check	-	-	0	0	0	0	2.2
LSD (5%)			2.5	3.8	1.7	1.6	11.9

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 5.2% v/v. Grass = annual grass (75% white robust foxtail & 25% yellow foxtail).

Summary:

Soybean injury was greatest on May 26 and for those treatments containing Valor. Soybean injury declined for the most part over time and was negligible for all treatments on July 8. This location has glyphosate-resistant waterhemp. On June 24, all preemergence treatments provided waterhemp control greater than 90%, except Sharpen at 1 and 2 fl oz/A and Valor at 2.5 oz/A. On June 24, all treatment provided common lambsquarters control similarly to waterhemp, except Valor was better and Prefix poorer. On June 24, only Sharpen (2 fl oz/A) plus Zidua (2.0 oz/A), Verdict (5 fl oz/A) plus Outlook (14 fl oz/A), and Sharpen (1 fl oz/A) plus Dual Magnum II (1.67 pt/A) controlled wild buckwheat greater than 95% and Prefix was poor (55%). Only Verdict (5 fl oz/A) plus Outlook (14 fl oz/A) and Valor (1.5 oz/A) plus Zidua (2.0 oz/A) controlled annual grass greater than 90% and Sharpen (1 and 2 fl oz/A) and Sharpen plus Dimetric were poor (0 and 26%, respectively). All weeds were larger than planned on June 24 in treatments 1 and 17, causing Ignite to be less effective. All treatments provided greater than 95% control of all weeds, except waterhemp in treatments 1 and 17. Soybean yields were similar for all treatments, except treatment 15. Glyphosate-resistant waterhemp, common lambsquarters, wild buckwheat, and annual grasses can be effectively controlled in LibertyLink soybean when the appropriate preemergence herbicide is applied and Ignite 280 is applied timely.

Management of glyphosate-resistant waterhemp with Zidua in Roundup Ready soybean, Holloway, MN, 2011. (Stachler) 'Asgrow A1026649 RR' Roundup Ready soybean was seeded May 4 at 139,500 seeds per acre was seeded in six row plots 30 feet in length in a cooperator's field having glyphosate-resistant waterhemp. Preemergence treatments were applied May 4. Postemergence treatments were applied May 26 and June 24. All treatments were applied in 17 gpa water at 40 psi through XR8002 nozzles to the center four rows of six row plots. All postemergence treatments included AMS at 5% v/v. Soygreen+Premier 90 at 1.5 lb product/A + 0.25% v/v was applied to the entire experiment June 15. Soybean injury was evaluated May 26, June 2, June 24, July 8. Waterhemp control was evaluated June 2, June 16, June 24, July 8, July 20 and September 27. Common lambsquarters and annual grass control were evaluated June 16, June 24, July 8, July 20 and September 27. Wild buckwheat control was evaluated June 24, July 8, July 20 and September 27. All evaluations are a visual estimate of percent weed control or percent soybean injury in the treated plot compared to the adjacent untreated strips and plots. Soybean from the center four rows in each plot was harvested September 29.

Table 1. Application information.

Date of Application	May 4	May 26	June 24
Time of Day	2:40 pm	12:15 pm	12.35 pm
Air Temperature (°F)	66	69	69
Relative Humidity (%)	24	28	59
Soil Temp. (°F at 6")	41	55	63
Wind Velocity (mph)	21	3	7
Cloud Cover (%)	75	5	90
Soil Moisture	good	good	good
Soybean Stage (range/Avg)	PRE	cot-unifoliate / unifoliate	3Trif-beg. bloom / beg. bloom
Waterhemp (range/Avg) Trt. 1	PRE	-	2-23 lf/15 lf; 0.25-25"/14"
Waterhemp (avg. density) Trt. 1	PRE	-	$102/M^2$
Watherhemp (range/Avg) Trt. 2	PRE	cot-4 lf/2 lf; 0.125-0.25"/0.125"	cot-22 lf/13 lf; 0.25-20"/9.5"
Waterhemp (avg. density) Trt. 2	PRE	$56/M^2$	$18/M^2$
Waterhemp (range/Avg) Trt. 3	PRE	-	6-16 lf/13 lf; 2-12"/7"
Waterhemp (avg. density) Trt. 3	PRE	-	$0.5/M^2$
Com. Lambsquarters (range/Avg) Trt. 1	PRE	-	6-25lf/19lf; 1-22"/13"
Com. Lambsquarters (avg. density) Trt. 1	PRE	-	$10/M^2$
Com. Lambsquarters (range/Avg) Trt. 2	PRE	cot-6 lf/2lf; 0.25-1"/0.5"	cot-24lf/11lf; 0. 25-18"/4"
Com. Lambsquarters (avg. density) Trt. 2	PRE	$9/M^2$	$3/M^2$
Com. Lambsquarters (range/Avg) Trt. 3	PRE	-	-
Com. Lambsquarters (avg. density) Trt. 3	PRE	-	$0/M^2$
Annual Grasses (range/Avg) Trt. 1	PRE	-	2 lf-8T/4T; 3-18"/13"
Annual Grasses (avg. density) Trt. 1	PRE	-	$18/M^2$
Annual Grasses (range/Avg) Trt. 2	PRE	1-4 lf/3 lf; 0.25-1.5"/0.75"	2-5 lf/3 lf; 1-2"/1.5"
Annual Grasses (avg. density) Trt. 2	PRE	$6/M^2$	$4/M^2$
Annual Grasses (range/Avg) Trt. 3	PRE	-	2 lf-11T/4T; 1-12"/6"
Annual Grasses (avg. density) Trt. 3	PRE	-	$2/M^2$
Wild Buckwheat (range/Avg) Trt. 2	PRE	cot-2 lf/1 lf; 0.25-1.25"/0.67"	-
Wild Buckwheat (avg. density) Trt. 2	PRE	$3/M^2$	-

Summary:

Valor plus Zidua caused the greatest soybean injury during the season on June 2, but injury declined over time. Treatments containing Sharpen caused soybean injury to increase by June 24. Negligible injury was observed for all treatments on July 8. Of the preemergence herbicides, treatment 6 controlled the fewest waterhemp and wild buckwheat on June 24. Roundup PowerMAX (32 fl oz/A) caused 80% mortality (data not shown) of ten flagged waterhemp plants per plot on June 24, indicating some frequency of resistant plants. Increasing the number of Roundup PowerMAX applications and making the initial application to small (0.25" tall) waterhemp plants improved control of glyphosate-resistant waterhemp, although not adequately. A single postemergence application of Roundup PowerMAX following a preemergence treatment providing excellent ($\geq$ 90%) waterhemp control, may provide excellent season-long control of most weeds and glyphosate-resistant waterhemp when the frequency of resistant plants is low.

Experiment continued on next page.

Table 2. Management of glyphosate-resistant waterhemp with Zidua in Roundup Ready soybean, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	June 2 Soyb Inj	June 24 Soyb Inj	June 24 Wahe Cntl	June 24 Colq Cntl	June 24 Wibw Cntl	June 24 Grass Cntl
	lb ai/A or lb ae/A		%	%	%	%	%	%
1. Roundup PowerMax	22 fl oz/A	June 24	0	0	0	0	0	0
2 Roundup PowerMax	32 fl oz/A	May 26						
Roundup PowerMax	32 fl oz/A	June 24	0	0	72	89	72	91
3. Sharpen+Zidua (PRE)	1 fl oz/A+2 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	1	5	97	91	85	74
4. Sharpen+Zidua (PRE)	1 fl oz/A+2.5 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	3	7	97	97	76	82
5. Valor SX+Zidua (PRE)	2 oz/A+1.5 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	11	4	98	99	84	90
6. Verdict+Zidua (PRE)	5 fl oz/A+1.5 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	4	7	90	95	71	87
7. Verdict+Zidua (PRE)	5 fl oz/A+2 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	3	6	98	96	84	82
LSD (5%)			2.9	3.4	6.6	7.7	15.0	9.1

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 5% v/v. Grass = annual grasses (75% white robust foxtail and 25% yellow foxtail).

Table 2 continued. Management of glyphosate-resistant waterhemp with Zidua in Roundup Ready soybean, Holloway, MN, 2011. (Stachler)

Treatment[1]	Rate	Date of Applic.	July 8 Soyb Inj	Sept. 27 Wahe Cntl	Sept. 27 Colq Cntl	Sept. 27 Wibw Cntl	Sept. 27 Grass Cntl	Sept. 29 Soyb Yield
	lb ai/A or lb ae/A		%	%	%	%	%	Bu/A
Roundup PowerMax	22 fl oz/A	June 24	0	58	93	93	98	38.5
Roundup PowerMax	32 fl oz/A	May 26						
Roundup PowerMax	32 fl oz/A	June 24	0	79	100	100	100	40.4
Sharpen+Zidua (PRE)	1 fl oz/A+2 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	3	99	100	100	99	45.5
Sharpen+Zidua (PRE)	1 fl oz/A+2.5 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	3	100	100	100	99	45.1
Valor SX+Zidua (PRE)	2 oz/A+1.5 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	2	100	100	100	100	39.6
Verdict+Zidua (PRE)	5 fl oz/A+1.5 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	3	99	100	100	100	42.3
Verdict+Zidua (PRE)	5 fl oz/A+2 oz/A	May 4						
Roundup PowerMax	22 fl oz/A	June 24	4	100	100	100	100	41.9
LSD (5%)			2.4	9.9	3.6	NS	NS	NS

[1]N-Pak AMS (liquid ammonium sulfate from Winfield Solutions) was included in all postemergence treatments at 5% v/v. Grass = annual grasses (75% white robust foxtail and 25% yellow foxtail).

Development of a Model for Prediction of Organic Matter Zones

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Organic matter (O.M.) varies in the Southern Minnesota Beet Sugar Cooperative growing area. Nitrogen management in sugarbeets is essential to maximizing yield and quality of the crop. Research in 2003-2006, in cooperation with Dr. John Lamb, University Of Minnesota, St. Paul determined that levels of O.M. can influence the sugar percent and purity of the sugarbeet (Table 1 and 2).

Table 1

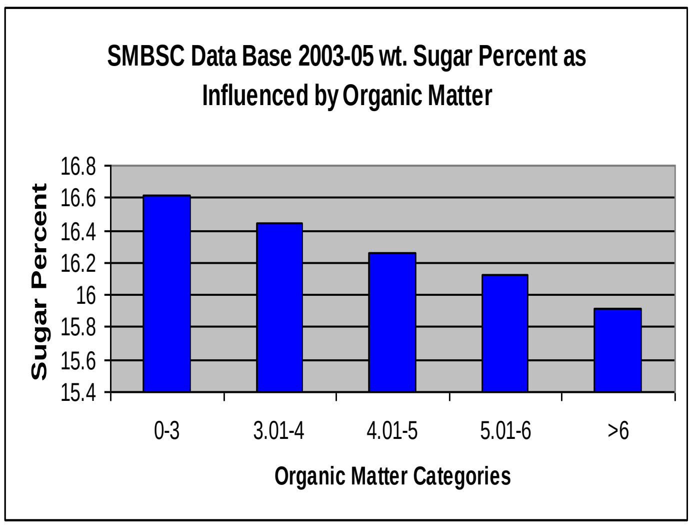
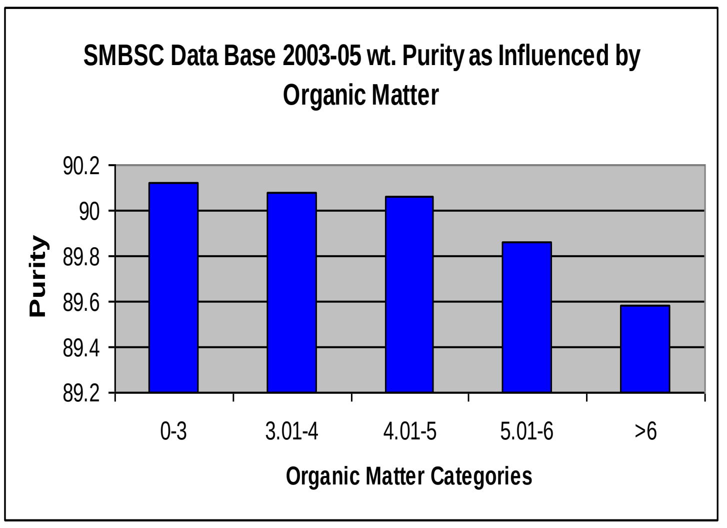
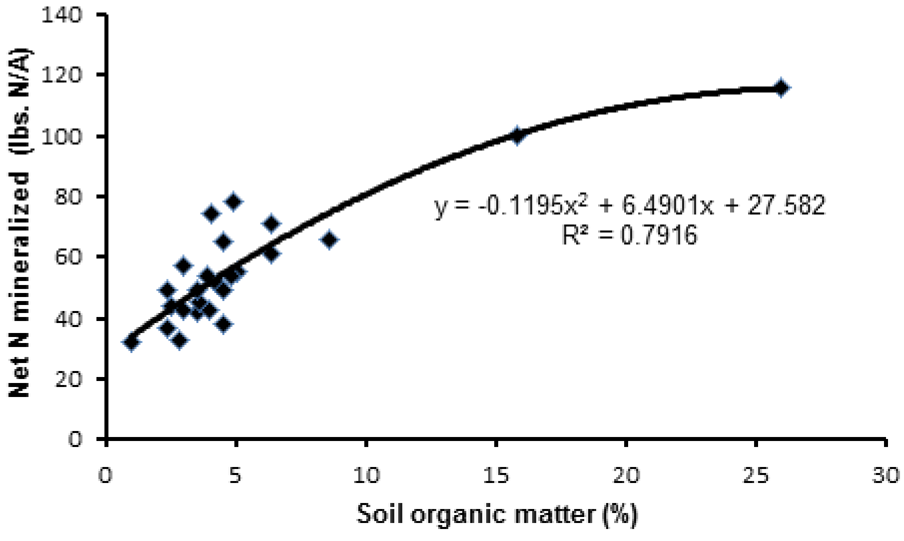


Table 2



A study was initiated in 2006 to determine the influence O.M. has on nitrogen mineralization and if O.M can be successfully predicted across the growing area. Research conducted in cooperation with Dr. John Lamb, University Of Minnesota, St. Paul and Dr. Albert Simms NW Research & Outreach Center, University of Minnesota, Crookston determined that O.M. level can influence mineralization of Nitrogen (Table 3). The y-axis represents the total N mineralized through the season and the x-axis represents the %O.M. The data shows that nitrogen mineralized throughout the production season has a good correlation (R^2 0.79) to O.M. levels.

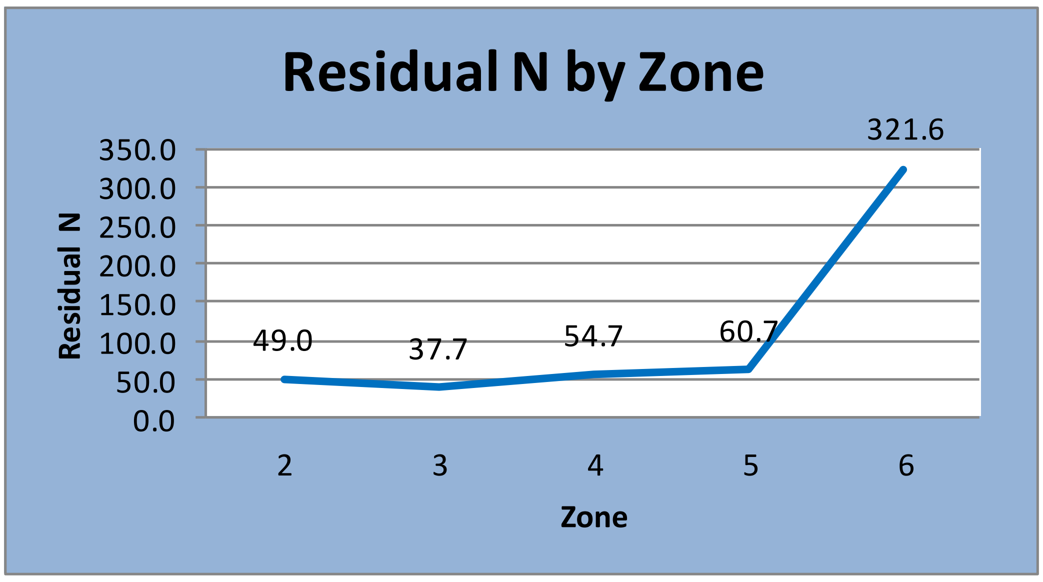
Table 3.



Satellite imagery of bare soil was investigated for development of a model for prediction of organic matter variance within a field. It was assumed the color of the soil on a greyscale would correlate to O.M. With the assistance of Dr. Dan Humburg, South Dakota State University, Brookings, SD, Landsat 5 satellite imagery was used. Multiple combinations of the wavelength bands pixel values from multiple years were compared to geo-referenced soil samples. Bands with the highest correlations to actual organic matter were used for the model. As organic matter tends to follow elevation, elevation was added to the model. Dr. Richard Horsley, Department of Plant Sciences, NDSU, Fargo, ND conducted analysis of the data and produced an algorithm used to define the O.M. zones. The completed model utilizes elevation data along with three different wavelength bands and correction factors to produce the final product. Mapping software was used to process a predicted O.M. map using the model. There are a maximum of 5 zones numbered 2 thru 6. The predicted zone number does not predict the actual O.M., but rather identifies similar O.M. zones in the field.

Soil samples were compared to the zones to test accuracy of the model for prediction of O.M zones. A statistical significance of 0.048 and a R^2 of 0.882 was achieved using 258 samples from 5 fields in the growing area. In 2009 a pilot program was designed to test if the model would influence sugarbeet yield and quality on a whole field basis. The test was initiated in the 2010 growing season. Seven fields were used for the test. Each organic matter zone was soil sampled to a 48 inch depth and nitrogen was adjusted to a given level to adjust for predicted O.M. mineralization. If O.M. ranged from 0-3%, N was adjusted to 120 lbs., 3-4% was adjusted to 110 lbs. N, 4-5% 100 lbs. N, 5-7% 90 lbs. N and O.M. above 7% was adjusted to 70 lbs. N. Within each field, a test strip using grid sampling technology and a test strip using conventional sampling were added to compare the zone program to represent different soil sampling methods. It was found that total N to 4 feet averaged 51 lbs. in zones 3-5 and zone 6 averaged 321 lbs. (Table 4).

Table 4



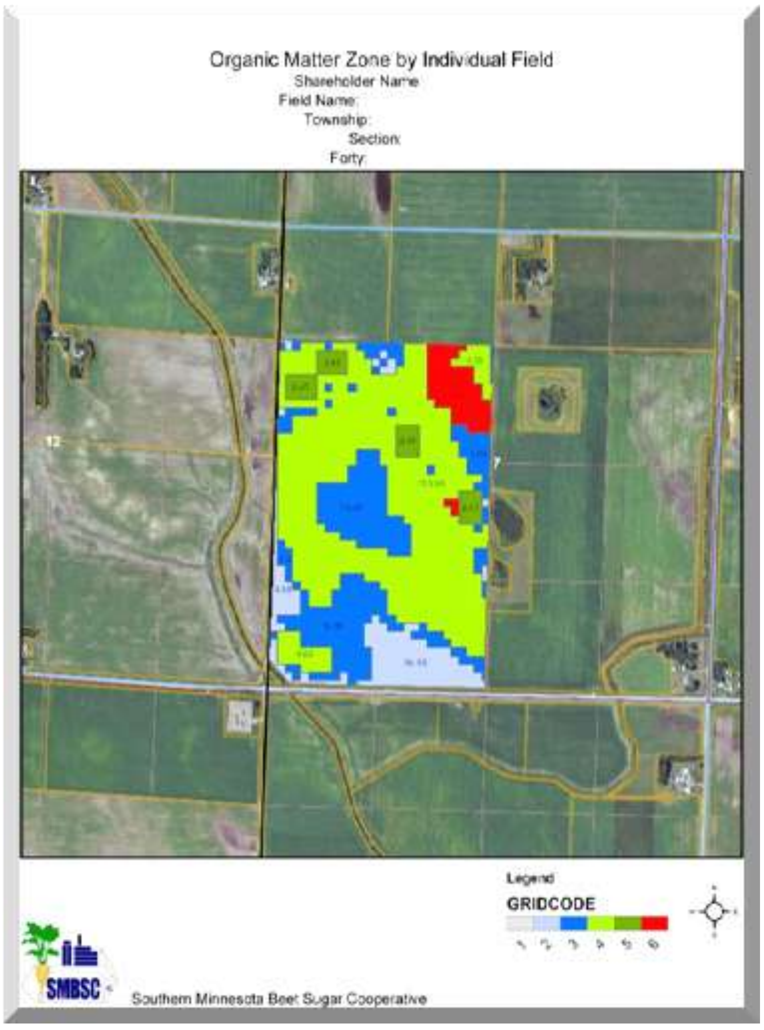
Two ten foot sugarbeet samples were harvested from each geo-referenced soil sample location. A total of 406 samples were collected and analyzed at the Southern Minnesota Beet Sugar Cooperative quality Lab. In the first analysis, sugarbeet samples from organic matter zones adjacent to the test strips were used to compare zone, grid and conventional fertility management. The results showed that of the six fields, four had higher sugar in the zones. Five of the six fields had higher purity, three of six fields had higher tons and five of the six fields had higher net revenue in the zones than in the grid or conventional. Net revenue was calculated by taking the sugarbeet payment minus the costs associated with sampling, mapping, application and the cost of fertilizer. In further analysis of the data, all O.M. zones were weighted to equalize the zones impact on the means of the data in comparison to the grid and conventional. For example, if one zone covers 30 acres and another is 5 acres, the zone with the larger area (acres) would have a greater influence on the mean and bias the data toward that zones result. To best evaluate the influence of managing nitrogen by zone of varying O.M. levels, it was concluded that the zone data needed to be weighted to equalize the data across each zone. Zone six was not considered in the analysis of the results since the nitrogen level was very high and therefore, the nitrogen could not be managed according to O.M. Sugar in the O.M. zones increased 0.1% over the grid method and 0.7% over the conventional method. Purity in the O.M. zones increased 0.3% over the grid method and 0.9% over conventional method. Tons per acre increased 0.8 tons per acre over the grid method and 1.2 ton per acre over the conventional method. Net revenue in the O.M. zones increased $69.81 per acre over the grid method and $78.55 per acre over the conventional method.

In 2011 the test was repeated, six fields were used for the test; however, the results were inconclusive. Heavy rains delayed planting until mid-May; a majority of the test fields were planted into wet soils. An abnormal hot and dry late summer slowed sugarbeet growth and N mineralization by O.M. Harvest stands were variable due to disease and accurate sampling was not possible. For 2012, seven fields will be planted to sugarbeets and will be managed using this program. Testing will also be conducted where fields will be planted to corn and nitrogen managed using this program. The corn will be followed by sugarbeets to test if management of corn using this program will assist in increasing the quality of sugarbeets. A study has been initiated to test if planting population by O.M. zone can enhance whole field production.

The data, thus far, suggests that the Organic Matter Zone program should be successful in most growing conditions. The purpose of the program is to enhance profitability for the grower by optimizing production of all crops in the rotation. A cooperative effort by consultants, retailers, advisors and growers is essential to the success of the program.

As a result of this research, a tool is available to soil sample contractors (consultants) via the Southern Minnesota Beet Sugar Cooperative website. The purpose of the tool is to optimize the production of sugar across a given field by the use of organic matter zones to determine soil sampling points and management of nitrogen. SMBSC has secured a patent for this organic matter mapping system. Consultants that have been approved for access to the site can select a field by entering the location of the field via designating county and or township along with common land unit (CLU), 40 code or drawing tool. The consultant will be able to observe the number of zones and acres per zone to determine if they want to purchase the selected field. For 2012, fields that are used for sugarbeet production can be purchased at no charge.

An example of a purchased map for use by the consultant to determine soil sampling zones delineated by organic matter levels is shown in the figure below. The download options for the organic matter zone maps are in the format of shapefile, geo-referenced bmp and tiff, and pdf files. Once a shape file is downloaded, the zone boundaries can be changed by the soil sampler, if needed. Spreader maps can be produced based upon the organic matter zones. Layers of information such as yield and veris maps can be overlaid to enhance the organic matter map. Presently the area available for organic matter maps is determined by the Landsat image used for development of the project and covers the majority of the SMBSC growing area. The area available for mapping will be investigated for expansion as the program is further developed and needs are assessed.


Organic Matter Zone by Individual Field
Shareholder Name
Field Name:
Township:
Section:
Forty:
Legend
GRIDCODE
SMBSC
Southern Minnesota Beet Sugar Cooperative

Zone Nitrogen Management using Organic Matter

Fertility zones in a given field can be identified using satellite imagery. A study has been implemented at Southern Minnesota Beet Sugar Cooperative (SMBSC) to test the viability of adjusting fertility within those zones and if it is beneficial to sugar beet yield, quality and revenue. The test also compares zone management to current sugar beet fertility practices in the SMBSC growing area. The test zones are defined as management zones created using a model that uses bare soil imagery and elevation to estimate changes in soil characteristics. A patent on the model has been granted. A GIS software program uses the model to generate a map of a field showing the calculated areas. Each zone is given a number to identify the areas. Generally, clay or lower organic matter soils will be assigned a lower number whereas darker or higher organic matter soils will be assigned a higher number. Grid testing is defined as dividing a field into 4.4 acre blocks and managing each block individually. Conventional is defined as soil sampling a field attempting to sample as many types of soils as possible, averaging all samples and using the soil sample result to adjust fertility across the whole field based on current recommendations.

Methods and Materials:
In 2011 there were 6 fields in the study. Each field was soil sampled to a depth of 4 feet and nitrogen (N) was adjusted based on the average organic matter within each zone. The criterion for total adjusted N is shown in Table 1.

Table 1.

OM	Adjusted N
< 3%	120
3.1 - 4%	110
4.1 - 5%	100
5.1 - 7%	90
> 7%	70

In each field two 140 foot wide test strips were installed. There were one of each, conventional and grid. The blocks within the grid strips were 440 feet in length. At harvest 2 adjacent 10 foot beet samples were collected from multiple points within each zone and test strips. The sugar beet samples tested in the zone were collected adjacent to the grid and conventional strips. This was done to reduce the natural variability in soils. Samples were collected from 5 of 6 fields. One field sustained severe weather damage and was harvested prematurely. There were 349 individual samples collected. Each sample was weighed and analyzed for quality at the SMBSC Tare Lab.

Results and Discussion:
All data from the five fields were combined. Table 2 shows the statistics for zones, grid and conventional, respectively. Average sample results for each zone are shown. Net Revenue is the gross beet payment minus the fertilizer, sampling, mapping and application costs. The data is weighted to reflect the acres in each zone.

Table 2:

Om <3%	Stand	Sugar	Purity	Nitrate	ES	EST	ESA	Tons	Om	Res_N	%Net Revenue	# of Samples
Zone	175	17.0	90.0	49	14.2	285	6394	22.5	2.9	60	112.5	2
Grid	164	16.8	90.0	20	14.1	281	4631	16.5	2.6	33	79.1	5
Conventional	182	16.8	90.6	16	14.2	284	6197	21.8	2.6	34	108.4	6

Om 3-4%	Stand	Sugar	Purity	Nitrate	ES	EST	ESA	Tons	Om	Res_N	%Net Revenue	# of Samples
Zone	142	16.4	90.1	34	13.7	275	4056	14.8	3.8	53	84.3	32
Grid	162	16.5	90.1	18	13.8	277	5113	18.5	3.7	57	105.9	8
Conventional	155	16.8	89.9	17	14.0	280	5194	18.5	3.6	58	109.7	8

Om 4-5%	Stand	Sugar	Purity	Nitrate	ES	EST	ESA	Tons	Om	Res_N	%Net Revenue	# of Samples
Zone	166	16.3	89.8	32	13.5	271	5249	19.4	4.5	78	102.4	33
Grid	139	16.2	90.0	37	13.6	271	4968	18.3	4.5	48	95.6	17
Conventional	136	17.2	91.1	24	14.7	293	4991	17.0	4.5	43	102.0	16

Om 5-7%	Stand	Sugar	Purity	Nitrate	ES	EST	ESA	Tons	Om	Res_N	%Net Revenue	# of Samples
Zone	158	16.5	89.8	37	13.8	275	6180	22.5	5.5	65	101.9	52
Grid	169	16.7	90.0	27	14.0	280	5994	21.4	5.5	76	100.1	38
Conventional	160	16.9	89.6	24	14.1	282	5836	20.7	5.4	71	97.9	38

Om >7%	Stand	Sugar	Purity	Nitrate	ES	EST	ESA	Tons	Om	Res_N	%Net Revenue	# of Samples
Zone	148	16.4	88.7	52	13.4	268	6497	24.2	7.8	87	95.3	10
Grid	123	16.0	88.3	91	13.0	259	7047	27.2	7.4	90	103.2	8
Conventional	114	16.7	89.0	42	13.8	275	6860	24.9	7.5	90	101.5	9

All Data	Stand	Sugar	Purity	Nitrate	ES	EST	ESA	Tons	Om	Res_N	%Net Revenue	# of Samples
Zone	158	16.5	89.6	41	13.7	274	5798	21.1	5.2	70	103.3	129
Grid	150	16.4	89.7	39	13.7	274	5537	20.2	4.8	60	94.4	74
Conventional	148	16.9	90.1	25	14.2	284	5772	20.3	4.8	58	102.3	77

The effects of weather in 2011 brought changes in yield and quality compared to 2010. A late, cold and wet spring brought poor planting conditions. Sugar and purity were not significantly affected by the fertility program. Tons increased as Om increased. All fields had fertilizer applied in the fall of 2010. It is thought some nitrogen may have been lost during the winter of 2010-2011 as the soil did not freeze below the heavy snow cover. The wet spring may have contributed to above normal mineralization during the rapid growth stage in the early summer. Hot and dry soils in late summer limited nitrogen uptake by the sugarbeets. Variability in sampling may have contributed to variations in data. Sugarbeet population varied significantly across sample points and across locations.

When fertilizer is applied conventionally there are large changes in yield and sugar within a field. Optimizing the efficiencies of fertility management and soil types are not realized. Fertilizer is added to high organic matter areas where soil test nitrogen (N) is most likely excessive and detrimental to sugarbeet quality. Too little is added where soil test N is low not taking full advantage of the crops potential. Grid technology is a vast improvement over conventional, however each 4.4 acre block may contain considerable changes in residual N.

Zone technology being tested at SMBSC has shown to be beneficial during a normal growing season. Variations in organic matter and residual nitrogen are taken into account and adjustments are made for each area. Averaging data over the soil changes (zones) within each nitrogen management technique shows that there is a slight advantage of Zone management compared to grid and conventional. Significant changes are not as pronounced when each zone is managed to its potential. Overall increase in beet quality is the greatest advantage. An increase in tons has not been realized.

Summary

In 2011, tests showed there was a minor advantage using zone nitrogen application to net revenue. There was no significant advantage or disadvantage in any of the tests. Research will continue indeterminately to improve zone identification and to fine-tune fertilizer recommendations within each zone. Additional testing will include planting and harvest population and its effect on yield and quality within the zones.

Harvest Population and its Effect on Revenue-2011

The Southern Minnesota Beet Sugar Cooperative has been accumulating grower data and entering it into a database for a number of years. Current analysis of the SMBSC database shows as population increases, sugar, purity and tons also increase. An analysis of the organic matter zone research data was done to determine if population influenced quality, tons and the final payment of sugarbeets.

Methods:
Harvest data from all organic matter zone test fields for the years 2009, 2010 and 2011 were combined and analyzed using Pearson Correlation. Harvest sugarbeet plant populations were compared to sugar, purity, nitrate, tons and revenue. 517 individual samples were used for analysis. Two sugarbeet samples were hand harvested at each sample location and were georeferenced for identification. Sugarbeets were collected from 10 feet of row at each sample location and analyzed by the SMBSC Tare Lab. Each sample has an individual soil test therefore the soil organic matter (Om) is known for each sample location. The total nitrogen 0-48 inches was adjusted to current SMBSC Zone recommendations.

Results and Discussion:
Table 1 shows the significance of how harvest population within each organic matter (Om) range relates to sugar, purity, brie nitrate, tons and revenue of the sugarbeet. Where the Om ranges from 4-7% sugar increased as population increased. Where Om is above 4%, purity increased as population increased. Where Om is above 3%, tons and revenue increased as population increased. Brie Nitrate was not influenced by population within the organic matter ranges tested except when organic matter was above 7%. When organic matter was above 7% the brie nitrate was inversely influenced by sugarbeet plant population. The variables evaluated were not influenced by sugarbeet plant population when organic matter was below 3%. In this test harvest populations ranged from 28628 - 59500 sugarbeet plants per acre or 4.8 to 10.2 inches between sugarbeet plants. The 100ft stand ranged from 120 to 250.

Table 1:

Om		Sugar %	Purity	Nitrate	Tons per acre	Revenue per acre
0-3%	R^2	-0.296	0.0337	0.462	-0.242	0.1835
	$P< 0.05$	NS	NS	NS	NS	NS
3-4%	R^2	0.1824	0.092	0.0298	0.581	0.8371
	$P< 0.05$	NS	NS	NS	0.0023	0.0001
4-5%	R^2	0.4505	0.3531	-0.1259	0.4514	0.3827
	$P< 0.05$	0.0183	0.0707	NS	0.0181	0.0488
5-7%	R^2	0.6411	0.3979	-0.259	0.776	0.92147
	$P< 0.05$	0.0001	0.0266	NS	0.0001	0.0001
>7%	R^2	0.2062	0.5932	-0.613	0.6629	0.3856
	$P< 0.05$	NS	0.0009	0.0005	0.0001	0.0427

Figure. 1

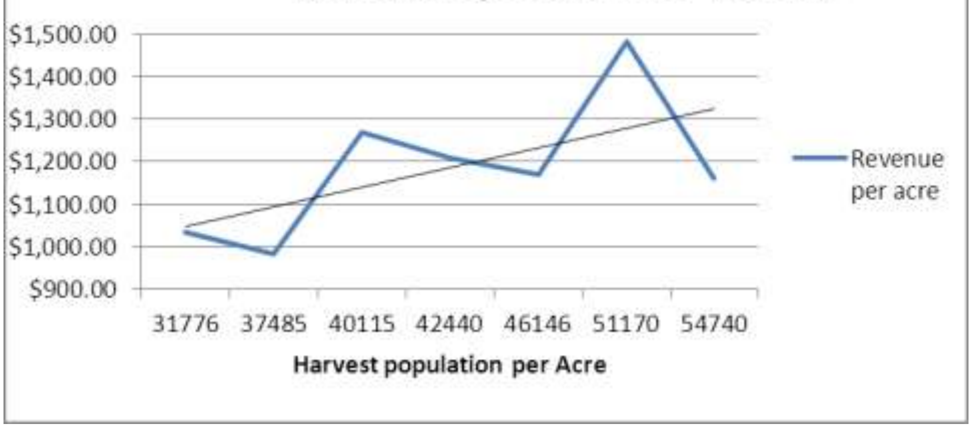


Figure. 2

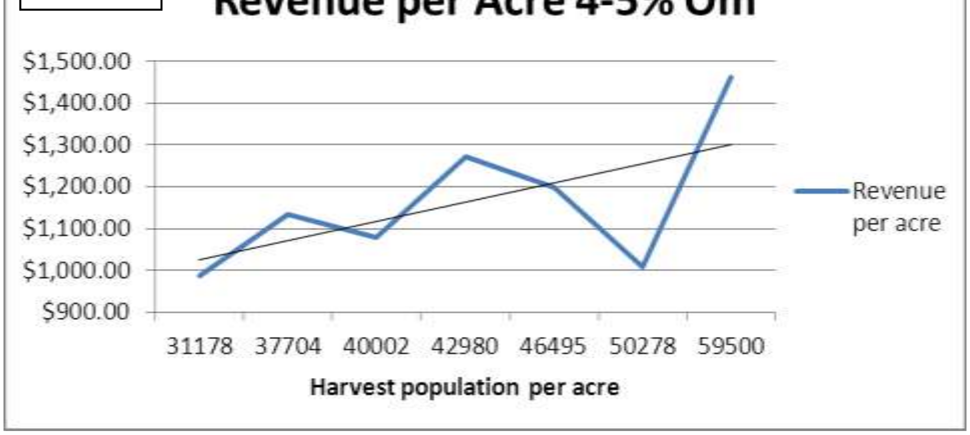
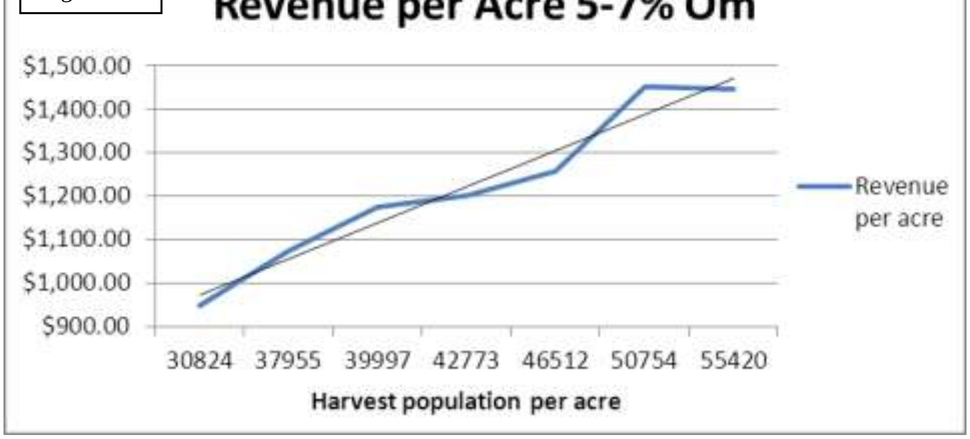
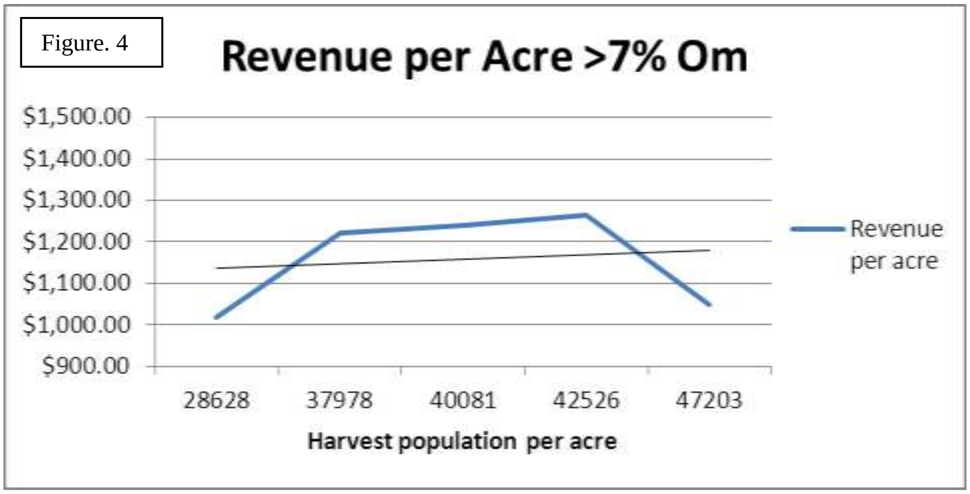


Figure. 3





Summary:
Where Om is above 3% an increase in population can positively increase sugarbeet quality, tons and revenue, Figure 1. The sugarbeet plant populations used in this test were harvest populations, therefore planting population should be adjusted to reflect germination and stand losses throughout the growing season. In this test a majority of samples were greater than 5 inch spacing. A test was established in 2011 to evaluate if the sugarbeet planting population ranging from 4 - 6 inch spacing affects quality, tons and revenue in varying organic matter zones. More data points are needed to correctly evaluate optimal sugarbeet plant population as influence by organic matter level.